RTMPose ASL Citizen

September 23, 2023

1 EDA

[64]:
```
from mmpose.apis import Pose2DInferencer, init_model
import cv2

import pandas as pd
from tqdm import tqdm
import gc
from operator import add
import torch

import matplotlib.pyplot as plt
import numpy as np
```

[76]:
```
cv2.__version__
```

[76]: '4.8.0'

[65]:
```
inferencer = Pose2DInferencer(
    device='cuda',
    model='rtmpose-l_8xb64-270e_coco-wholebody-256x192',
    det_model='yolox_tiny_8x8_300e_coco',
    det_cat_ids=[0],  # the category id of 'human' class
)
```

```
09/23 11:43:41 - mmengine - WARNING - The current default scope
"mmdet" is not "mmpose", `init_default_scope` will force set the currentdefault
scope to "mmpose".
Loads checkpoint by http backend from path:
https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/rtmpose-l_simcc-
coco-wholebody_pt-aic-coco_270e-256x192-6f206314_20230124.pth
09/23 11:43:42 - mmengine - WARNING - The current default scope
"mmpose" is not "mmdet", `init_default_scope` will force set the currentdefault
scope to "mmdet".
Loads checkpoint by http backend from path: https://download.openmmlab.com/mmdet
ection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171
234-b4047906.pth
```

[78]:
```
#inferencer = Pose2DInferencer('wholebody', device='cuda')
```

[ ]:
```
result_generator = inferencer('webcam',
                              show=True,
                              return_vis=True,
                              return_datasample=False)
#cv2.destroyAllWindows()
#cv2.waitKey(0)
#cv2.destroyAllWindows()
#cv2.waitKey(1)
#result = next(result_generator)
results = [result for result in result_generator]
cv2.destroyAllWindows()
```

[16]:
```
result_generator = inferencer('demo.jpg',
                              show=True,
                              return_vis=True,
                              return_datasample=False,
                              wait_time=5)
#cv2.destroyAllWindows()
#cv2.waitKey(0)
#cv2.destroyAllWindows()
#cv2.waitKey(1)
#result = next(result_generator)
#results = [result for result in result_generator]
#cv2.destroyAllWindows()
#result_generator = inferencer('demo2.jpg', show=True, return_vis =␣
 ↪True,return_datasample=False,wait_time=5)
result = next(result_generator)
cv2.destroyAllWindows()
```

Output()

[84]:
```
result['visualization'][0]
```

[84]:
```
array([[[200, 199, 192],
        [200, 199, 192],
        [200, 199, 192],
        …,
        [217, 212, 209],
        [217, 212, 209],
        [217, 212, 209]],

       [[200, 199, 192],
```

```
         [200, 199, 192],
         [200, 199, 192],
         …,
         [217, 212, 209],
         [217, 212, 209],
         [217, 212, 209]],

        [[200, 199, 192],
         [200, 199, 192],
         [200, 199, 192],
         …,
         [217, 212, 209],
         [217, 212, 209],
         [217, 212, 209]],

        …,

        [[192, 192, 187],
         [192, 192, 187],
         [192, 192, 187],
         …,
         [ 23,  23,  23],
         [ 39,  37,  47],
         [ 44,  42,  52]],

        [[192, 192, 187],
         [192, 192, 187],
         [192, 192, 187],
         …,
         [ 30,  28,  29],
         [ 44,  44,  54],
         [ 46,  46,  56]],

        [[192, 192, 187],
         [192, 192, 187],
         [192, 192, 187],
         …,
         [ 33,  31,  32],
         [ 50,  50,  60],
         [ 50,  50,  60]]], dtype=uint8)
```

[85]:
```
image_array = result['visualization'][0]

# Display the image using Matplotlib
plt.imshow(image_array, cmap='gray')
plt.axis('off')  # Hide the axis ticks and labels
plt.show()
```

[86]:
```
image_array = result['visualization'][0]
bgr_image = cv2.cvtColor(image_array, cv2.COLOR_RGB2BGR)

# Display the image using OpenCV
cv2.imshow('Color Image', bgr_image)
cv2.waitKey(0)
cv2.destroyAllWindows()
```

[87]:
```
# Open the video file
#video_path = 0
cap = cv2.VideoCapture(
    "file://media/kristian/HDD/ASL_Citizen/ASL_Citizen/videos/
 ↪0023159093449660606-CAFETERIA.mp4"
)
#cap = cv2.VideoCapture(0)

# Loop through the video frames
while cap.isOpened():
    # Read a frame from the video
    success, frame = cap.read()

    if success:
        result_generator = inferencer(frame,
```

```
                                        show=False,
                                        return_vis=True,
                                        return_datasample=False)
        result = next(result_generator)
        image_array = cv2.cvtColor(result['visualization'][0],
                                   cv2.COLOR_RGB2BGR)
        # Display the annotated frame
        cv2.imshow("RTMPose Inference", image_array)

        # Break the loop if 'q' is pressed
        if cv2.waitKey(1) & 0xFF == ord("q"):
            break
    else:
        # Break the loop if the end of the video is reached
        break

# Release the video capture object and close the display window
cap.release()
cv2.destroyAllWindows()
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IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
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Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

[88]:
```
result['predictions'][0][0]['keypoints']
```

[88]:
```
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 [134.2633819580078, 292.39110362529755],
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 [134.2633819580078, 275.6139769554138],
 [134.2633819580078, 285.9383625984192],
 [242.66943454742432, 284.6478143930435],
 [134.2633819580078, 287.22891080379486],
 [134.2633819580078, 287.22891080379486]]
```

[89]:
```python
np.array(result['predictions'][0][0]['keypoints']).shape
```

[89]: (133, 2)

[66]:
```python
def extract_keypoints_from_file(filepath):
    # Open the video file
    cap = cv2.VideoCapture(filepath)

    # Initialize an empty list to store the keypoints for each frame
    keypoints = []

    # Loop through the frames of the video
    while cap.isOpened():
        # Read a frame from the video
        ret, frame = cap.read()
        if not ret:
            break
        frame = cv2.resize(frame, (640, 480))
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=False,
                                      return_datasample=False)
        result = next(result_generator)
        # Extract the keypoints from the results object
        if np.array(result['predictions'][0][0]['keypoints']).shape == (133,
                                                                        2):
            keypoint = np.array(
                result['predictions'][0][0]['keypoints']).flatten()
            keypoint = np.append(
```

```
                np.array(result['predictions'][0][0]['keypoint_scores']),
                keypoint)
        else:
            keypoint = np.zeros(399)

        # Append the keypoints to the list
        keypoints.append(keypoint)
        gc.collect()
        torch.cuda.empty_cache()
    # Release the video capture object and the YOLO model
    cap.release()

    # Convert the keypoints list to a NumPy array
    return np.array(keypoints)
```

[67]:
```
def extract_keypoints_from_file_flip(filepath):
    # Open the video file
    cap = cv2.VideoCapture(filepath)

    # Initialize an empty list to store the keypoints for each frame
    keypoints = []

    # Loop through the frames of the video
    while cap.isOpened():
        # Read a frame from the video
        ret, frame = cap.read()
        if not ret:
            break
        frame = cv2.flip(frame, 1)
        frame = cv2.resize(frame, (640, 480))
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=False,
                                      return_datasample=False)
        result = next(result_generator)
        # Extract the keypoints from the results object
        if np.array(result['predictions'][0][0]['keypoints']).shape == (133,
                                                                        2):
            keypoint = np.array(
                result['predictions'][0][0]['keypoints']).flatten()
            keypoint = np.append(
                np.array(result['predictions'][0][0]['keypoint_scores']),
                keypoint)
        else:
            keypoint = np.zeros(399)

        # Append the keypoints to the list
```

```
        keypoints.append(keypoint)
        gc.collect()
        torch.cuda.empty_cache()
    # Release the video capture object and the YOLO model
    cap.release()

    # Convert the keypoints list to a NumPy array
    return np.array(keypoints)
```

[ ]:
```
result_generator = inferencer(
    'webcam',
    show=True,
    return_vis=True,
    return_datasample=False,
)
results = [result for result in result_generator]
cv2.destroyAllWindows()
```

[ ]:
```
test = extract_keypoints_from_file(
    'file://media/kristian/HDD/ASL_Citizen/ASL_Citizen/videos/
 ↪0023159093449660606-CAFETERIA.mp4'
)
```

[92]:
```
test_flip = extract_keypoints_from_file_flip(
    'file://media/kristian/HDD/ASL_Citizen/ASL_Citizen/videos/
 ↪0023159093449660606-CAFETERIA.mp4'
)
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[93]:
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test[0]
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[93]: array([9.19722855e-01, 9.18537438e-01, 9.25077319e-01, 8.25981200e-01,
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             6.33725249e+02, 6.19656523e+02, 2.75595471e+02, 1.07851654e+02,
             4.49315139e+02, 4.87362314e+02, 6.33725249e+02, 2.85580238e+02,
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             2.35506317e+02, 2.88252848e+02, 2.50205673e+02, 2.92261764e+02,
```

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2.43524148e+02, 3.95157259e+02, 2.28824791e+02, 3.96493565e+02,
2.14125434e+02, 2.97606984e+02, 1.95417162e+02, 3.05624815e+02,
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2.68913945e+02, 1.07851654e+02, 2.67577640e+02, 1.07851654e+02,
```

```
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       2.70250250e+02, 1.07851654e+02, 6.33725249e+02, 1.07851654e+02,
       2.68913945e+02, 1.07851654e+02, 2.71586555e+02, 1.07851654e+02,
       2.91631133e+02, 1.07851654e+02, 3.02321574e+02])
```

[94]:
```
test_flip[0]
```

[94]:
```
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       1.04462516e+00, 1.05802107e+00, 1.04476666e+00, 1.01680422e+00,
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```

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       2.91936674e+02, 2.20619730e+02, 6.23616746e+02, 1.97021938e+02,
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       4.19102551e+02, 2.20619730e+02, 3.71906968e+02])
```

[95]:
```
test.shape
```

[95]: (55, 399)

[68]:
```
def signvideodataframe(filepath):
    # Read the CSV file into a DataFrame
    df = pd.read_csv(filepath)

    # Define the path to the videos directory
    #path = 'file:///media/kristian/HDD/ASL_Citizen/ASL_Citizen/videos/'
    path = 'file:///home/kristian/ASL_Citizen/videos/'
    # Create a 'Path' column by concatenating the path with 'Video file' column
    df['Path'] = path + df['Video file']

    # Calculate the frequency of each gloss and create a 'frequency' column
    df['Frequency'] = df['Gloss'].map(df['Gloss'].value_counts())

    # Sort the DataFrame by the 'Gloss' column
    df = df.sort_values(by='Gloss')

    # Reset the index of the DataFrame
    df = df.reset_index(drop=True)

    return df
```

[69]:
```
#traindf = signvideodataframe('file:///media/kristian/HDD/ASL_Citizen/
 ↪ASL_Citizen/splits/train.csv')
traindf = signvideodataframe(
    'file:///home/kristian/ASL_Citizen/splits/train.csv')
```

[70]:
```
traindf.head()
```

[70]:
```
  Participant ID                      Video file    Gloss ASL-LEX Code  \
0            P31   3827306090663467-1 DOLLAR.mp4  1DOLLAR     C_02_025
1            P37  16792698524451422-1 DOLLAR.mp4  1DOLLAR     C_02_025
2            P11   6868778695018762-1 DOLLAR.mp4  1DOLLAR     C_02_025
3            P11   6870709051348651-1 DOLLAR.mp4  1DOLLAR     C_02_025
4            P50   0719792557216079-1 DOLLAR.mp4  1DOLLAR     C_02_025

                                                 Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/38273…         15
1  file:///home/kristian/ASL_Citizen/videos/16792…         15
2  file:///home/kristian/ASL_Citizen/videos/68687…         15
3  file:///home/kristian/ASL_Citizen/videos/68707…         15
4  file:///home/kristian/ASL_Citizen/videos/07197…         15
```

[34]:
```
traindf.tail()
```

[34]:
```
      Participant ID                      Video file    Gloss ASL-LEX Code  \
40149            P37   9716493262876276-ZOOM OFF.mp4  ZOOMOFF     D_01_057
40150            P31   7550572181460327-ZOOM OFF.mp4  ZOOMOFF     D_01_057
40151            P46  47985881750082227-ZOOM OFF.mp4  ZOOMOFF     D_01_057
40152            P50  04671245574824856-ZOOM OFF.mp4  ZOOMOFF     D_01_057
40153            P51  19959052532136146-ZOOM OFF.mp4  ZOOMOFF     D_01_057

                                                   Path  Frequency
40149  file:///home/kristian/ASL_Citizen/videos/97164…         15
40150  file:///home/kristian/ASL_Citizen/videos/75505…         15
40151  file:///home/kristian/ASL_Citizen/videos/47985…         15
40152  file:///home/kristian/ASL_Citizen/videos/04671…         15
40153  file:///home/kristian/ASL_Citizen/videos/19959…         15
```

[71]:
```
traindf['Path'][100]
```

[71]:
```
'file:///home/kristian/ASL_Citizen/videos/44951093832888867-seedABOUT.mp4'
```

[99]:
```
# Open the video file
cap = cv2.VideoCapture(traindf['Path'][100])
#cap = cv2.VideoCapture(0)

# Loop through the video frames
while cap.isOpened():
    # Read a frame from the video
    success, frame = cap.read()

    if success:
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=True,
```

```
                                        return_datasample=False)
        result = next(result_generator)
        image_array = cv2.cvtColor(result['visualization'][0],
                                   cv2.COLOR_RGB2BGR)
        # Display the annotated frame
        cv2.imshow("RTMPose Inference", image_array)

        # Break the loop if 'q' is pressed
        if cv2.waitKey(1) & 0xFF == ord("q"):
            break
    else:
        # Break the loop if the end of the video is reached
        break

# Release the video capture object and close the display window
cap.release()
cv2.destroyAllWindows()
```

Output()

Output()

Output()

Output()

Output()

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Output()
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Output()
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Output()
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```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

```
Output()
```

```
Output()

Output()

Output()

Output()

Output()

Output()

Output()

Output()

Output()
```

```
Output()

Output()

Output()

Output()

Output()

Output()

Output()

Output()

Output()
```

```
Output()
```

```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

```
Output()
```

```
Output()
```

```
Output()
```

```
Output()
```

```
Output()
```

[100]:
```
traindf.sample(20)
```

[100]:
```
    Participant ID                            Video file         Gloss  \
241            P27            9451130688097962-DECIDE.mp4        DECIDE
843            P29             9608839995774701-SHAVE.mp4         SHAVE
414            P16          2421908984724852-ELEVATOR.mp4      ELEVATOR
733            P36              3567776249024257-NOON.mp4          NOON
543            P52  17320386407822008-seedHURDLE-TRIP.mp4   HURDLE/TRIP
309            P29           17411166247412857-DINNER.mp4        DINNER
866            P37             43245204383901537-SINK.mp4          SINK
850            P40            39648042077468615-SHAVE.mp4         SHAVE
35             P11         30121385480613116-BACKPACK.mp4      BACKPACK
78             P29              6922856844053422-BELT.mp4          BELT
600            P29             23536769368182653-LOCK.mp4          LOCK
345             P7           425667211082861-DOWNSIZE.mp4      DOWNSIZE
191            P40       0048559284485312215-CONFUSED.mp4      CONFUSED
104            P37              6392685968074112-BITE.mp4          BITE
704            P11        9931923430169016-MICROSCOPE.mp4    MICROSCOPE
683            P14         23020749118320083-MECHANIC.mp4      MECHANIC
101            P43              5780599191678353-BITE.mp4          BITE
782            P16           3665296105710427-RAZOR 2.mp4         RAZOR
835            P29     5492001682449854-ROCKING CHAIR.mp4  ROCKINGCHAIR
94             P33               556637926515527-BELT.mp4          BELT

    ASL-LEX Code                                                Path  Frequency
241     B_02_074  file:///home/kristian/ASL_Citizen/videos/94511…         20
843     J_02_018  file:///home/kristian/ASL_Citizen/videos/96088…         19
414     G_03_036  file:///home/kristian/ASL_Citizen/videos/24219…         19
733     G_02_014  file:///home/kristian/ASL_Citizen/videos/35677…         19
543     G_01_036  file:///home/kristian/ASL_Citizen/videos/17320…         22
309     G_03_044  file:///home/kristian/ASL_Citizen/videos/17411…         18
866     E_02_042  file:///home/kristian/ASL_Citizen/videos/43245…         18
850     J_02_018  file:///home/kristian/ASL_Citizen/videos/39648…         19
35      G_03_091  file:///home/kristian/ASL_Citizen/videos/30121…         19
78      A_03_036  file:///home/kristian/ASL_Citizen/videos/69228…         19
600     H_02_017  file:///home/kristian/ASL_Citizen/videos/23536…         18
345     C_01_055  file:///home/kristian/ASL_Citizen/videos/42566…         18
191     J_01_110  file:///home/kristian/ASL_Citizen/videos/00485…         18
104     K_02_045  file:///home/kristian/ASL_Citizen/videos/63926…         21
704     A_03_076  file:///home/kristian/ASL_Citizen/videos/99319…         18
683     A_03_030  file:///home/kristian/ASL_Citizen/videos/23020…         20
101     K_02_045  file:///home/kristian/ASL_Citizen/videos/57805…         21
782     K_03_103  file:///home/kristian/ASL_Citizen/videos/36652…         18
```

```
835     G_01_010  file:///home/kristian/ASL_Citizen/videos/54920…         20
94      A_03_036  file:///home/kristian/ASL_Citizen/videos/55663…         19
```

[72]:
```
traindf = traindf[traindf['Frequency'] > 17]
traindf = traindf.reset_index(drop=True)
```

[39]:
```
traindf.head()
```

[39]:
```
  Participant ID                     Video file Gloss ASL-LEX Code  \
0            P52  07157565148825373-seedAXE.mp4  AXE1     G_03_066
1            P28       7179300005186042-AXE.mp4  AXE1     G_03_066
2            P29      16216064841959765-AXE.mp4  AXE1     G_03_066
3            P37       6193814382865199-AXE.mp4  AXE1     G_03_066
4            P40       5947453960317015-AXE.mp4  AXE1     G_03_066

                                                Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/07157…         19
1  file:///home/kristian/ASL_Citizen/videos/71793…         19
2  file:///home/kristian/ASL_Citizen/videos/16216…         19
3  file:///home/kristian/ASL_Citizen/videos/61938…         19
4  file:///home/kristian/ASL_Citizen/videos/59474…         19
```

[40]:
```
traindf.tail()
```

[40]:
```
    Participant ID                      Video file     Gloss ASL-LEX Code  \
945            P50   9161417844146778-WHAT FOR.mp4  WHATFOR1     C_02_054
946            P14  00930662603221255-WHAT FOR.mp4  WHATFOR1     C_02_054
947            P27     82063651021682-WHAT FOR.mp4  WHATFOR1     C_02_054
948            P40   5268072837528903-WHAT FOR.mp4  WHATFOR1     C_02_054
949            P40   6363286086951516-WHAT FOR.mp4  WHATFOR1     C_02_054

                                                 Path  Frequency
945  file:///home/kristian/ASL_Citizen/videos/91614…         20
946  file:///home/kristian/ASL_Citizen/videos/00930…         20
947  file:///home/kristian/ASL_Citizen/videos/82063…         20
948  file:///home/kristian/ASL_Citizen/videos/52680…         20
949  file:///home/kristian/ASL_Citizen/videos/63632…         20
```

[41]:
```
traindf.describe()
```

[41]:
```
        Frequency
count  950.000000
mean    19.082105
std      1.316026
min     18.000000
25%     18.000000
50%     19.000000
```

```
75%      20.000000
max      24.000000
```

[73]:
```
traindf['Gloss'].nunique()
```

[73]: 50

[74]:
```
words = traindf['Gloss'].unique()
words
```

[74]:
```
array(['AXE1', 'BACKPACK1', 'BASKETBALL1', 'BEE1', 'BELT1', 'BITE1',
       'BREAKFAST1', 'CANCER1', 'CHRISTMAS1', 'CONFUSED1', 'DARK1',
       'DEAF1', 'DECIDE1', 'DEMAND1', 'DEVELOP1', 'DINNER1', 'DOG1',
       'DOWNSIZE1', 'DRAG1', 'EAT1', 'EDIT1', 'ELEVATOR1', 'FINE1',
       'FLOAT1', 'FOREIGNER1', 'GUESS1', 'HALLOWEEN1', 'HOSPITAL1',
       'HURDLE/TRIP1', 'JEWELRY', 'KNIGHT1', 'LOCK1', 'LUNCH1', 'MAPLE',
       'MEAT1', 'MECHANIC1', 'MICROSCOPE1', 'MOVIE1', 'NOON1', 'PARTY1',
       'PATIENT2', 'RAZOR2', 'RIVER1', 'ROCKINGCHAIR1', 'SHAVE1', 'SINK',
       'SQUEEZE', 'THEY1', 'TWINS1', 'WHATFOR1'], dtype=object)
```

[75]:
```
#valdf = signvideodataframe('file:///media/kristian/HDD/ASL_Citizen/ASL_Citizen/
↪splits/val.csv')
valdf = signvideodataframe('file:///home/kristian/ASL_Citizen/splits/val.csv')
```

[76]:
```
valdf.head()
```

[76]:
```
  Participant ID                      Video file     Gloss ASL-LEX Code  \
0            P26  22595012150860327-1 DOLLAR.mp4   1DOLLAR     C_02_025
1            P39   7421622940519235-1 DOLLAR.mp4   1DOLLAR     C_02_025
2            P21    686738356933241-1 DOLLAR.mp4   1DOLLAR     C_02_025
3            P12  9219095671540121-5 DOLLARS.mp4  5DOLLARS     B_01_062
4            P21  1448188216215387-5 DOLLARS.mp4  5DOLLARS     B_01_062

                                                Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/22595…          3
1  file:///home/kristian/ASL_Citizen/videos/74216…          3
2  file:///home/kristian/ASL_Citizen/videos/68673…          3
3  file:///home/kristian/ASL_Citizen/videos/92190…          4
4  file:///home/kristian/ASL_Citizen/videos/14481…          4
```

[46]:
```
valdf.tail()
```

[46]:
```
      Participant ID                      Video file    Gloss ASL-LEX Code  \
10299            P21    6959326205750493-ZOOM IN.mp4   ZOOMIN     B_02_056
10300            P12   7758716133684984-ZOOM OFF.mp4  ZOOMOFF     D_01_057
10301            P39    844134294032034-ZOOM OFF.mp4  ZOOMOFF     D_01_057
10302            P21   5548062993721732-ZOOM OFF.mp4  ZOOMOFF     D_01_057
10303            P26  19366754134806952-ZOOM OFF.mp4  ZOOMOFF     D_01_057
```

```
                                                   Path  Frequency
10299  file:///home/kristian/ASL_Citizen/videos/69593…          3
10300  file:///home/kristian/ASL_Citizen/videos/77587…          4
10301  file:///home/kristian/ASL_Citizen/videos/84413…          4
10302  file:///home/kristian/ASL_Citizen/videos/55480…          4
10303  file:///home/kristian/ASL_Citizen/videos/19366…          4
```

[77]:
```
#testdf = signvideodataframe('file:///media/kristian/HDD/ASL_Citizen/
↪ASL_Citizen/splits/test.csv')
testdf = signvideodataframe(
    'file:///home/kristian/ASL_Citizen/splits/test.csv')
```

[48]:
```
testdf.head()
```

[48]:
```
  Participant ID                       Video file    Gloss ASL-LEX Code  \
0            P18   23521769221811684-1 DOLLAR.mp4  1DOLLAR     C_02_025
1            P42  023931338852502426-1 DOLLAR.mp4  1DOLLAR     C_02_025
2            P49    4893817008748198-1 DOLLAR.mp4  1DOLLAR     C_02_025
3            P17   13991818149960333-1 DOLLAR.mp4  1DOLLAR     C_02_025
4            P49   34625615110480457-1 DOLLAR.mp4  1DOLLAR     C_02_025

                                                 Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/23521…         13
1  file:///home/kristian/ASL_Citizen/videos/02393…         13
2  file:///home/kristian/ASL_Citizen/videos/48938…         13
3  file:///home/kristian/ASL_Citizen/videos/13991…         13
4  file:///home/kristian/ASL_Citizen/videos/34625…         13
```

[49]:
```
testdf.tail()
```

[49]:
```
      Participant ID                     Video file    Gloss ASL-LEX Code  \
32936            P18  4320702510886756-ZOOM OFF.mp4  ZOOMOFF     D_01_057
32937             P9  7676354653247301-ZOOM OFF.mp4  ZOOMOFF     D_01_057
32938            P47  5386272465310649-ZOOM OFF.mp4  ZOOMOFF     D_01_057
32939            P18   738440364224181-ZOOM OFF.mp4  ZOOMOFF     D_01_057
32940            P17  9953298353288469-ZOOM OFF.mp4  ZOOMOFF     D_01_057

                                                   Path  Frequency
32936  file:///home/kristian/ASL_Citizen/videos/43207…         13
32937  file:///home/kristian/ASL_Citizen/videos/76763…         13
32938  file:///home/kristian/ASL_Citizen/videos/53862…         13
32939  file:///home/kristian/ASL_Citizen/videos/73844…         13
32940  file:///home/kristian/ASL_Citizen/videos/99532…         13
```

[78]:
```
valdf = valdf[valdf['Gloss'].isin(words)]
valdf = valdf.reset_index(drop=True)
```

[51]:
```
valdf.head()
```

[51]:
```
  Participant ID                     Video file      Gloss ASL-LEX Code  \
0            P39      19778675091674147-AXE.mp4       AXE1     G_03_066
1            P26       8581142177964065-AXE.mp4       AXE1     G_03_066
2            P39       3877478645046861-AXE.mp4       AXE1     G_03_066
3            P21       8521417940364975-AXE.mp4       AXE1     G_03_066
4             P5  9990244640190733-BACKPACK.mp4  BACKPACK1     G_03_091

                                                Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/19778…          4
1  file:///home/kristian/ASL_Citizen/videos/85811…          4
2  file:///home/kristian/ASL_Citizen/videos/38774…          4
3  file:///home/kristian/ASL_Citizen/videos/85214…          4
4  file:///home/kristian/ASL_Citizen/videos/99902…          3
```

[52]:
```
valdf.tail()
```

[52]:
```
    Participant ID                       Video file     Gloss ASL-LEX Code  \
186            P26  032677896012150764-WHAT FOR.mp4  WHATFOR1     C_02_054
187             P5    6523145816470133-WHAT FOR.mp4  WHATFOR1     C_02_054
188            P39    0283886564670357-WHAT FOR.mp4  WHATFOR1     C_02_054
189            P21    6142521746642153-WHAT FOR.mp4  WHATFOR1     C_02_054
190            P12   06408604416165864-WHAT FOR.mp4  WHATFOR1     C_02_054

                                                 Path  Frequency
186  file:///home/kristian/ASL_Citizen/videos/03267…          5
187  file:///home/kristian/ASL_Citizen/videos/65231…          5
188  file:///home/kristian/ASL_Citizen/videos/02838…          5
189  file:///home/kristian/ASL_Citizen/videos/61425…          5
190  file:///home/kristian/ASL_Citizen/videos/06408…          5
```

[79]:
```
valdf['Gloss'].nunique()
```

[79]: 50

[54]:
```
valdf.describe()
```

[54]:
```
         Frequency
count  191.000000
mean     3.963351
std      0.770316
min      3.000000
25%      3.000000
50%      4.000000
75%      4.000000
max      6.000000
```

[55]:
```
valdf.head()
```

[55]:
```
  Participant ID                      Video file      Gloss ASL-LEX Code  \
0            P39      19778675091674147-AXE.mp4       AXE1     G_03_066
1            P26       8581142177964065-AXE.mp4       AXE1     G_03_066
2            P39       3877478645046861-AXE.mp4       AXE1     G_03_066
3            P21       8521417940364975-AXE.mp4       AXE1     G_03_066
4             P5  9990244640190733-BACKPACK.mp4  BACKPACK1     G_03_091

                                                Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/19778…          4
1  file:///home/kristian/ASL_Citizen/videos/85811…          4
2  file:///home/kristian/ASL_Citizen/videos/38774…          4
3  file:///home/kristian/ASL_Citizen/videos/85214…          4
4  file:///home/kristian/ASL_Citizen/videos/99902…          3
```

[80]:
```
testdf = testdf[testdf['Gloss'].isin(words)]
testdf = testdf.reset_index(drop=True)
```

[57]:
```
testdf['Gloss'].nunique()
```

[57]: 50

[81]:
```
testdf.head()
```

[81]:
```
  Participant ID                 Video file Gloss ASL-LEX Code  \
0            P15  33721516025652254-AXE.mp4  AXE1     G_03_066
1            P47    519067006979435-AXE.mp4  AXE1     G_03_066
2            P35   5104381603195376-AXE.mp4  AXE1     G_03_066
3            P42  44458614013793873-AXE.mp4  AXE1     G_03_066
4            P42   9604797909481075-AXE.mp4  AXE1     G_03_066

                                                Path  Frequency
0  file:///home/kristian/ASL_Citizen/videos/33721…         15
1  file:///home/kristian/ASL_Citizen/videos/51906…         15
2  file:///home/kristian/ASL_Citizen/videos/51043…         15
3  file:///home/kristian/ASL_Citizen/videos/44458…         15
4  file:///home/kristian/ASL_Citizen/videos/96047…         15
```

[59]:
```
testdf.tail()
```

[59]:
```
     Participant ID                       Video file     Gloss ASL-LEX Code  \
724             P42    3448123355846451-WHAT FOR.mp4  WHATFOR1     C_02_054
725             P47  034046510887022485-WHAT FOR.mp4  WHATFOR1     C_02_054
726             P22    9359050586202402-WHAT FOR.mp4  WHATFOR1     C_02_054
727             P42    2748457214117681-WHAT FOR.mp4  WHATFOR1     C_02_054
728             P15     540014801916062-WHAT FOR.mp4  WHATFOR1     C_02_054
```

```
                                                  Path  Frequency
724  file:///home/kristian/ASL_Citizen/videos/34481…         18
725  file:///home/kristian/ASL_Citizen/videos/03404…         18
726  file:///home/kristian/ASL_Citizen/videos/93590…         18
727  file:///home/kristian/ASL_Citizen/videos/27484…         18
728  file:///home/kristian/ASL_Citizen/videos/54001…         18
```

[60]:
```
testdf.describe()
```

[60]:
```
        Frequency
count  729.000000
mean    14.978052
std      2.229192
min      9.000000
25%     14.000000
50%     15.000000
75%     16.000000
max     20.000000
```

[82]:
```
traindf['Gloss'] = traindf['Gloss'].str.replace('\d+', '', regex=True)
valdf['Gloss'] = valdf['Gloss'].str.replace('\d+', '', regex=True)
testdf['Gloss'] = testdf['Gloss'].str.replace('\d+', '', regex=True)
```

[83]:
```
words = traindf['Gloss'].unique()
words
```

[83]:
```
array(['AXE', 'BACKPACK', 'BASKETBALL', 'BEE', 'BELT', 'BITE',
       'BREAKFAST', 'CANCER', 'CHRISTMAS', 'CONFUSED', 'DARK', 'DEAF',
       'DECIDE', 'DEMAND', 'DEVELOP', 'DINNER', 'DOG', 'DOWNSIZE', 'DRAG',
       'EAT', 'EDIT', 'ELEVATOR', 'FINE', 'FLOAT', 'FOREIGNER', 'GUESS',
       'HALLOWEEN', 'HOSPITAL', 'HURDLE/TRIP', 'JEWELRY', 'KNIGHT',
       'LOCK', 'LUNCH', 'MAPLE', 'MEAT', 'MECHANIC', 'MICROSCOPE',
       'MOVIE', 'NOON', 'PARTY', 'PATIENT', 'RAZOR', 'RIVER',
       'ROCKINGCHAIR', 'SHAVE', 'SINK', 'SQUEEZE', 'THEY', 'TWINS',
       'WHATFOR'], dtype=object)
```

[84]:
```
words = valdf['Gloss'].unique()
words
```

[84]:
```
array(['AXE', 'BACKPACK', 'BASKETBALL', 'BEE', 'BELT', 'BITE',
       'BREAKFAST', 'CANCER', 'CHRISTMAS', 'CONFUSED', 'DARK', 'DEAF',
       'DECIDE', 'DEMAND', 'DEVELOP', 'DINNER', 'DOG', 'DOWNSIZE', 'DRAG',
       'EAT', 'EDIT', 'ELEVATOR', 'FINE', 'FLOAT', 'FOREIGNER', 'GUESS',
       'HALLOWEEN', 'HOSPITAL', 'HURDLE/TRIP', 'JEWELRY', 'KNIGHT',
       'LOCK', 'LUNCH', 'MAPLE', 'MEAT', 'MECHANIC', 'MICROSCOPE',
       'MOVIE', 'NOON', 'PARTY', 'PATIENT', 'RAZOR', 'RIVER',
       'ROCKINGCHAIR', 'SHAVE', 'SINK', 'SQUEEZE', 'THEY', 'TWINS',
```

```
       'WHATFOR'], dtype=object)
```

[85]:
```
words = testdf['Gloss'].unique()
words
```

[85]:
```
array(['AXE', 'BACKPACK', 'BASKETBALL', 'BEE', 'BELT', 'BITE',
       'BREAKFAST', 'CANCER', 'CHRISTMAS', 'CONFUSED', 'DARK', 'DEAF',
       'DECIDE', 'DEMAND', 'DEVELOP', 'DINNER', 'DOG', 'DOWNSIZE', 'DRAG',
       'EAT', 'EDIT', 'ELEVATOR', 'FINE', 'FLOAT', 'FOREIGNER', 'GUESS',
       'HALLOWEEN', 'HOSPITAL', 'HURDLE/TRIP', 'JEWELRY', 'KNIGHT',
       'LOCK', 'LUNCH', 'MAPLE', 'MEAT', 'MECHANIC', 'MICROSCOPE',
       'MOVIE', 'NOON', 'PARTY', 'PATIENT', 'RAZOR', 'RIVER',
       'ROCKINGCHAIR', 'SHAVE', 'SINK', 'SQUEEZE', 'THEY', 'TWINS',
       'WHATFOR'], dtype=object)
```

[86]:
```
print(traindf['Gloss'].nunique())
print(valdf['Gloss'].nunique())
print(testdf['Gloss'].nunique())
```

```
50
50
50
```

[ ]:
```
extract_keypoints_from_file(traindf['Path'][0]).shape
```

[ ]:
```
type(extract_keypoints_from_file(traindf.Path[0]))
```

[68]:
```
cap = cv2.VideoCapture(traindf.Path[0])
length = int(cap.get(cv2.CAP_PROP_FRAME_COUNT))
print(length)
```

```
100
```

[69]:
```
cap = cv2.VideoCapture(traindf.Path[0])
frames = int(cap.get(cv2.CAP_PROP_FRAME_COUNT))
fps = int(cap.get(cv2.CAP_PROP_FPS))
length = round(frames / fps)
width = int(cap.get(cv2.CAP_PROP_FRAME_WIDTH))
height = int(cap.get(cv2.CAP_PROP_FRAME_HEIGHT))
print(frames)
print(fps)
print(length)
print(width)
print(height)
```

```
100
31
3
```

```
640
480
```

[70]:
```
traindf.count()
```

[70]:
```
Participant ID    950
Video file        950
Gloss             950
ASL-LEX Code      950
Path              950
Frequency         950
dtype: int64
```

[87]:
```
def frames_from_file(filepath):
    cap = cv2.VideoCapture(filepath)
    frames = int(cap.get(cv2.CAP_PROP_FRAME_COUNT))
    fps = int(cap.get(cv2.CAP_PROP_FPS))
    length = round(frames / fps)
    width = int(cap.get(cv2.CAP_PROP_FRAME_WIDTH))
    height = int(cap.get(cv2.CAP_PROP_FRAME_HEIGHT))
    return frames, fps, length, width, height
```

[ ]:
```

```

[72]:
```
frames_from_file(traindf.Path[643])
```

[72]:
```
(83, 29, 3, 640, 480)
```

[73]:
```
tqdm.pandas()
traindf[[
    'Frames', 'FPS', 'Length', 'Width', 'Height'
]] = traindf['Path'].progress_apply(lambda x: pd.Series(frames_from_file(x)))
```

```
100%|                        | 950/950 [00:15<00:00, 61.01it/s]
```

[74]:
```
traindf.head()
```

[74]:
```
  Participant ID                     Video file Gloss ASL-LEX Code  \
0            P52  07157565148825373-seedAXE.mp4   AXE     G_03_066
1            P28       7179300005186042-AXE.mp4   AXE     G_03_066
2            P29      16216064841959765-AXE.mp4   AXE     G_03_066
3            P37       6193814382865199-AXE.mp4   AXE     G_03_066
4            P40       5947453960317015-AXE.mp4   AXE     G_03_066

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/07157…         19     100   31
1  file:///home/kristian/ASL_Citizen/videos/71793…         19      81   30
2  file:///home/kristian/ASL_Citizen/videos/16216…         19      47   30
```

```
3  file:///home/kristian/ASL_Citizen/videos/61938…          19       67   30
4  file:///home/kristian/ASL_Citizen/videos/59474…          19       89   30

   Length  Width  Height
0       3    640     480
1       3    640     480
2       2    640     480
3       2    640     480
4       3    640     480
```

[75]:
```
traindf['Frames'].max()
```

[75]: 540

[76]:
```
traindf.describe()
```

[76]:

	Frequency	Frames	FPS	Length	Width	Height
count	950.000000	950.000000	950.000000	950.000000	950.000000	950.000000
mean	19.082105	87.755789	29.354737	3.016842	641.347368	480.252632
std	1.316026	46.654745	2.197195	1.568167	20.731496	3.887155
min	18.000000	25.000000	11.000000	1.000000	640.000000	480.000000
25%	18.000000	60.000000	29.000000	2.000000	640.000000	480.000000
50%	19.000000	77.000000	30.000000	3.000000	640.000000	480.000000
75%	20.000000	97.000000	30.000000	3.000000	640.000000	480.000000
max	24.000000	540.000000	31.000000	18.000000	960.000000	540.000000

[77]:
```
traindf = traindf[(traindf['Length'] > 1) & (traindf['FPS'] > 28) &
                  (traindf['Frames'] < 131)]
traindf = traindf.reset_index(drop=True)
traindf.describe()
```

[77]:

	Frequency	Frames	FPS	Length	Width	Height
count	804.000000	804.000000	804.000000	804.000000	804.000000	804.000000
mean	19.084577	76.113184	29.680348	2.593284	641.592040	480.298507
std	1.305343	20.091965	0.479790	0.671427	22.528858	4.224161
min	18.000000	45.000000	29.000000	2.000000	640.000000	480.000000
25%	18.000000	60.000000	29.000000	2.000000	640.000000	480.000000
50%	19.000000	74.000000	30.000000	2.000000	640.000000	480.000000
75%	20.000000	88.000000	30.000000	3.000000	640.000000	480.000000
max	24.000000	130.000000	31.000000	4.000000	960.000000	540.000000

[78]:
```
traindf['Frequency'] = traindf['Gloss'].map(traindf['Gloss'].value_counts())

traindf.describe()
```

[78]:

	Frequency	Frames	FPS	Length	Width	Height
count	804.000000	804.000000	804.000000	804.000000	804.000000	804.000000
mean	16.261194	76.113184	29.680348	2.593284	641.592040	480.298507

```
std      1.722009   20.091965    0.479790    0.671427   22.528858    4.224161
min     13.000000   45.000000   29.000000    2.000000  640.000000  480.000000
25%     15.000000   60.000000   29.000000    2.000000  640.000000  480.000000
50%     16.000000   74.000000   30.000000    2.000000  640.000000  480.000000
75%     17.000000   88.000000   30.000000    3.000000  640.000000  480.000000
max     20.000000  130.000000   31.000000    4.000000  960.000000  540.000000
```

[79]:
```
traindf.head(10)
```

[79]:
```
  Participant ID                     Video file Gloss ASL-LEX Code  \
0            P52  07157565148825373-seedAXE.mp4   AXE     G_03_066
1            P28       7179300005186042-AXE.mp4   AXE     G_03_066
2            P29      16216064841959765-AXE.mp4   AXE     G_03_066
3            P37       6193814382865199-AXE.mp4   AXE     G_03_066
4            P40       5947453960317015-AXE.mp4   AXE     G_03_066
5            P40        929570016067665-AXE.mp4   AXE     G_03_066
6            P16        904767261814883-AXE.mp4   AXE     G_03_066
7            P43     016134052760367945-AXE.mp4   AXE     G_03_066
8            P40      23099527328070546-AXE.mp4   AXE     G_03_066
9            P37      21310388087265242-AXE.mp4   AXE     G_03_066

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/07157…         18     100   31
1  file:///home/kristian/ASL_Citizen/videos/71793…         18      81   30
2  file:///home/kristian/ASL_Citizen/videos/16216…         18      47   30
3  file:///home/kristian/ASL_Citizen/videos/61938…         18      67   30
4  file:///home/kristian/ASL_Citizen/videos/59474…         18      89   30
5  file:///home/kristian/ASL_Citizen/videos/92957…         18     112   29
6  file:///home/kristian/ASL_Citizen/videos/90476…         18      64   30
7  file:///home/kristian/ASL_Citizen/videos/01613…         18      75   30
8  file:///home/kristian/ASL_Citizen/videos/23099…         18      91   29
9  file:///home/kristian/ASL_Citizen/videos/21310…         18      69   30

   Length  Width  Height
0       3    640     480
1       3    640     480
2       2    640     480
3       2    640     480
4       3    640     480
5       4    640     480
6       2    640     480
7       2    640     480
8       3    640     480
9       2    640     480
```

[80]:
```
print(traindf['Gloss'].nunique())
```

```
50
```

[81]:
```
tqdm.pandas()
valdf[[
    'Frames', 'FPS', 'Length', 'Width', 'Height'
]] = valdf['Path'].progress_apply(lambda x: pd.Series(frames_from_file(x)))
```

```
100%|                        | 191/191 [00:03<00:00, 50.66it/s]
```

[82]:
```
valdf.head()
```

[82]:
```
  Participant ID                     Video file     Gloss ASL-LEX Code  \
0            P39      19778675091674147-AXE.mp4       AXE     G_03_066
1            P26       8581142177964065-AXE.mp4       AXE     G_03_066
2            P39       3877478645046861-AXE.mp4       AXE     G_03_066
3            P21       8521417940364975-AXE.mp4       AXE     G_03_066
4             P5  9990244640190733-BACKPACK.mp4  BACKPACK     G_03_091

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/19778…          4     121   30
1  file:///home/kristian/ASL_Citizen/videos/85811…          4      81   29
2  file:///home/kristian/ASL_Citizen/videos/38774…          4     120   30
3  file:///home/kristian/ASL_Citizen/videos/85214…          4      71   29
4  file:///home/kristian/ASL_Citizen/videos/99902…          3      93   29

   Length  Width  Height
0       4    640     480
1       3    640     480
2       4    640     480
3       2    640     480
4       3    640     480
```

[83]:
```
valdf['Frames'].max()
```

[83]: 207

[84]:
```
valdf.describe()
```

[84]:

	Frequency	Frames	FPS	Length	Width	Height
count	191.000000	191.000000	191.000000	191.000000	191.0	191.0
mean	3.963351	88.905759	29.706806	3.000000	640.0	480.0
std	0.770316	36.214006	0.456423	1.248157	0.0	0.0
min	3.000000	37.000000	29.000000	1.000000	640.0	480.0
25%	3.000000	61.500000	29.000000	2.000000	640.0	480.0
50%	4.000000	76.000000	30.000000	3.000000	640.0	480.0
75%	4.000000	117.500000	30.000000	4.000000	640.0	480.0
max	6.000000	207.000000	30.000000	7.000000	640.0	480.0

[85]:
```
valdf = valdf[(valdf['Length'] > 1) & (valdf['FPS'] > 28) &
              (valdf['Frames'] < 131)]
```

```
valdf = valdf.reset_index(drop=True)
valdf.describe()
```

[85]:

	Frequency	Frames	FPS	Length	Width	Height
count	162.000000	162.000000	162.000000	162.000000	162.0	162.0
mean	3.993827	78.203704	29.691358	2.623457	640.0	480.0
std	0.760001	23.787397	0.463365	0.772311	0.0	0.0
min	3.000000	45.000000	29.000000	2.000000	640.0	480.0
25%	3.000000	59.250000	29.000000	2.000000	640.0	480.0
50%	4.000000	71.500000	30.000000	2.000000	640.0	480.0
75%	4.000000	92.000000	30.000000	3.000000	640.0	480.0
max	6.000000	130.000000	30.000000	4.000000	640.0	480.0

[86]:

```
valdf['Frequency'] = valdf['Gloss'].map(valdf['Gloss'].value_counts())
valdf.describe()
```

[86]:

	Frequency	Frames	FPS	Length	Width	Height
count	162.000000	162.000000	162.000000	162.000000	162.0	162.0
mean	3.506173	78.203704	29.691358	2.623457	640.0	480.0
std	0.907162	23.787397	0.463365	0.772311	0.0	0.0
min	2.000000	45.000000	29.000000	2.000000	640.0	480.0
25%	3.000000	59.250000	29.000000	2.000000	640.0	480.0
50%	4.000000	71.500000	30.000000	2.000000	640.0	480.0
75%	4.000000	92.000000	30.000000	3.000000	640.0	480.0
max	5.000000	130.000000	30.000000	4.000000	640.0	480.0

[87]:

```
valdf.tail(60)
```

[87]:

	Participant ID	Video file	Gloss	\
102	P12	2553847483769758-LUNCH.mp4	LUNCH	
103	P12	5796656512680336-LUNCH.mp4	LUNCH	
104	P5	5530107164077924-LUNCH.mp4	LUNCH	
105	P21	07736207797943306-LUNCH.mp4	LUNCH	
106	P26	2560023931191153-MAPLE.mp4	MAPLE	
107	P21	7629092396207264-MAPLE.mp4	MAPLE	
108	P39	6940052288653344-MEAT.mp4	MEAT	
109	P21	23447000304598498-MEAT.mp4	MEAT	
110	P26	46170617189439445-MEAT.mp4	MEAT	
111	P26	424117143455232-MECHANIC.mp4	MECHANIC	
112	P21	7355641552290353-MECHANIC.mp4	MECHANIC	
113	P26	1550944296003025-MICROSCOPE.mp4	MICROSCOPE	
114	P21	9187403001004872-MICROSCOPE.mp4	MICROSCOPE	
115	P39	5547731542068628-MICROSCOPE.mp4	MICROSCOPE	
116	P5	10557248501909733-MICROSCOPE.mp4	MICROSCOPE	
117	P26	2838376949179944-MOVIE.mp4	MOVIE	
118	P12	39474504957896217-MOVIE.mp4	MOVIE	
119	P21	671764401941833-MOVIE.mp4	MOVIE	

120	P39	5535338426456671-MOVIE.mp4	MOVIE
121	P12	15347326711184706-NOON.mp4	NOON
122	P26	22732217637347518-NOON.mp4	NOON
123	P21	7713607971692202-NOON.mp4	NOON
124	P39	717958009426233-NOON.mp4	NOON
125	P12	878457250310533-PARTY.mp4	PARTY
126	P26	29398177566155903-PARTY.mp4	PARTY
127	P21	006918970578539518-PARTY.mp4	PARTY
128	P39	6496108914533325-PARTY.mp4	PARTY
129	P26	08197479357139326-PATIENT 2.mp4	PATIENT
130	P12	06585822033156608-PATIENT 2.mp4	PATIENT
131	P21	9858541230690814-PATIENT 2.mp4	PATIENT
132	P26	28202328150486666-RAZOR 2.mp4	RAZOR
133	P21	2710513815020268-RAZOR 2.mp4	RAZOR
134	P21	5962378845845178-RIVER.mp4	RIVER
135	P12	3054167723169219-RIVER.mp4	RIVER
136	P26	05621288177415629-RIVER.mp4	RIVER
137	P26	9826258167906428-ROCKING CHAIR.mp4	ROCKINGCHAIR
138	P21	6414524542629407-ROCKING CHAIR.mp4	ROCKINGCHAIR
139	P12	6050297960065525-ROCKING CHAIR.mp4	ROCKINGCHAIR
140	P39	8563899734807414-ROCKING CHAIR.mp4	ROCKINGCHAIR
141	P26	6416983573445294-SHAVE.mp4	SHAVE
142	P39	3159241677201454-SHAVE.mp4	SHAVE
143	P21	021193533049441937-SHAVE.mp4	SHAVE
144	P12	3423044704100937-SHAVE.mp4	SHAVE
145	P12	6961575623504714-SHAVE.mp4	SHAVE
146	P12	36176458889227514-SINK.mp4	SINK
147	P21	6376722418151588-SINK.mp4	SINK
148	P26	9377718462347715-SINK.mp4	SINK
149	P26	17092802473126545-SQUEEZE.mp4	SQUEEZE
150	P21	03951129691638511-SQUEEZE.mp4	SQUEEZE
151	P26	2151941336300882-THEY.mp4	THEY
152	P21	9598803772091737-THEY.mp4	THEY
153	P39	30415256515089983-TWINS.mp4	TWINS
154	P26	9969703511848236-TWINS.mp4	TWINS
155	P5	7359133874002342-TWINS.mp4	TWINS
156	P21	9942639780287319-TWINS.mp4	TWINS
157	P26	032677896012150764-WHAT FOR.mp4	WHATFOR
158	P5	6523145816470133-WHAT FOR.mp4	WHATFOR
159	P39	0283886564670357-WHAT FOR.mp4	WHATFOR
160	P21	6142521746642153-WHAT FOR.mp4	WHATFOR
161	P12	06408604416165864-WHAT FOR.mp4	WHATFOR

	ASL-LEX Code	Path \
102	G_02_081	file:///home/kristian/ASL_Citizen/videos/25538…
103	G_02_081	file:///home/kristian/ASL_Citizen/videos/57966…
104	G_02_081	file:///home/kristian/ASL_Citizen/videos/55301…

105	G_02_081	file:///home/kristian/ASL_Citizen/videos/07736…
106	H_03_064	file:///home/kristian/ASL_Citizen/videos/25600…
107	H_03_064	file:///home/kristian/ASL_Citizen/videos/76290…
108	D_02_022	file:///home/kristian/ASL_Citizen/videos/69400…
109	D_02_022	file:///home/kristian/ASL_Citizen/videos/23447…
110	D_02_022	file:///home/kristian/ASL_Citizen/videos/46170…
111	A_03_030	file:///home/kristian/ASL_Citizen/videos/42411…
112	A_03_030	file:///home/kristian/ASL_Citizen/videos/73556…
113	A_03_076	file:///home/kristian/ASL_Citizen/videos/15509…
114	A_03_076	file:///home/kristian/ASL_Citizen/videos/91874…
115	A_03_076	file:///home/kristian/ASL_Citizen/videos/55477…
116	A_03_076	file:///home/kristian/ASL_Citizen/videos/10557…
117	B_03_077	file:///home/kristian/ASL_Citizen/videos/28383…
118	B_03_077	file:///home/kristian/ASL_Citizen/videos/39474…
119	B_03_077	file:///home/kristian/ASL_Citizen/videos/67176…
120	B_03_077	file:///home/kristian/ASL_Citizen/videos/55353…
121	G_02_014	file:///home/kristian/ASL_Citizen/videos/15347…
122	G_02_014	file:///home/kristian/ASL_Citizen/videos/22732…
123	G_02_014	file:///home/kristian/ASL_Citizen/videos/77136…
124	G_02_014	file:///home/kristian/ASL_Citizen/videos/71795…
125	G_02_059	file:///home/kristian/ASL_Citizen/videos/87845…
126	G_02_059	file:///home/kristian/ASL_Citizen/videos/29398…
127	G_02_059	file:///home/kristian/ASL_Citizen/videos/00691…
128	G_02_059	file:///home/kristian/ASL_Citizen/videos/64961…
129	B_01_085	file:///home/kristian/ASL_Citizen/videos/08197…
130	B_01_085	file:///home/kristian/ASL_Citizen/videos/06585…
131	B_01_085	file:///home/kristian/ASL_Citizen/videos/98585…
132	K_03_103	file:///home/kristian/ASL_Citizen/videos/28202…
133	K_03_103	file:///home/kristian/ASL_Citizen/videos/27105…
134	A_03_035	file:///home/kristian/ASL_Citizen/videos/59623…
135	A_03_035	file:///home/kristian/ASL_Citizen/videos/30541…
136	A_03_035	file:///home/kristian/ASL_Citizen/videos/05621…
137	G_01_010	file:///home/kristian/ASL_Citizen/videos/98262…
138	G_01_010	file:///home/kristian/ASL_Citizen/videos/64145…
139	G_01_010	file:///home/kristian/ASL_Citizen/videos/60502…
140	G_01_010	file:///home/kristian/ASL_Citizen/videos/85638…
141	J_02_018	file:///home/kristian/ASL_Citizen/videos/64169…
142	J_02_018	file:///home/kristian/ASL_Citizen/videos/31592…
143	J_02_018	file:///home/kristian/ASL_Citizen/videos/02119…
144	J_02_018	file:///home/kristian/ASL_Citizen/videos/34230…
145	J_02_018	file:///home/kristian/ASL_Citizen/videos/69615…
146	E_02_042	file:///home/kristian/ASL_Citizen/videos/36176…
147	E_02_042	file:///home/kristian/ASL_Citizen/videos/63767…
148	E_02_042	file:///home/kristian/ASL_Citizen/videos/93777…
149	H_03_019	file:///home/kristian/ASL_Citizen/videos/17092…
150	H_03_019	file:///home/kristian/ASL_Citizen/videos/03951…
151	F_02_103	file:///home/kristian/ASL_Citizen/videos/21519…

152	F_02_103	file:///home/kristian/ASL_Citizen/videos/95988…
153	F_01_032	file:///home/kristian/ASL_Citizen/videos/30415…
154	F_01_032	file:///home/kristian/ASL_Citizen/videos/99697…
155	F_01_032	file:///home/kristian/ASL_Citizen/videos/73591…
156	F_01_032	file:///home/kristian/ASL_Citizen/videos/99426…
157	C_02_054	file:///home/kristian/ASL_Citizen/videos/03267…
158	C_02_054	file:///home/kristian/ASL_Citizen/videos/65231…
159	C_02_054	file:///home/kristian/ASL_Citizen/videos/02838…
160	C_02_054	file:///home/kristian/ASL_Citizen/videos/61425…
161	C_02_054	file:///home/kristian/ASL_Citizen/videos/06408…

	Frequency	Frames	FPS	Length	Width	Height
102	4	58	30	2	640	480
103	4	65	30	2	640	480
104	4	78	30	3	640	480
105	4	56	29	2	640	480
106	2	82	30	3	640	480
107	2	76	29	3	640	480
108	3	120	30	4	640	480
109	3	64	29	2	640	480
110	3	85	30	3	640	480
111	2	97	30	3	640	480
112	2	62	30	2	640	480
113	4	90	29	3	640	480
114	4	62	30	2	640	480
115	4	126	30	4	640	480
116	4	92	30	3	640	480
117	4	83	30	3	640	480
118	4	64	30	2	640	480
119	4	63	29	2	640	480
120	4	126	30	4	640	480
121	4	67	29	2	640	480
122	4	64	29	2	640	480
123	4	68	30	2	640	480
124	4	123	30	4	640	480
125	4	72	30	2	640	480
126	4	68	30	2	640	480
127	4	47	30	2	640	480
128	4	112	30	4	640	480
129	3	50	30	2	640	480
130	3	49	29	2	640	480
131	3	50	29	2	640	480
132	2	99	29	3	640	480
133	2	77	30	3	640	480
134	3	65	29	2	640	480
135	3	75	30	2	640	480
136	3	73	30	2	640	480

```
137          4      76   30        3    640     480
138          4      56   30        2    640     480
139          4      75   30        2    640     480
140          4     113   30        4    640     480
141          5      95   30        3    640     480
142          5     129   30        4    640     480
143          5      55   30        2    640     480
144          5      84   30        3    640     480
145          5      68   29        2    640     480
146          3      55   30        2    640     480
147          3      64   30        2    640     480
148          3      89   30        3    640     480
149          2      57   29        2    640     480
150          2      69   29        2    640     480
151          2      71   29        2    640     480
152          2      59   29        2    640     480
153          4     119   30        4    640     480
154          4      70   30        2    640     480
155          4      82   29        3    640     480
156          4      53   29        2    640     480
157          5      81   29        3    640     480
158          5     116   30        4    640     480
159          5     121   30        4    640     480
160          5      57   30        2    640     480
161          5      71   30        2    640     480
```

[88]:
```
valdf.head(10)
```

[88]:
```
  Participant ID                       Video file       Gloss ASL-LEX Code  \
0            P39        19778675091674147-AXE.mp4         AXE     G_03_066
1            P26         8581142177964065-AXE.mp4         AXE     G_03_066
2            P39         3877478645046861-AXE.mp4         AXE     G_03_066
3            P21         8521417940364975-AXE.mp4         AXE     G_03_066
4             P5    9990244640190733-BACKPACK.mp4    BACKPACK     G_03_091
5            P39    4985293038019454-BACKPACK.mp4    BACKPACK     G_03_091
6            P21      20198961584817-BACKPACK.mp4    BACKPACK     G_03_091
7             P5  8423017864044668-BASKETBALL.mp4  BASKETBALL     A_03_045
8            P39  6251993314243527-BASKETBALL.mp4  BASKETBALL     A_03_045
9            P26  6152714959604932-BASKETBALL.mp4  BASKETBALL     A_03_045

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/19778…          4     121   30
1  file:///home/kristian/ASL_Citizen/videos/85811…          4      81   29
2  file:///home/kristian/ASL_Citizen/videos/38774…          4     120   30
3  file:///home/kristian/ASL_Citizen/videos/85214…          4      71   29
4  file:///home/kristian/ASL_Citizen/videos/99902…          3      93   29
5  file:///home/kristian/ASL_Citizen/videos/49852…          3     128   30
```

```
6  file:///home/kristian/ASL_Citizen/videos/20198…          3      48   30
7  file:///home/kristian/ASL_Citizen/videos/84230…          5      90   30
8  file:///home/kristian/ASL_Citizen/videos/62519…          5     127   30
9  file:///home/kristian/ASL_Citizen/videos/61527…          5      60   30

   Length  Width  Height
0       4    640     480
1       3    640     480
2       4    640     480
3       2    640     480
4       3    640     480
5       4    640     480
6       2    640     480
7       3    640     480
8       4    640     480
9       2    640     480
```

[89]:
```
valdf.describe()
```

[89]:

	Frequency	Frames	FPS	Length	Width	Height
count	162.000000	162.000000	162.000000	162.000000	162.0	162.0
mean	3.506173	78.203704	29.691358	2.623457	640.0	480.0
std	0.907162	23.787397	0.463365	0.772311	0.0	0.0
min	2.000000	45.000000	29.000000	2.000000	640.0	480.0
25%	3.000000	59.250000	29.000000	2.000000	640.0	480.0
50%	4.000000	71.500000	30.000000	2.000000	640.0	480.0
75%	4.000000	92.000000	30.000000	3.000000	640.0	480.0
max	5.000000	130.000000	30.000000	4.000000	640.0	480.0

[90]:
```
print(valdf['Gloss'].nunique())
```

```
50
```

[91]:
```
tqdm.pandas()
testdf[[
    'Frames', 'FPS', 'Length', 'Width', 'Height'
]] = testdf['Path'].progress_apply(lambda x: pd.Series(frames_from_file(x)))
```

```
100%|                      | 729/729 [00:16<00:00, 44.57it/s]
```

[92]:
```
testdf.head()
```

[92]:

	Participant ID	Video file	Gloss	ASL-LEX Code	\
0	P15	33721516025652254-AXE.mp4	AXE	G_03_066	
1	P47	519067006979435-AXE.mp4	AXE	G_03_066	
2	P35	5104381603195376-AXE.mp4	AXE	G_03_066	
3	P42	44458614013793873-AXE.mp4	AXE	G_03_066	
4	P42	9604797909481075-AXE.mp4	AXE	G_03_066	

```
                                                   Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/33721…         15     196   29
1  file:///home/kristian/ASL_Citizen/videos/51906…         15     102   26
2  file:///home/kristian/ASL_Citizen/videos/51043…         15      70   29
3  file:///home/kristian/ASL_Citizen/videos/44458…         15      57   30
4  file:///home/kristian/ASL_Citizen/videos/96047…         15      66   30

   Length  Width  Height
0       7    640     480
1       4    640     480
2       2    640     480
3       2    960     540
4       2    960     540
```

[93]:
```
testdf['Frames'].max()
```

[93]: 234

[94]:
```
testdf.describe()
```

[94]:

	Frequency	Frames	FPS	Length	Width	Height
count	729.000000	729.000000	729.000000	729.000000	729.000000	729.000000
mean	14.978052	75.192044	28.696845	2.624143	684.334705	488.312757
std	2.229192	27.848864	3.113689	1.003439	110.626974	20.742558
min	9.000000	10.000000	14.000000	0.000000	640.000000	480.000000
25%	14.000000	56.000000	29.000000	2.000000	640.000000	480.000000
50%	15.000000	73.000000	30.000000	3.000000	640.000000	480.000000
75%	16.000000	90.000000	30.000000	3.000000	640.000000	480.000000
max	20.000000	234.000000	31.000000	8.000000	960.000000	540.000000

[95]:
```
testdf = testdf[(testdf['Length'] > 1) & (testdf['FPS'] > 28) &
                (testdf['Frames'] < 131)]

testdf = testdf.reset_index(drop=True)
testdf.describe()
```

[95]:

	Frequency	Frames	FPS	Length	Width	Height
count	534.000000	534.000000	534.000000	534.000000	534.000000	534.000000
mean	15.014981	77.256554	29.702247	2.619850	688.539326	489.101124
std	2.217904	19.420007	0.526337	0.670792	114.896647	21.543121
min	9.000000	45.000000	29.000000	2.000000	640.000000	480.000000
25%	14.000000	61.000000	29.000000	2.000000	640.000000	480.000000
50%	15.000000	75.000000	30.000000	3.000000	640.000000	480.000000
75%	16.000000	91.000000	30.000000	3.000000	640.000000	480.000000
max	20.000000	130.000000	31.000000	4.000000	960.000000	540.000000

[96]:
```
testdf['Frequency'] = testdf['Gloss'].map(testdf['Gloss'].value_counts())

testdf.describe()
```

[96]:

	Frequency	Frames	FPS	Length	Width	Height
count	534.000000	534.000000	534.000000	534.000000	534.000000	534.000000
mean	11.254682	77.256554	29.702247	2.619850	688.539326	489.101124
std	2.311308	19.420007	0.526337	0.670792	114.896647	21.543121
min	5.000000	45.000000	29.000000	2.000000	640.000000	480.000000
25%	10.000000	61.000000	29.000000	2.000000	640.000000	480.000000
50%	12.000000	75.000000	30.000000	3.000000	640.000000	480.000000
75%	13.000000	91.000000	30.000000	3.000000	640.000000	480.000000
max	15.000000	130.000000	31.000000	4.000000	960.000000	540.000000

[97]:
```
testdf.tail(60)
```

[97]:

	Participant ID	Video file	Gloss	ASL-LEX Code	\
474	P9	5911137084980156-SHAVE.mp4	SHAVE	J_02_018	
475	P35	5887689273566759-SHAVE.mp4	SHAVE	J_02_018	
476	P48	6621939724418062-SHAVE.mp4	SHAVE	J_02_018	
477	P17	09709454810039175-SHAVE.mp4	SHAVE	J_02_018	
478	P42	3588759801071051-SHAVE.mp4	SHAVE	J_02_018	
479	P35	4608324102845509-SHAVE.mp4	SHAVE	J_02_018	
480	P6	37779347947817365-SHAVE.mp4	SHAVE	J_02_018	
481	P35	5403299092715226-SHAVE.mp4	SHAVE	J_02_018	
482	P47	4814760954431352-SHAVE.mp4	SHAVE	J_02_018	
483	P22	4185420608277408-SHAVE.mp4	SHAVE	J_02_018	
484	P42	45913985094539034-SHAVE.mp4	SHAVE	J_02_018	
485	P48	9572472020825835-SHAVE.mp4	SHAVE	J_02_018	
486	P48	8837115118398433-SINK.mp4	SINK	E_02_042	
487	P9	8342342809172125-SINK.mp4	SINK	E_02_042	
488	P35	5780399875754547-SINK.mp4	SINK	E_02_042	
489	P6	30542066641425136-SINK.mp4	SINK	E_02_042	
490	P47	10941417100216433-SINK.mp4	SINK	E_02_042	
491	P49	9462586175856116-SINK.mp4	SINK	E_02_042	
492	P17	65783462643741-SINK.mp4	SINK	E_02_042	
493	P22	8675465806927196-SINK.mp4	SINK	E_02_042	
494	P42	013933028993222907-SINK.mp4	SINK	E_02_042	
495	P42	1507074049477588-SQUEEZE.mp4	SQUEEZE	H_03_019	
496	P35	47046133854683725-SQUEEZE.mp4	SQUEEZE	H_03_019	
497	P48	5650251393797099-SQUEEZE.mp4	SQUEEZE	H_03_019	
498	P9	1630741460505114-SQUEEZE.mp4	SQUEEZE	H_03_019	
499	P49	6110727438268888-SQUEEZE.mp4	SQUEEZE	H_03_019	
500	P35	4877518027558987-THEY.mp4	THEY	F_02_103	
501	P47	27954487382286475-THEY.mp4	THEY	F_02_103	
502	P17	5713986054090463-THEY.mp4	THEY	F_02_103	
503	P42	9506371438753063-THEY.mp4	THEY	F_02_103	

504	P42	6351385061595975-THEY.mp4	THEY	F_02_103
505	P35	37410330681116033-THEY.mp4	THEY	F_02_103
506	P9	8208473879770646-THEY.mp4	THEY	F_02_103
507	P15	8161529489147155-THEY.mp4	THEY	F_02_103
508	P6	4843002553575395-THEY.mp4	THEY	F_02_103
509	P48	6294547374725679-THEY.mp4	THEY	F_02_103
510	P48	24605674688653978-TWINS.mp4	TWINS	F_01_032
511	P17	31730779368330464-TWINS.mp4	TWINS	F_01_032
512	P42	5607838772101854-TWINS.mp4	TWINS	F_01_032
513	P9	4032127809635533-TWINS.mp4	TWINS	F_01_032
514	P22	29587887363119436-TWINS.mp4	TWINS	F_01_032
515	P35	06625351805349333-TWINS.mp4	TWINS	F_01_032
516	P49	5414581968670888-TWINS.mp4	TWINS	F_01_032
517	P15	03604051300002031-TWINS.mp4	TWINS	F_01_032
518	P35	2825233660609592-TWINS.mp4	TWINS	F_01_032
519	P6	8598719617773274-TWINS.mp4	TWINS	F_01_032
520	P47	18536227362107272-TWINS.mp4	TWINS	F_01_032
521	P17	33051835760678294-WHAT FOR.mp4	WHATFOR	C_02_054
522	P6	6734748834983595-WHAT FOR.mp4	WHATFOR	C_02_054
523	P6	41953269936944704-WHAT FOR.mp4	WHATFOR	C_02_054
524	P48	11542521046357379-WHAT FOR.mp4	WHATFOR	C_02_054
525	P9	6491618764233542-WHAT FOR.mp4	WHATFOR	C_02_054
526	P42	9684934734400592-WHAT FOR.mp4	WHATFOR	C_02_054
527	P35	06612660137871473-WHAT FOR.mp4	WHATFOR	C_02_054
528	P42	5370182591161741-WHAT FOR.mp4	WHATFOR	C_02_054
529	P35	5702632225441844-WHAT FOR.mp4	WHATFOR	C_02_054
530	P35	8630644173768907-WHAT FOR.mp4	WHATFOR	C_02_054
531	P22	9359050586202402-WHAT FOR.mp4	WHATFOR	C_02_054
532	P42	2748457214117681-WHAT FOR.mp4	WHATFOR	C_02_054
533	P15	540014801916062-WHAT FOR.mp4	WHATFOR	C_02_054

	Path	Frequency	Frames	\
474	file:///home/kristian/ASL_Citizen/videos/59111…	12	110	
475	file:///home/kristian/ASL_Citizen/videos/58876…	12	92	
476	file:///home/kristian/ASL_Citizen/videos/66219…	12	80	
477	file:///home/kristian/ASL_Citizen/videos/09709…	12	76	
478	file:///home/kristian/ASL_Citizen/videos/35887…	12	86	
479	file:///home/kristian/ASL_Citizen/videos/46083…	12	87	
480	file:///home/kristian/ASL_Citizen/videos/37779…	12	57	
481	file:///home/kristian/ASL_Citizen/videos/54032…	12	60	
482	file:///home/kristian/ASL_Citizen/videos/48147…	12	102	
483	file:///home/kristian/ASL_Citizen/videos/41854…	12	59	
484	file:///home/kristian/ASL_Citizen/videos/45913…	12	106	
485	file:///home/kristian/ASL_Citizen/videos/95724…	12	79	
486	file:///home/kristian/ASL_Citizen/videos/88371…	9	74	
487	file:///home/kristian/ASL_Citizen/videos/83423…	9	123	
488	file:///home/kristian/ASL_Citizen/videos/57803…	9	54	

489	file:///home/kristian/ASL_Citizen/videos/30542…	9	53
490	file:///home/kristian/ASL_Citizen/videos/10941…	9	105
491	file:///home/kristian/ASL_Citizen/videos/94625…	9	109
492	file:///home/kristian/ASL_Citizen/videos/65783…	9	62
493	file:///home/kristian/ASL_Citizen/videos/86754…	9	52
494	file:///home/kristian/ASL_Citizen/videos/01393…	9	78
495	file:///home/kristian/ASL_Citizen/videos/15070…	5	75
496	file:///home/kristian/ASL_Citizen/videos/47046…	5	84
497	file:///home/kristian/ASL_Citizen/videos/56502…	5	79
498	file:///home/kristian/ASL_Citizen/videos/16307…	5	87
499	file:///home/kristian/ASL_Citizen/videos/61107…	5	67
500	file:///home/kristian/ASL_Citizen/videos/48775…	10	103
501	file:///home/kristian/ASL_Citizen/videos/27954…	10	98
502	file:///home/kristian/ASL_Citizen/videos/57139…	10	61
503	file:///home/kristian/ASL_Citizen/videos/95063…	10	45
504	file:///home/kristian/ASL_Citizen/videos/63513…	10	53
505	file:///home/kristian/ASL_Citizen/videos/37410…	10	69
506	file:///home/kristian/ASL_Citizen/videos/82084…	10	92
507	file:///home/kristian/ASL_Citizen/videos/81615…	10	86
508	file:///home/kristian/ASL_Citizen/videos/48430…	10	63
509	file:///home/kristian/ASL_Citizen/videos/62945…	10	61
510	file:///home/kristian/ASL_Citizen/videos/24605…	11	54
511	file:///home/kristian/ASL_Citizen/videos/31730…	11	57
512	file:///home/kristian/ASL_Citizen/videos/56078…	11	49
513	file:///home/kristian/ASL_Citizen/videos/40321…	11	90
514	file:///home/kristian/ASL_Citizen/videos/29587…	11	53
515	file:///home/kristian/ASL_Citizen/videos/06625…	11	75
516	file:///home/kristian/ASL_Citizen/videos/54145…	11	52
517	file:///home/kristian/ASL_Citizen/videos/03604…	11	79
518	file:///home/kristian/ASL_Citizen/videos/28252…	11	56
519	file:///home/kristian/ASL_Citizen/videos/85987…	11	45
520	file:///home/kristian/ASL_Citizen/videos/18536…	11	116
521	file:///home/kristian/ASL_Citizen/videos/33051…	13	52
522	file:///home/kristian/ASL_Citizen/videos/67347…	13	66
523	file:///home/kristian/ASL_Citizen/videos/41953…	13	56
524	file:///home/kristian/ASL_Citizen/videos/11542…	13	84
525	file:///home/kristian/ASL_Citizen/videos/64916…	13	82
526	file:///home/kristian/ASL_Citizen/videos/96849…	13	89
527	file:///home/kristian/ASL_Citizen/videos/06612…	13	83
528	file:///home/kristian/ASL_Citizen/videos/53701…	13	53
529	file:///home/kristian/ASL_Citizen/videos/57026…	13	80
530	file:///home/kristian/ASL_Citizen/videos/86306…	13	66
531	file:///home/kristian/ASL_Citizen/videos/93590…	13	48
532	file:///home/kristian/ASL_Citizen/videos/27484…	13	74
533	file:///home/kristian/ASL_Citizen/videos/54001…	13	79

FPS Length Width Height

474	29	4	640	480
475	30	3	640	480
476	30	3	640	480
477	31	2	640	480
478	30	3	960	540
479	30	3	640	480
480	29	2	640	480
481	30	2	640	480
482	30	3	640	480
483	30	2	640	480
484	30	4	960	540
485	30	3	640	480
486	30	2	640	480
487	30	4	640	480
488	29	2	640	480
489	29	2	640	480
490	30	4	640	480
491	30	4	640	480
492	30	2	640	480
493	30	2	640	480
494	30	3	960	540
495	30	2	960	540
496	30	3	640	480
497	30	3	640	480
498	29	3	640	480
499	30	2	640	480
500	29	4	640	480
501	30	3	640	480
502	30	2	640	480
503	30	2	960	540
504	31	2	960	540
505	30	2	640	480
506	29	3	640	480
507	29	3	640	480
508	29	2	640	480
509	30	2	640	480
510	30	2	640	480
511	29	2	640	480
512	30	2	960	540
513	29	3	640	480
514	29	2	640	480
515	29	3	640	480
516	30	2	640	480
517	30	3	640	480
518	29	2	640	480
519	29	2	640	480
520	30	4	640	480

```
521   31        2    640     480
522   29        2    640     480
523   29        2    640     480
524   30        3    640     480
525   30        3    640     480
526   30        3    960     540
527   30        3    640     480
528   30        2    960     540
529   29        3    640     480
530   29        2    640     480
531   30        2    640     480
532   30        2    960     540
533   29        3    640     480
```

[98]:
```
testdf.head(10)
```

[98]:
```
  Participant ID                 Video file Gloss ASL-LEX Code  \
0            P35   5104381603195376-AXE.mp4   AXE     G_03_066
1            P42  44458614013793873-AXE.mp4   AXE     G_03_066
2            P42   9604797909481075-AXE.mp4   AXE     G_03_066
3             P9  30728048195204827-AXE.mp4   AXE     G_03_066
4             P6  28522130623160047-AXE.mp4   AXE     G_03_066
5             P6   9169591255818932-AXE.mp4   AXE     G_03_066
6            P17   7135244799398011-AXE.mp4   AXE     G_03_066
7            P49  23228935359891456-AXE.mp4   AXE     G_03_066
8            P22   5872128462194921-AXE.mp4   AXE     G_03_066
9            P35   3681922148149226-AXE.mp4   AXE     G_03_066

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/51043…         11      70   29
1  file:///home/kristian/ASL_Citizen/videos/44458…         11      57   30
2  file:///home/kristian/ASL_Citizen/videos/96047…         11      66   30
3  file:///home/kristian/ASL_Citizen/videos/30728…         11      96   30
4  file:///home/kristian/ASL_Citizen/videos/28522…         11      54   29
5  file:///home/kristian/ASL_Citizen/videos/91695…         11      59   30
6  file:///home/kristian/ASL_Citizen/videos/71352…         11      82   30
7  file:///home/kristian/ASL_Citizen/videos/23228…         11      94   30
8  file:///home/kristian/ASL_Citizen/videos/58721…         11      53   30
9  file:///home/kristian/ASL_Citizen/videos/36819…         11      77   30

   Length  Width  Height
0       2    640     480
1       2    960     540
2       2    960     540
3       3    640     480
4       2    640     480
5       2    640     480
```

```
6        3    640     480
7        3    640     480
8        2    640     480
9        3    640     480
```

[99]:
```
testdf.describe()
```

[99]:

	Frequency	Frames	FPS	Length	Width	Height
count	534.000000	534.000000	534.000000	534.000000	534.000000	534.000000
mean	11.254682	77.256554	29.702247	2.619850	688.539326	489.101124
std	2.311308	19.420007	0.526337	0.670792	114.896647	21.543121
min	5.000000	45.000000	29.000000	2.000000	640.000000	480.000000
25%	10.000000	61.000000	29.000000	2.000000	640.000000	480.000000
50%	12.000000	75.000000	30.000000	3.000000	640.000000	480.000000
75%	13.000000	91.000000	30.000000	3.000000	640.000000	480.000000
max	15.000000	130.000000	31.000000	4.000000	960.000000	540.000000

[100]:
```
print(testdf['Gloss'].nunique())
```

```
50
```

[ ]:
```
keypoints_series = traindf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/train_keypoints.
 ↪npy",
    keypoints_series)
keypoints_series = traindf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪train_keypoints_flip.npy",
    keypoints_series)
```

[ ]:
```
keypoints_series.shape
```

[101]:
```
keypoints_series = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/train_keypoints.
 ↪npy",
    allow_pickle=True)
```

[102]:
```
keypoints_series.shape
```

[102]: (804,)

[103]:
```
max(keypoints.shape[0] for keypoints in keypoints_series)
```

[103]: 130

[104]:
```
min(keypoints.shape[0] for keypoints in keypoints_series)
```

[104]: 45

[107]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(keypoints_series), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(keypoints_series):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]
```

[108]:
```
keypoints_np.shape
```

[108]: (804, 130, 399)

[109]:
```
print(keypoints_np[6])
```

```
[[  0.          0.          0.        …  0.          0.
    0.        ]
 [  0.          0.          0.        …  0.          0.
    0.        ]
 [  0.          0.          0.        …  0.          0.
    0.        ]
 …
 [  0.89147449   0.8976084    0.89568257 … 458.35784853 239.05811119
  458.35784853]
 [  0.89196533   0.89440548   0.8918556  … 456.38752186 233.94797389
  456.38752186]
 [  0.89188373   0.8966639    0.89486736 … 459.60636568 227.72271776
  459.60636568]]
```

[110]:
```
keypoints_np.shape
```

[110]: (804, 130, 399)

[ ]:
```
keypoints_series = testdf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/test_keypoints.
 ↪npy",
    keypoints_series)
keypoints_series = testdf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪test_keypoints_flip.npy",
    keypoints_series)
```

[99]:
```
keypoints_series.shape
```

[99]: (534,)

[111]:
```
keypoints_series = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/test_keypoints.
 ↪npy",
    allow_pickle=True)
```

[112]:
```
keypoints_series.shape
```

[112]: (534,)

[113]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(keypoints_series), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(keypoints_series):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]
```

[114]:
```
keypoints_np.shape
```

[114]: (534, 130, 399)

[ ]:
```
keypoints_series = valdf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/val_keypoints.npy",
    keypoints_series)
keypoints_series = valdf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/val_keypoints_flip.
 ↪npy",
    keypoints_series)
```

[ ]:
```
keypoints_series.shape
```

[115]:
```
keypoints_series = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/val_keypoints.npy",
    allow_pickle=True)
```

[116]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(keypoints_series), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(keypoints_series):
```

```
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]
```

[117]:
```
keypoints_np.shape
```

[117]: (162, 130, 399)

2 Preprocessing

[88]:
```
from sklearn.preprocessing import OrdinalEncoder
from keras.utils import to_categorical
import numpy as np
from sklearn.preprocessing import MaxAbsScaler
```

[89]:
```
import numpy as np

train_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/train_keypoints.
 ↪npy",
    allow_pickle=True)
val_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/val_keypoints.npy",
    allow_pickle=True)
test_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/test_keypoints.
 ↪npy",
    allow_pickle=True)

print('Training Keypoints Shape:', train_keypoints.shape)
print('Validation Kepoints Shape:', val_keypoints.shape)
print('Test Keypoints Shape:', test_keypoints.shape)
```

```
Training Keypoints Shape: (804,)
Validation Kepoints Shape: (162,)
Test Keypoints Shape: (534,)
```

[90]:
```
train_keypoints_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪train_keypoints_flip.npy",
    allow_pickle=True)
val_keypoints_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/val_keypoints_flip.
 ↪npy",
    allow_pickle=True)
test_keypoints_flip = np.load(
```

```
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪test_keypoints_flip.npy",
    allow_pickle=True)

print('Training Keypoints Shape:', train_keypoints_flip.shape)
print('Validation Kepoints Shape:', val_keypoints_flip.shape)
print('Test Keypoints Shape:', test_keypoints_flip.shape)
```

```
Training Keypoints Shape: (804,)
Validation Kepoints Shape: (162,)
Test Keypoints Shape: (534,)
```

[91]:
```
max_len = 130
```

[92]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(train_keypoints), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(train_keypoints):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

train_keypoints = keypoints_np
print('Training Keypoints Shape:', train_keypoints.shape)
```

```
Training Keypoints Shape: (804, 130, 399)
```

[93]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(val_keypoints), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(val_keypoints):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

val_keypoints = keypoints_np
print('Validation Keypoints Shape:', val_keypoints.shape)
```

```
Validation Keypoints Shape: (162, 130, 399)
```

[94]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(test_keypoints), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(test_keypoints):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
```

```
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

test_keypoints = keypoints_np
print('Test Keypoints Shape:', test_keypoints.shape)
```

```
Test Keypoints Shape: (534, 130, 399)
```

[95]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(train_keypoints_flip), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(train_keypoints_flip):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

train_keypoints_flip = keypoints_np
print('Training Keypoints Shape:', train_keypoints_flip.shape)
```

```
Training Keypoints Shape: (804, 130, 399)
```

[96]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(val_keypoints_flip), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(val_keypoints_flip):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

val_keypoints_flip = keypoints_np
print('Validation Keypoints Shape:', val_keypoints_flip.shape)
```

```
Validation Keypoints Shape: (162, 130, 399)
```

[97]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(test_keypoints_flip), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(test_keypoints_flip):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

test_keypoints_flip = keypoints_np
print('Test Keypoints Shape:', test_keypoints_flip.shape)
```

```
Test Keypoints Shape: (534, 130, 399)
```

[111]:
```
traindf.head()
```

[111]:
```
  Participant ID                     Video file Gloss ASL-LEX Code  \
0            P52  07157565148825373-seedAXE.mp4   AXE     G_03_066
1            P28       7179300005186042-AXE.mp4   AXE     G_03_066
2            P29      16216064841959765-AXE.mp4   AXE     G_03_066
3            P37       6193814382865199-AXE.mp4   AXE     G_03_066
4            P40       5947453960317015-AXE.mp4   AXE     G_03_066

                                                Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/07157…         18     100   31
1  file:///home/kristian/ASL_Citizen/videos/71793…         18      81   30
2  file:///home/kristian/ASL_Citizen/videos/16216…         18      47   30
3  file:///home/kristian/ASL_Citizen/videos/61938…         18      67   30
4  file:///home/kristian/ASL_Citizen/videos/59474…         18      89   30

   Length  Width  Height
0       3    640     480
1       3    640     480
2       2    640     480
3       2    640     480
4       3    640     480
```

[112]:
```
encoder = OrdinalEncoder()
```

[113]:
```
traindf['Cat_label'] = encoder.fit_transform(traindf[['Gloss']]).astype(int)
traindf = traindf.sort_values(by='Gloss', )
```

[114]:
```
traindf.head()
```

[114]:
```
   Participant ID                     Video file Gloss ASL-LEX Code  \
0             P52  07157565148825373-seedAXE.mp4   AXE     G_03_066
17            P37      29360158406046777-AXE.mp4   AXE     G_03_066
16            P27     053394218351220823-AXE.mp4   AXE     G_03_066
15            P40      10598328043940142-AXE.mp4   AXE     G_03_066
14            P50       3937261764308986-AXE.mp4   AXE     G_03_066

                                                Path  Frequency  Frames  FPS  \
0   file:///home/kristian/ASL_Citizen/videos/07157…         18     100   31
17  file:///home/kristian/ASL_Citizen/videos/29360…         18      73   30
16  file:///home/kristian/ASL_Citizen/videos/05339…         18      52   29
15  file:///home/kristian/ASL_Citizen/videos/10598…         18      81   29
14  file:///home/kristian/ASL_Citizen/videos/39372…         18      72   30

    Length  Width  Height  Cat_label
0        3    640     480          0
17       2    640     480          0
```

```
16        2    640     480          0
15        3    640     480          0
14        2    640     480          0
```

[115]:
```
traindf.tail()
```

[115]:
```
    Participant ID                      Video file    Gloss ASL-LEX Code  \
789            P40   6445331634562388-WHAT FOR.mp4  WHATFOR     C_02_054
788            P37   6237575353180616-WHAT FOR.mp4  WHATFOR     C_02_054
802            P40   5268072837528903-WHAT FOR.mp4  WHATFOR     C_02_054
794            P37  16185522171162914-WHAT FOR.mp4  WHATFOR     C_02_054
803            P40   6363286086951516-WHAT FOR.mp4  WHATFOR     C_02_054

                                                 Path  Frequency  Frames  \
789  file:///home/kristian/ASL_Citizen/videos/64453…         16      89
788  file:///home/kristian/ASL_Citizen/videos/62375…         16      56
802  file:///home/kristian/ASL_Citizen/videos/52680…         16      92
794  file:///home/kristian/ASL_Citizen/videos/16185…         16      64
803  file:///home/kristian/ASL_Citizen/videos/63632…         16      65

     FPS  Length  Width  Height  Cat_label
789   30       3    640     480         49
788   30       2    640     480         49
802   29       3    640     480         49
794   30       2    640     480         49
803   29       2    640     480         49
```

[116]:
```
valdf['Cat_label'] = encoder.fit_transform(valdf[['Gloss']]).astype(int)
valdf = valdf.sort_values(by='Gloss', )
```

[117]:
```
valdf.head()
```

[117]:
```
  Participant ID                     Video file     Gloss ASL-LEX Code  \
0            P39      19778675091674147-AXE.mp4       AXE     G_03_066
1            P26       8581142177964065-AXE.mp4       AXE     G_03_066
2            P39       3877478645046861-AXE.mp4       AXE     G_03_066
3            P21       8521417940364975-AXE.mp4       AXE     G_03_066
4             P5  9990244640190733-BACKPACK.mp4  BACKPACK     G_03_091

                                                 Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/19778…          4     121   30
1  file:///home/kristian/ASL_Citizen/videos/85811…          4      81   29
2  file:///home/kristian/ASL_Citizen/videos/38774…          4     120   30
3  file:///home/kristian/ASL_Citizen/videos/85214…          4      71   29
4  file:///home/kristian/ASL_Citizen/videos/99902…          3      93   29

   Length  Width  Height  Cat_label
```

```
0       4    640     480          0
1       3    640     480          0
2       4    640     480          0
3       2    640     480          0
4       3    640     480          1
```

[118]:
```
valdf.tail()
```

[118]:
```
    Participant ID                        Video file    Gloss ASL-LEX Code  \
159            P39    0283886564670357-WHAT FOR.mp4  WHATFOR     C_02_054
160            P21    6142521746642153-WHAT FOR.mp4  WHATFOR     C_02_054
157            P26  0326778960121507 64-WHAT FOR.mp4  WHATFOR     C_02_054
158             P5    6523145816470133-WHAT FOR.mp4  WHATFOR     C_02_054
161            P12   06408604416165864-WHAT FOR.mp4  WHATFOR     C_02_054

                                                 Path  Frequency  Frames  \
159  file:///home/kristian/ASL_Citizen/videos/02838…          5     121
160  file:///home/kristian/ASL_Citizen/videos/61425…          5      57
157  file:///home/kristian/ASL_Citizen/videos/03267…          5      81
158  file:///home/kristian/ASL_Citizen/videos/65231…          5     116
161  file:///home/kristian/ASL_Citizen/videos/06408…          5      71

     FPS  Length  Width  Height  Cat_label
159   30       4    640     480         49
160   30       2    640     480         49
157   29       3    640     480         49
158   30       4    640     480         49
161   30       2    640     480         49
```

[119]:
```
testdf['Cat_label'] = encoder.fit_transform(testdf[['Gloss']]).astype(int)
testdf = testdf.sort_values(by='Gloss', )
```

[120]:
```
testdf.head()
```

[120]:
```
  Participant ID                 Video file Gloss ASL-LEX Code  \
0            P35   5104381603195376-AXE.mp4   AXE     G_03_066
1            P42  44458614013793873-AXE.mp4   AXE     G_03_066
2            P42   9604797909481075-AXE.mp4   AXE     G_03_066
3             P9  30728048195204827-AXE.mp4   AXE     G_03_066
4             P6  28522130623160047-AXE.mp4   AXE     G_03_066

                                                 Path  Frequency  Frames  FPS  \
0  file:///home/kristian/ASL_Citizen/videos/51043…         11      70   29
1  file:///home/kristian/ASL_Citizen/videos/44458…         11      57   30
2  file:///home/kristian/ASL_Citizen/videos/96047…         11      66   30
3  file:///home/kristian/ASL_Citizen/videos/30728…         11      96   30
4  file:///home/kristian/ASL_Citizen/videos/28522…         11      54   29
```

```
   Length  Width  Height  Cat_label
0       2    640     480          0
1       2    960     540          0
2       2    960     540          0
3       3    640     480          0
4       2    640     480          0
```

[121]:
```
testdf.tail()
```

[121]:
```
    Participant ID                      Video file    Gloss ASL-LEX Code  \
522             P6   6734748834983595-WHAT FOR.mp4  WHATFOR     C_02_054
521            P17  33051835760678294-WHAT FOR.mp4  WHATFOR     C_02_054
532            P42   2748457214117681-WHAT FOR.mp4  WHATFOR     C_02_054
526            P42   9684934734400592-WHAT FOR.mp4  WHATFOR     C_02_054
533            P15    540014801916062-WHAT FOR.mp4  WHATFOR     C_02_054

                                                 Path  Frequency  Frames  \
522  file:///home/kristian/ASL_Citizen/videos/67347…         13      66
521  file:///home/kristian/ASL_Citizen/videos/33051…         13      52
532  file:///home/kristian/ASL_Citizen/videos/27484…         13      74
526  file:///home/kristian/ASL_Citizen/videos/96849…         13      89
533  file:///home/kristian/ASL_Citizen/videos/54001…         13      79

     FPS  Length  Width  Height  Cat_label
522   29       2    640     480         49
521   31       2    640     480         49
532   30       2    960     540         49
526   30       3    960     540         49
533   29       3    640     480         49
```

[98]:
```
label_map = {label: num for num, label in enumerate(traindf['Gloss'].unique())}
```

[99]:
```
label_map
```

[99]:
```
{'AXE': 0,
 'BACKPACK': 1,
 'BASKETBALL': 2,
 'BEE': 3,
 'BELT': 4,
 'BITE': 5,
 'BREAKFAST': 6,
 'CANCER': 7,
 'CHRISTMAS': 8,
 'CONFUSED': 9,
 'DARK': 10,
 'DEAF': 11,
```

```
 'DECIDE': 12,
 'DEMAND': 13,
 'DEVELOP': 14,
 'DINNER': 15,
 'DOG': 16,
 'DOWNSIZE': 17,
 'DRAG': 18,
 'EAT': 19,
 'EDIT': 20,
 'ELEVATOR': 21,
 'FINE': 22,
 'FLOAT': 23,
 'FOREIGNER': 24,
 'GUESS': 25,
 'HALLOWEEN': 26,
 'HOSPITAL': 27,
 'HURDLE/TRIP': 28,
 'JEWELRY': 29,
 'KNIGHT': 30,
 'LOCK': 31,
 'LUNCH': 32,
 'MAPLE': 33,
 'MEAT': 34,
 'MECHANIC': 35,
 'MICROSCOPE': 36,
 'MOVIE': 37,
 'NOON': 38,
 'PARTY': 39,
 'PATIENT': 40,
 'RAZOR': 41,
 'RIVER': 42,
 'ROCKINGCHAIR': 43,
 'SHAVE': 44,
 'SINK': 45,
 'SQUEEZE': 46,
 'THEY': 47,
 'TWINS': 48,
 'WHATFOR': 49}
```

[100]:
```
inv_label_map = {v: k for k, v in label_map.items()}
```

[125]:
```
inv_label_map
```

[125]:
```
{0: 'AXE',
 1: 'BACKPACK',
 2: 'BASKETBALL',
 3: 'BEE',
```

```
4: 'BELT',
5: 'BITE',
6: 'BREAKFAST',
7: 'CANCER',
8: 'CHRISTMAS',
9: 'CONFUSED',
10: 'DARK',
11: 'DEAF',
12: 'DECIDE',
13: 'DEMAND',
14: 'DEVELOP',
15: 'DINNER',
16: 'DOG',
17: 'DOWNSIZE',
18: 'DRAG',
19: 'EAT',
20: 'EDIT',
21: 'ELEVATOR',
22: 'FINE',
23: 'FLOAT',
24: 'FOREIGNER',
25: 'GUESS',
26: 'HALLOWEEN',
27: 'HOSPITAL',
28: 'HURDLE/TRIP',
29: 'JEWELRY',
30: 'KNIGHT',
31: 'LOCK',
32: 'LUNCH',
33: 'MAPLE',
34: 'MEAT',
35: 'MECHANIC',
36: 'MICROSCOPE',
37: 'MOVIE',
38: 'NOON',
39: 'PARTY',
40: 'PATIENT',
41: 'RAZOR',
42: 'RIVER',
43: 'ROCKINGCHAIR',
44: 'SHAVE',
45: 'SINK',
46: 'SQUEEZE',
47: 'THEY',
48: 'TWINS',
49: 'WHATFOR'}
```

[126]:
```
inv_label_map[0]
```

[126]: 'AXE'

[127]:
```
traindf.sample(10)
```

[127]:
```
    Participant ID                        Video file        Gloss  \
328            P37          3878260902223658-EAT.mp4          EAT
508            P31         7892179183511641-LOCK.mp4         LOCK
466            P16  7664642326742872-HURDLE-TRIP.mp4  HURDLE/TRIP
101             P1    7809503445047001-BREAKFAST.mp4    BREAKFAST
412            P40        9825690623317844-GUESS.mp4        GUESS
112             P7    8518237171580363-BREAKFAST.mp4    BREAKFAST
578            P31     4328181527879751-MECHANIC.mp4     MECHANIC
650            P50     156048761492376-PATIENT 2.mp4      PATIENT
229            P31       9079367190714687-DEMAND.mp4       DEMAND
467            P40  6219112771870119-HURDLE-TRIP.mp4  HURDLE/TRIP

    ASL-LEX Code                                                Path  \
328     B_02_002  file:///home/kristian/ASL_Citizen/videos/38782…
508     H_02_017  file:///home/kristian/ASL_Citizen/videos/78921…
466     G_01_036  file:///home/kristian/ASL_Citizen/videos/76646…
101     J_01_053  file:///home/kristian/ASL_Citizen/videos/78095…
412     D_02_013  file:///home/kristian/ASL_Citizen/videos/98256…
112     J_01_053  file:///home/kristian/ASL_Citizen/videos/85182…
578     A_03_030  file:///home/kristian/ASL_Citizen/videos/43281…
650     B_01_085  file:///home/kristian/ASL_Citizen/videos/15604…
229     D_03_080  file:///home/kristian/ASL_Citizen/videos/90793…
467     G_01_036  file:///home/kristian/ASL_Citizen/videos/62191…

     Frequency  Frames  FPS  Length  Width  Height  Cat_label
328         14      51   30       2    640     480         19
508         14      94   29       3    640     480         31
466         17      56   30       2    640     480         28
101         18      77   30       3    640     480          6
412         15      72   30       2    640     480         25
112         18      80   30       3    640     480          6
578         16      84   30       3    640     480         35
650         15      72   30       2    640     480         40
229         16      75   30       2    640     480         13
467         17      77   30       3    640     480         28
```

[128]:
```
Ytrain = encoder.fit_transform(traindf[['Gloss']])
Ytest = encoder.fit_transform(testdf[['Gloss']])
Yval = encoder.fit_transform(valdf[['Gloss']])
```

[129]:
```
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪train_labels_array_1D.npy",
    Ytrain)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪test_labels_array_1D.npy",
    Ytest)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪val_labels_array_1D.npy",
    Yval)
```

[101]:
```
Ytrain = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪train_labels_array_1D.npy"
)
Ytest = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪test_labels_array_1D.npy"
)
Yval = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪val_labels_array_1D.npy"
)
Ytrain_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪train_labels_array_1D.npy"
)
Ytest_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪test_labels_array_1D.npy"
)
Yval_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/RTMPose-L/
 ↪val_labels_array_1D.npy"
)
```

[102]:
```
Xtrain = train_keypoints
Xtest = test_keypoints
Xval = val_keypoints
Xtrain_flip = train_keypoints_flip
Xtest_flip = test_keypoints_flip
Xval_flip = val_keypoints_flip
```

[103]:
```
Xval = val_keypoints
Xval_flip = val_keypoints_flip
```

[104]:
```
n_classes = 50
print("Shape before one-hot encoding: ", Ytrain.shape)
Ytrain = to_categorical(Ytrain, n_classes)
print("Shape after one-hot encoding: ", Ytrain.shape)
print("Shape before one-hot encoding: ", Ytest.shape)
Ytest = to_categorical(Ytest, n_classes)
print("Shape after one-hot encoding: ", Ytest.shape)
print("Shape before one-hot encoding: ", Yval.shape)
Yval = to_categorical(Yval, n_classes)
print("Shape after one-hot encoding: ", Yval.shape)
print("Shape before one-hot encoding: ", Ytrain_flip.shape)
Ytrain_flip = to_categorical(Ytrain_flip, n_classes)
print("Shape after one-hot encoding: ", Ytrain_flip.shape)
print("Shape before one-hot encoding: ", Ytest_flip.shape)
Ytest_flip = to_categorical(Ytest_flip, n_classes)
print("Shape after one-hot encoding: ", Ytest_flip.shape)
print("Shape before one-hot encoding: ", Yval_flip.shape)
Yval_flip = to_categorical(Yval_flip, n_classes)
print("Shape after one-hot encoding: ", Yval_flip.shape)
```

```
Shape before one-hot encoding:  (804, 1)
Shape after one-hot encoding:  (804, 50)
Shape before one-hot encoding:  (534, 1)
Shape after one-hot encoding:  (534, 50)
Shape before one-hot encoding:  (162, 1)
Shape after one-hot encoding:  (162, 50)
Shape before one-hot encoding:  (804, 1)
Shape after one-hot encoding:  (804, 50)
Shape before one-hot encoding:  (534, 1)
Shape after one-hot encoding:  (534, 50)
Shape before one-hot encoding:  (162, 1)
Shape after one-hot encoding:  (162, 50)
```

[105]:
```
type(Ytrain)
```

[105]: numpy.ndarray

[106]:
```
Ytrain.shape
```

[106]: (804, 50)

[107]:
```
Xtrain = np.concatenate((Xtrain, Xtest, Xtrain_flip, Xtest_flip), axis=0)
print(Xtrain.shape)
Ytrain = np.concatenate((Ytrain, Ytest, Ytrain_flip, Ytest_flip), axis=0)
print(Ytrain.shape)
```

```
(2676, 130, 399)
(2676, 50)
```

[108]:
```
Xval.shape
```

[108]: (162, 130, 399)

[109]:
```
Xval_flip.shape
```

[109]: (162, 130, 399)

[110]:
```
Xval = np.concatenate((Xval, Xval_flip), axis=0)
print(Xval.shape)
Yval = np.concatenate((Yval, Yval_flip), axis=0)
print(Yval.shape)
```

```
(324, 130, 399)
(324, 50)
```

[140]:
```
print(Xtrain.shape)
Xval.shape
```

```
(2676, 130, 399)
```

[140]: (324, 130, 399)

[111]:
```
import numpy as np

# Calculate the sparsity
num_zero_values = np.count_nonzero(Xtrain == 0)
total_values = Xtrain.size

sparsity = num_zero_values / total_values

print(f"Sparsity: {sparsity:.2%}")
```

```
Sparsity: 41.10%
```

[112]:
```
from sklearn.preprocessing import MaxAbsScaler

num_samples, num_frames, num_keypoints = Xtrain.shape
Xtrain = Xtrain.reshape(num_samples, -1)

# Create a MaxAbsScaler
scaler = MaxAbsScaler()

# Fit and transform the data
scaler.fit(Xtrain)
Xtrain = scaler.transform(Xtrain)
```

```
# Reshape the scaled data back to the original shape
Xtrain = Xtrain.reshape(num_samples, num_frames, num_keypoints)
```

[113]:
```
num_samples, num_frames, num_keypoints = Xval.shape
Xval = Xval.reshape(num_samples, -1)

# Transform the data
Xval = scaler.transform(Xval)

# Reshape the scaled data back to the original shape
Xval = Xval.reshape(num_samples, num_frames, num_keypoints)
```

[114]:
```
num_samples, num_frames, num_keypoints = Xval_flip.shape
Xval_flip = Xval_flip.reshape(num_samples, -1)

# Transform the data
Xval_flip = scaler.transform(Xval_flip)

# Reshape the scaled data back to the original shape
Xval_flip = Xval_flip.reshape(num_samples, num_frames, num_keypoints)
```

[89]:
```
from pickle import dump
# to save the scaler
dump(scaler, open('scaler.pkl', 'wb'))
```

[115]:
```
Xtrain.shape
```

[115]: (2676, 130, 399)

[116]:
```
print(Xtrain.shape)
Xtest.shape
```

```
(2676, 130, 399)
```

[116]: (534, 130, 399)

[117]:
```
print(Ytrain.shape)
Ytest.shape
```

```
(2676, 50)
```

[117]: (534, 50)

[118]:
```
Xtrain
```

[118]:
```
array([[[ 0.        ,  0.        ,  0.        , …,  0.        ,
          0.        ,  0.        ],
        [ 0.        ,  0.        ,  0.        , …,  0.        ,
```

```
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 …,
 [ 0.91958868,  0.92974823,  0.93220932, …,  0.7722404 ,
   0.1042105 ,  0.76703893],
 [ 0.91978571,  0.92445097,  0.92643472, …,  0.77459191,
   0.10417073,  0.76668809],
 [ 0.92015144,  0.92409164,  0.92320841, …,  0.77556884,
   0.10754215,  0.76620177]],

[[ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 …,
 [ 0.91272948,  0.93885547,  0.95148304, …,  0.60843908,
  -0.01746995,  0.90794086],
 [ 0.91398806,  0.94068406,  0.95195426, …,  0.60831635,
  -0.01291171,  0.90386723],
 [ 0.91724594,  0.94622617,  0.94746574, …,  0.91756649,
  -0.01238007,  0.90648441]],

[[ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 …,
 [ 0.9489732 ,  0.9465698 ,  0.91406756, …,  0.66221485,
   0.06345712,  0.65775446],
 [ 0.9524288 ,  0.94241184,  0.91561966, …,  0.6439192 ,
   0.07934621,  0.63734874],
 [ 0.94869448,  0.94377932,  0.9120731 , …,  0.64453519,
   0.0828044 ,  0.6367507 ]],

…,

[[ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
 [ 0.        ,  0.        ,  0.        , …,  0.        ,
   0.        ,  0.        ],
```

```
       …,
       [ 0.92799027,  0.93613429,  0.92615343, …,  0.56098195,
         0.01564942,  0.86767824],
       [ 0.93066124,  0.93034798,  0.92458476, …,  0.54531465,
         0.02007483,  0.54844987],
       [ 0.9287373 ,  0.93351729,  0.92576464, …,  0.56510014,
         0.02058779,  0.86653012]],

      [[ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       [ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       [ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       …,
       [ 0.85879297,  0.92041222,  0.91744176, …,  0.79108357,
         0.03274715,  0.78575518],
       [ 0.85082728,  0.91817014,  0.91572521, …,  0.79681481,
         0.0244044 ,  0.78868423],
       [ 0.84696441,  0.91695961,  0.91208894, …,  0.79237475,
         0.0312305 ,  0.7828047 ]],

      [[ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       [ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       [ 0.        ,  0.        ,  0.        , …,  0.        ,
         0.        ,  0.        ],
       …,
       [ 0.93299951,  0.90804417,  0.90797991, …,  0.79341821,
         0.02597378,  0.7880741 ],
       [ 0.93482975,  0.90673117,  0.90888015, …,  0.79484848,
         0.02608884,  0.78673797],
       [ 0.93097541,  0.90441684,  0.90399588, …,  0.79624381,
         0.02693731,  0.78662703]]])
```

[151]:
```
Ytrain
```

[151]:
```
array([[1., 0., 0., …, 0., 0., 0.],
       [1., 0., 0., …, 0., 0., 0.],
       [1., 0., 0., …, 0., 0., 0.],
       …,
       [0., 0., 0., …, 0., 0., 1.],
       [0., 0., 0., …, 0., 0., 1.],
       [0., 0., 0., …, 0., 0., 1.]], dtype=float32)
```

[152]:
```
Yval.shape
```

[152]: (324, 50)

[153]:
```
Xval.shape
```

[153]: (324, 130, 399)

[ ]:
```

```

[ ]:
```

```

3 Model

[119]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout, GRU
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
↪Dropout, Activation
import tensorflow as tf
from keras.utils.vis_utils import plot_model
from tensorflow.keras import layers, models, regularizers
from tensorflow.keras.optimizers import Adam, Adagrad, Adadelta, SGD, Nadam
import os
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa
from sklearn.metrics import classification_report, confusion_matrix
from keras.utils.vis_utils import plot_model
from tensorflow.keras.utils import get_custom_objects
import matplotlib.pyplot as plt
import visualkeras
from PIL import ImageFont
```

[120]:
```
tf.random.set_seed(100)
tf.keras.utils.set_random_seed(100)
```

[121]:
```
physical_devices = tf.config.list_physical_devices('GPU')
if physical_devices:
    for device in physical_devices:
        tf.config.experimental.set_memory_growth(device, True)
```

[122]:
```
def mish(x):
    return x * tf.math.tanh(tf.math.softplus(x))
```

[123]:
```
get_custom_objects().update({'mish': mish})
```

3.1 Hyperparameter Tuning 1 LSTM Layer

[119]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'elu', 'gelu', 'relu'],
            default='selu')
        model = Sequential()
        model.add(
            LSTM(units=hp.Int('units_1',
                              min_value=50,
                              max_value=200,
                              step=25,
                              default=100),
                 return_sequences=False,
                 input_shape=self.input_shape,
                 kernel_regularizer=regularizers.l2(
                     hp.Float('regularizer_1',
                              min_value=1e-4,
                              max_value=1e-2,
                              sampling='LOG',
                              default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.65,
                step=0.05,
            )))
        model.add(
```

```
            Dense(units=hp.Int('units_2',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=80),
                  activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))

        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.0005)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

```
/tmp/ipykernel_1754845/3904456553.py:5: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='1_LSTM',
    overwrite=False)
```

```
2023-09-08 22:45:50.144623: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-08 22:45:51.472322: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1739 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[121]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 7
dense_activation (Choice)
{'default': 'selu', 'conditions': [], 'values': ['selu', 'mish', 'elu', 'gelu',
'relu'], 'ordered': False}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_1 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_1 (Float)
{'default': 0.65, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0005, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
```

[122]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[124]:
```
tuner.search(Xtrain,
             Ytrain,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 02m 16s]
```

```
val_f1_score: 0.0011976048117503524

Best val_f1_score So Far: 0.5806974470615387
Total elapsed time: 11h 07m 50s
INFO:tensorflow:Oracle triggered exit
```

[125]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0427 summary
Hyperparameters:
dense_activation: elu
units_1: 125
regularizer_1: 0.0001880895482273795
dropout_1: 0.30000000000000004
units_2: 70
dropout_2: 0.05
learning_rate: 0.00024203632250928224
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.5806974470615387

Trial 0700 summary
Hyperparameters:
dense_activation: relu
units_1: 200
regularizer_1: 0.00022419548935667316
dropout_1: 0.25
units_2: 80
dropout_2: 0.1
learning_rate: 0.00017051882988302358
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.5669972598552704

Trial 0598 summary
Hyperparameters:
dense_activation: gelu
```

```
units_1: 200
regularizer_1: 0.0005716024863895304
dropout_1: 0.15000000000000002
units_2: 120
dropout_2: 0.4
learning_rate: 0.00018312641261031653
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0593
Score: 0.5641029179096222

Trial 0670 summary
Hyperparameters:
dense_activation: selu
units_1: 125
regularizer_1: 0.0012934593487528372
dropout_1: 0.35000000000000003
units_2: 80
dropout_2: 0.0
learning_rate: 0.0005026453831067469
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.5388183891773224

Trial 0701 summary
Hyperparameters:
dense_activation: mish
units_1: 125
regularizer_1: 0.0003357459276085053
dropout_1: 0.0
units_2: 90
dropout_2: 0.55
learning_rate: 0.00030048159810771484
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0694
Score: 0.5291155278682709

Trial 0426 summary
Hyperparameters:
dense_activation: selu
```

```
units_1: 200
regularizer_1: 0.0034681885165451717
dropout_1: 0.1
units_2: 80
dropout_2: 0.1
learning_rate: 0.00011697013417309727
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0422
Score: 0.49506451189517975

Trial 0671 summary
Hyperparameters:
dense_activation: selu
units_1: 100
regularizer_1: 0.002520316346228181
dropout_1: 0.45
units_2: 90
dropout_2: 0.0
learning_rate: 0.0004417092183921467
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.4939984530210495

Trial 0593 summary
Hyperparameters:
dense_activation: gelu
units_1: 200
regularizer_1: 0.0005716024863895304
dropout_1: 0.15000000000000002
units_2: 120
dropout_2: 0.4
learning_rate: 0.00018312641261031653
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0587
Score: 0.48347342014312744

Trial 0693 summary
Hyperparameters:
dense_activation: relu
```

```
units_1: 200
regularizer_1: 0.00022419548935667316
dropout_1: 0.25
units_2: 80
dropout_2: 0.1
learning_rate: 0.00017051882988302358
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0680
Score: 0.4796612113714218

Trial 0422 summary
Hyperparameters:
dense_activation: selu
units_1: 200
regularizer_1: 0.0034681885165451717
dropout_1: 0.1
units_2: 80
dropout_2: 0.1
learning_rate: 0.00011697013417309727
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0413
Score: 0.473745658993721
```

[126]:
```
best_model = tuner.get_best_models(num_models=3)[0]
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
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object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
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object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
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```
object: (root).optimizer._variables.0
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object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
```

[127]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 2s 156ms/step - loss: 2.2577 -
f1_score: 0.5901
```

[128]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 13ms/step - loss: 0.1129 - f1_score:
0.9890
```

[129]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 125)               262500

 dropout (Dropout)           (None, 125)               0

 dense (Dense)               (None, 70)                8820
```

```
 dropout_1 (Dropout)         (None, 70)                0

 dense_1 (Dense)             (None, 50)                3550

=================================================================
Total params: 274,870
Trainable params: 274,870
Non-trainable params: 0
_________________________________________________________________
```

[130]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[130]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
LSTM
input:
(None, 130, 399)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 70)
Dropout
input:
(None, 70)
output:
(None, 70)
Dense
input:
(None, 70)
output:
(None, 50)

[131]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 11ms/step
              precision    recall  f1-score   support

         AXE      0.833     0.625     0.714         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.727     0.800     0.762        10
         BEE      0.400     0.200     0.267        10
        BELT      0.600     0.750     0.667         4
        BITE      0.000     0.000     0.000         8
   BREAKFAST      0.429     0.500     0.462         6
      CANCER      1.000     0.875     0.933         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.625     0.833     0.714         6
        DARK      0.667     1.000     0.800         4
        DEAF      0.111     0.167     0.133         6
      DECIDE      1.000     0.500     0.667         6
      DEMAND      0.750     0.750     0.750         8
     DEVELOP      0.500     0.500     0.500         6
      DINNER      0.750     0.375     0.500         8
         DOG      0.556     0.833     0.667         6
    DOWNSIZE      0.857     0.750     0.800         8
        DRAG      0.286     0.500     0.364         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.500     0.833     0.625         6
    ELEVATOR      0.500     0.375     0.429         8
        FINE      0.667     0.500     0.571         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      0.875     0.875     0.875         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.250     0.333     0.286         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.250     0.400         4
        LOCK      0.375     0.375     0.375         8
       LUNCH      0.444     0.500     0.471         8
       MAPLE      0.333     0.500     0.400         4
        MEAT      1.000     0.667     0.800         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      0.667     0.250     0.364         8
```

```
       MOVIE      0.333     0.625     0.435         8
        NOON      0.800     1.000     0.889         8
       PARTY      0.667     0.750     0.706         8
     PATIENT      0.500     0.667     0.571         6
       RAZOR      0.800     1.000     0.889         4
       RIVER      0.444     0.667     0.533         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.500     0.300     0.375        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.500     1.000     0.667         4
       TWINS      0.500     0.625     0.556         8
     WHATFOR      0.800     0.400     0.533        10

    accuracy                          0.605       324
   macro avg      0.618     0.612     0.590       324
weighted avg      0.619     0.605     0.589       324
```

[132]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[133]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 LSTM/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[134]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 4.0426 - f1_score:
0.0166

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets
```

```
28/28 [==============================] - 24s 763ms/step - loss: 4.0426 -
f1_score: 0.0166 - val_loss: 4.0121 - val_f1_score: 0.0032
Epoch 2/500
28/28 [==============================] - 2s 62ms/step - loss: 4.0145 - f1_score:
0.0162 - val_loss: 4.0032 - val_f1_score: 0.0017
Epoch 3/500
28/28 [==============================] - ETA: 0s - loss: 4.0083 - f1_score:
0.0119

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 329ms/step - loss: 4.0083 -
f1_score: 0.0119 - val_loss: 3.9995 - val_f1_score: 0.0100
Epoch 4/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9944 - f1_score:
0.0133 - val_loss: 3.9950 - val_f1_score: 0.0031
Epoch 5/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9896 - f1_score:
0.0137 - val_loss: 3.9885 - val_f1_score: 0.0083
Epoch 6/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9820 - f1_score:
0.0105 - val_loss: 3.9959 - val_f1_score: 0.0065
Epoch 7/500
28/28 [==============================] - 2s 65ms/step - loss: 3.9618 - f1_score:
0.0134 - val_loss: 3.9710 - val_f1_score: 0.0089
Epoch 8/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9465 - f1_score:
0.0176 - val_loss: 3.9536 - val_f1_score: 0.0050
Epoch 9/500
27/28 [===========================>..] - ETA: 0s - loss: 3.9162 - f1_score:
0.0202

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 357ms/step - loss: 3.9142 -
f1_score: 0.0205 - val_loss: 3.8941 - val_f1_score: 0.0113
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 3.8490 - f1_score:
0.0176
```

```
WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 361ms/step - loss: 3.8490 -
f1_score: 0.0176 - val_loss: 3.8128 - val_f1_score: 0.0132
Epoch 11/500
28/28 [==============================] - ETA: 0s - loss: 3.7760 - f1_score:
0.0267

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 324ms/step - loss: 3.7760 -
f1_score: 0.0267 - val_loss: 3.7141 - val_f1_score: 0.0239
Epoch 12/500
28/28 [==============================] - 2s 64ms/step - loss: 3.6917 - f1_score:
0.0335 - val_loss: 3.6445 - val_f1_score: 0.0216
Epoch 13/500
28/28 [==============================] - ETA: 0s - loss: 3.6200 - f1_score:
0.0455

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 338ms/step - loss: 3.6200 -
f1_score: 0.0455 - val_loss: 3.6071 - val_f1_score: 0.0292
Epoch 14/500
28/28 [==============================] - 2s 63ms/step - loss: 3.5261 - f1_score:
0.0524 - val_loss: 3.4351 - val_f1_score: 0.0236
Epoch 15/500
28/28 [==============================] - 2s 64ms/step - loss: 3.4744 - f1_score:
0.0545 - val_loss: 3.3876 - val_f1_score: 0.0283
Epoch 16/500
28/28 [==============================] - ETA: 0s - loss: 3.3767 - f1_score:
0.0734

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 419ms/step - loss: 3.3767 -
f1_score: 0.0734 - val_loss: 3.3136 - val_f1_score: 0.0448
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 3.2977 - f1_score:
0.0742

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 349ms/step - loss: 3.2977 -
f1_score: 0.0742 - val_loss: 3.2142 - val_f1_score: 0.0453
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 3.2211 - f1_score:
0.0978

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 375ms/step - loss: 3.2211 -
f1_score: 0.0978 - val_loss: 3.1328 - val_f1_score: 0.0833
Epoch 19/500
28/28 [==============================] - ETA: 0s - loss: 3.1260 - f1_score:
0.1101

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 368ms/step - loss: 3.1260 -
f1_score: 0.1101 - val_loss: 3.0926 - val_f1_score: 0.1211
Epoch 20/500
28/28 [==============================] - 2s 62ms/step - loss: 3.0649 - f1_score:
0.1136 - val_loss: 3.0034 - val_f1_score: 0.1082
Epoch 21/500
28/28 [==============================] - ETA: 0s - loss: 2.9886 - f1_score:
0.1292
```

```
WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 347ms/step - loss: 2.9886 -
f1_score: 0.1292 - val_loss: 3.0219 - val_f1_score: 0.1248
Epoch 22/500
28/28 [==============================] - 2s 66ms/step - loss: 2.9156 - f1_score:
0.1361 - val_loss: 3.0147 - val_f1_score: 0.1134
Epoch 23/500
28/28 [==============================] - ETA: 0s - loss: 2.8564 - f1_score:
0.1457

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 365ms/step - loss: 2.8564 -
f1_score: 0.1457 - val_loss: 2.8967 - val_f1_score: 0.1404
Epoch 24/500
28/28 [==============================] - 2s 62ms/step - loss: 2.8163 - f1_score:
0.1442 - val_loss: 3.0067 - val_f1_score: 0.1260
Epoch 25/500
28/28 [==============================] - 2s 63ms/step - loss: 2.7748 - f1_score:
0.1630 - val_loss: 2.8414 - val_f1_score: 0.1375
Epoch 26/500
27/28 [============================>..] - ETA: 0s - loss: 2.7005 - f1_score:
0.1879

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 323ms/step - loss: 2.6897 -
f1_score: 0.1902 - val_loss: 2.7545 - val_f1_score: 0.1550
Epoch 27/500
28/28 [==============================] - ETA: 0s - loss: 2.6024 - f1_score:
0.1983

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 385ms/step - loss: 2.6024 -
f1_score: 0.1983 - val_loss: 2.7124 - val_f1_score: 0.1622
Epoch 28/500
27/28 [==========================>..] - ETA: 0s - loss: 2.5887 - f1_score:
0.2055

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 341ms/step - loss: 2.5904 -
f1_score: 0.2048 - val_loss: 2.6505 - val_f1_score: 0.1658
Epoch 29/500
28/28 [==============================] - ETA: 0s - loss: 2.5485 - f1_score:
0.2057

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 332ms/step - loss: 2.5485 -
f1_score: 0.2057 - val_loss: 2.8092 - val_f1_score: 0.1665
Epoch 30/500
28/28 [==============================] - ETA: 0s - loss: 2.4928 - f1_score:
0.2132

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 361ms/step - loss: 2.4928 -
f1_score: 0.2132 - val_loss: 2.6148 - val_f1_score: 0.1754
Epoch 31/500
28/28 [==============================] - 2s 63ms/step - loss: 2.4388 - f1_score:
0.2466 - val_loss: 2.6846 - val_f1_score: 0.1506
Epoch 32/500
28/28 [==============================] - ETA: 0s - loss: 2.4132 - f1_score:
0.2423
```

```
WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 380ms/step - loss: 2.4132 -
f1_score: 0.2423 - val_loss: 2.5145 - val_f1_score: 0.2096
Epoch 33/500
28/28 [==============================] - 2s 63ms/step - loss: 2.3933 - f1_score:
0.2578 - val_loss: 2.5117 - val_f1_score: 0.1910
Epoch 34/500
28/28 [==============================] - 2s 63ms/step - loss: 2.2918 - f1_score:
0.2934 - val_loss: 2.5673 - val_f1_score: 0.1960
Epoch 35/500
28/28 [==============================] - ETA: 0s - loss: 2.2885 - f1_score:
0.2777

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 347ms/step - loss: 2.2885 -
f1_score: 0.2777 - val_loss: 2.4463 - val_f1_score: 0.2369
Epoch 36/500
28/28 [==============================] - 2s 62ms/step - loss: 2.2338 - f1_score:
0.2911 - val_loss: 2.5062 - val_f1_score: 0.2147
Epoch 37/500
28/28 [==============================] - ETA: 0s - loss: 2.2185 - f1_score:
0.2971

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 335ms/step - loss: 2.2185 -
f1_score: 0.2971 - val_loss: 2.4328 - val_f1_score: 0.2484
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 2.1520 - f1_score:
0.3181

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 373ms/step - loss: 2.1520 -
f1_score: 0.3181 - val_loss: 2.4502 - val_f1_score: 0.2522
Epoch 39/500
28/28 [==============================] - ETA: 0s - loss: 2.1127 - f1_score:
0.3437

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 17s 620ms/step - loss: 2.1127 -
f1_score: 0.3437 - val_loss: 2.3986 - val_f1_score: 0.2808
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 2.0931 - f1_score:
0.3352

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 360ms/step - loss: 2.0931 -
f1_score: 0.3352 - val_loss: 2.2902 - val_f1_score: 0.2906
Epoch 41/500
28/28 [==============================] - 2s 64ms/step - loss: 2.0430 - f1_score:
0.3582 - val_loss: 2.3995 - val_f1_score: 0.2592
Epoch 42/500
28/28 [==============================] - 2s 63ms/step - loss: 1.9987 - f1_score:
0.3607 - val_loss: 2.2866 - val_f1_score: 0.2748
Epoch 43/500
28/28 [==============================] - 2s 63ms/step - loss: 1.9808 - f1_score:
0.3689 - val_loss: 2.2927 - val_f1_score: 0.2856
Epoch 44/500
28/28 [==============================] - ETA: 0s - loss: 1.9373 - f1_score:
0.3919

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets
```

```
28/28 [==============================] - 10s 350ms/step - loss: 1.9373 -
f1_score: 0.3919 - val_loss: 2.2951 - val_f1_score: 0.2998
Epoch 45/500
28/28 [==============================] - ETA: 0s - loss: 1.8780 - f1_score:
0.4033

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 415ms/step - loss: 1.8780 -
f1_score: 0.4033 - val_loss: 2.2013 - val_f1_score: 0.3259
Epoch 46/500
28/28 [==============================] - 2s 62ms/step - loss: 1.8578 - f1_score:
0.4100 - val_loss: 2.2237 - val_f1_score: 0.2873
Epoch 47/500
28/28 [==============================] - ETA: 0s - loss: 1.8145 - f1_score:
0.4456

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 337ms/step - loss: 1.8145 -
f1_score: 0.4456 - val_loss: 2.1677 - val_f1_score: 0.3440
Epoch 48/500
28/28 [==============================] - ETA: 0s - loss: 1.7899 - f1_score:
0.4477

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 397ms/step - loss: 1.7899 -
f1_score: 0.4477 - val_loss: 2.0956 - val_f1_score: 0.3735
Epoch 49/500
28/28 [==============================] - 2s 62ms/step - loss: 1.8234 - f1_score:
0.4313 - val_loss: 2.2326 - val_f1_score: 0.2998
Epoch 50/500
28/28 [==============================] - 2s 63ms/step - loss: 1.7157 - f1_score:
0.4630 - val_loss: 2.1203 - val_f1_score: 0.3254
Epoch 51/500
```

```
28/28 [==============================] - 2s 62ms/step - loss: 1.6562 - f1_score:
0.4814 - val_loss: 2.1089 - val_f1_score: 0.3629
Epoch 52/500
28/28 [==============================] - ETA: 0s - loss: 1.6127 - f1_score:
0.5006

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 387ms/step - loss: 1.6127 -
f1_score: 0.5006 - val_loss: 2.1426 - val_f1_score: 0.3844
Epoch 53/500
28/28 [==============================] - 2s 63ms/step - loss: 1.6091 - f1_score:
0.4955 - val_loss: 2.1186 - val_f1_score: 0.3769
Epoch 54/500
28/28 [==============================] - 2s 65ms/step - loss: 1.5937 - f1_score:
0.5078 - val_loss: 2.1063 - val_f1_score: 0.3714
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 1.5475 - f1_score:
0.5143

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 348ms/step - loss: 1.5475 -
f1_score: 0.5143 - val_loss: 2.0912 - val_f1_score: 0.4212
Epoch 56/500
28/28 [==============================] - 2s 65ms/step - loss: 1.5488 - f1_score:
0.5155 - val_loss: 2.0638 - val_f1_score: 0.3960
Epoch 57/500
28/28 [==============================] - 2s 62ms/step - loss: 1.5315 - f1_score:
0.5141 - val_loss: 2.1100 - val_f1_score: 0.4060
Epoch 58/500
28/28 [==============================] - 2s 65ms/step - loss: 1.4436 - f1_score:
0.5482 - val_loss: 1.9854 - val_f1_score: 0.4182
Epoch 59/500
28/28 [==============================] - 2s 64ms/step - loss: 1.4194 - f1_score:
0.5558 - val_loss: 2.1462 - val_f1_score: 0.3834
Epoch 60/500
28/28 [==============================] - 2s 64ms/step - loss: 1.3779 - f1_score:
0.5703 - val_loss: 1.9626 - val_f1_score: 0.3998
Epoch 61/500
```

```
28/28 [==============================] - 2s 64ms/step - loss: 1.3827 - f1_score:
0.5657 - val_loss: 1.9326 - val_f1_score: 0.4212
Epoch 62/500
28/28 [==============================] - 2s 65ms/step - loss: 1.3801 - f1_score:
0.5659 - val_loss: 1.9668 - val_f1_score: 0.4207
Epoch 63/500
28/28 [==============================] - ETA: 0s - loss: 1.3078 - f1_score:
0.5947

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 335ms/step - loss: 1.3078 -
f1_score: 0.5947 - val_loss: 1.9882 - val_f1_score: 0.4397
Epoch 64/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2974 - f1_score:
0.5943 - val_loss: 1.9352 - val_f1_score: 0.4316
Epoch 65/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3308 - f1_score:
0.5772 - val_loss: 1.9721 - val_f1_score: 0.4293
Epoch 66/500
28/28 [==============================] - 2s 65ms/step - loss: 1.2742 - f1_score:
0.6022 - val_loss: 1.8908 - val_f1_score: 0.4331
Epoch 67/500
28/28 [==============================] - 2s 64ms/step - loss: 1.2474 - f1_score:
0.6078 - val_loss: 2.0328 - val_f1_score: 0.4392
Epoch 68/500
28/28 [==============================] - ETA: 0s - loss: 1.2354 - f1_score:
0.6193

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 356ms/step - loss: 1.2354 -
f1_score: 0.6193 - val_loss: 1.9110 - val_f1_score: 0.4465
Epoch 69/500
28/28 [==============================] - ETA: 0s - loss: 1.1949 - f1_score:
0.6195

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 12s 436ms/step - loss: 1.1949 -
f1_score: 0.6195 - val_loss: 1.8992 - val_f1_score: 0.4779
Epoch 70/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1660 - f1_score:
0.6398 - val_loss: 1.9007 - val_f1_score: 0.4407
Epoch 71/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1643 - f1_score:
0.6446 - val_loss: 1.8918 - val_f1_score: 0.4594
Epoch 72/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1485 - f1_score:
0.6575 - val_loss: 1.9851 - val_f1_score: 0.4691
Epoch 73/500
28/28 [==============================] - ETA: 0s - loss: 1.1238 - f1_score:
0.6547

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 359ms/step - loss: 1.1238 -
f1_score: 0.6547 - val_loss: 1.8865 - val_f1_score: 0.4945
Epoch 74/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0958 - f1_score:
0.6567 - val_loss: 1.9398 - val_f1_score: 0.4941
Epoch 75/500
28/28 [==============================] - ETA: 0s - loss: 1.0863 - f1_score:
0.6641

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 367ms/step - loss: 1.0863 -
f1_score: 0.6641 - val_loss: 1.9314 - val_f1_score: 0.5001
Epoch 76/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0388 - f1_score:
0.6753 - val_loss: 2.0602 - val_f1_score: 0.4393
Epoch 77/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0593 - f1_score:
0.6702 - val_loss: 2.0298 - val_f1_score: 0.4717
Epoch 78/500
```

```
28/28 [==============================] - 2s 64ms/step - loss: 1.0060 - f1_score:
0.6881 - val_loss: 1.8680 - val_f1_score: 0.4648
Epoch 79/500
28/28 [==============================] - 2s 64ms/step - loss: 0.9943 - f1_score:
0.6980 - val_loss: 1.9622 - val_f1_score: 0.4680
Epoch 80/500
28/28 [==============================] - ETA: 0s - loss: 0.9740 - f1_score:
0.7050

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 361ms/step - loss: 0.9740 -
f1_score: 0.7050 - val_loss: 1.8734 - val_f1_score: 0.5082
Epoch 81/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9685 - f1_score:
0.7166 - val_loss: 1.9937 - val_f1_score: 0.4975
Epoch 82/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0004 - f1_score:
0.7023 - val_loss: 1.9264 - val_f1_score: 0.4749
Epoch 83/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9403 - f1_score:
0.7134 - val_loss: 1.9347 - val_f1_score: 0.4780
Epoch 84/500
28/28 [==============================] - 2s 67ms/step - loss: 0.9410 - f1_score:
0.7143 - val_loss: 2.1294 - val_f1_score: 0.4592
Epoch 85/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8937 - f1_score:
0.7297 - val_loss: 2.0584 - val_f1_score: 0.4381
Epoch 86/500
28/28 [==============================] - 2s 64ms/step - loss: 0.9013 - f1_score:
0.7232 - val_loss: 2.0707 - val_f1_score: 0.4644
Epoch 87/500
28/28 [==============================] - 2s 65ms/step - loss: 0.9346 - f1_score:
0.7159 - val_loss: 2.0185 - val_f1_score: 0.4899
Epoch 88/500
28/28 [==============================] - 2s 66ms/step - loss: 0.9367 - f1_score:
0.7206 - val_loss: 2.0537 - val_f1_score: 0.4757
Epoch 89/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8467 - f1_score:
0.7399 - val_loss: 1.9086 - val_f1_score: 0.4776
Epoch 90/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8394 - f1_score:
0.7503 - val_loss: 1.9398 - val_f1_score: 0.5079
Epoch 91/500
```

```
28/28 [==============================] - 2s 69ms/step - loss: 0.8667 - f1_score:
0.7321 - val_loss: 1.9279 - val_f1_score: 0.4960
Epoch 92/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7997 - f1_score:
0.7572 - val_loss: 2.0325 - val_f1_score: 0.5023
Epoch 93/500
28/28 [==============================] - ETA: 0s - loss: 0.8018 - f1_score:
0.7545

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 13s 469ms/step - loss: 0.8018 -
f1_score: 0.7545 - val_loss: 1.9609 - val_f1_score: 0.5174
Epoch 94/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8030 - f1_score:
0.7480 - val_loss: 2.0582 - val_f1_score: 0.4904
Epoch 95/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8710 - f1_score:
0.7363 - val_loss: 2.1002 - val_f1_score: 0.4722
Epoch 96/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8381 - f1_score:
0.7498 - val_loss: 1.9518 - val_f1_score: 0.5056
Epoch 97/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7617 - f1_score:
0.7788 - val_loss: 2.0905 - val_f1_score: 0.4776
Epoch 98/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7978 - f1_score:
0.7525 - val_loss: 1.9966 - val_f1_score: 0.4910
Epoch 99/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7527 - f1_score:
0.7798 - val_loss: 1.9667 - val_f1_score: 0.5164
Epoch 100/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7716 - f1_score:
0.7664 - val_loss: 2.0179 - val_f1_score: 0.4974
Epoch 101/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8229 - f1_score:
0.7439 - val_loss: 2.1043 - val_f1_score: 0.4288
Epoch 102/500
28/28 [==============================] - 2s 67ms/step - loss: 0.8348 - f1_score:
0.7404 - val_loss: 1.9881 - val_f1_score: 0.4875
Epoch 103/500
28/28 [==============================] - 2s 67ms/step - loss: 0.6919 - f1_score:
0.7918 - val_loss: 1.8923 - val_f1_score: 0.5165
Epoch 104/500
```

```
28/28 [==============================] - 2s 66ms/step - loss: 0.6690 - f1_score:
0.7992 - val_loss: 2.0214 - val_f1_score: 0.5044
Epoch 105/500
28/28 [==============================] - ETA: 0s - loss: 0.6654 - f1_score:
0.7968

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 368ms/step - loss: 0.6654 -
f1_score: 0.7968 - val_loss: 2.0449 - val_f1_score: 0.5180
Epoch 106/500
28/28 [==============================] - ETA: 0s - loss: 0.6548 - f1_score:
0.8131

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 388ms/step - loss: 0.6548 -
f1_score: 0.8131 - val_loss: 1.9414 - val_f1_score: 0.5189
Epoch 107/500
28/28 [==============================] - ETA: 0s - loss: 0.6375 - f1_score:
0.8183

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 392ms/step - loss: 0.6375 -
f1_score: 0.8183 - val_loss: 1.9482 - val_f1_score: 0.5364
Epoch 108/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6455 - f1_score:
0.7997 - val_loss: 2.0816 - val_f1_score: 0.5147
Epoch 109/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6088 - f1_score:
0.8297 - val_loss: 2.0545 - val_f1_score: 0.5353
Epoch 110/500
28/28 [==============================] - 2s 64ms/step - loss: 0.5992 - f1_score:
0.8291 - val_loss: 2.0485 - val_f1_score: 0.5215
Epoch 111/500
```

```
28/28 [==============================] - 2s 64ms/step - loss: 0.5605 - f1_score:
0.8420 - val_loss: 1.9421 - val_f1_score: 0.5326
Epoch 112/500
28/28 [==============================] - 2s 64ms/step - loss: 0.5696 - f1_score:
0.8375 - val_loss: 2.0775 - val_f1_score: 0.4938
Epoch 113/500
28/28 [==============================] - 2s 66ms/step - loss: 0.5885 - f1_score:
0.8295 - val_loss: 2.0974 - val_f1_score: 0.5295
Epoch 114/500
28/28 [==============================] - ETA: 0s - loss: 0.6101 - f1_score:
0.8324

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 9s 335ms/step - loss: 0.6101 -
f1_score: 0.8324 - val_loss: 2.0943 - val_f1_score: 0.5375
Epoch 115/500
28/28 [==============================] - 2s 66ms/step - loss: 0.5788 - f1_score:
0.8353 - val_loss: 2.0077 - val_f1_score: 0.5312
Epoch 116/500
28/28 [==============================] - ETA: 0s - loss: 0.6023 - f1_score:
0.8193

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 365ms/step - loss: 0.6023 -
f1_score: 0.8193 - val_loss: 1.9320 - val_f1_score: 0.5429
Epoch 117/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6590 - f1_score:
0.8042 - val_loss: 1.9951 - val_f1_score: 0.4930
Epoch 118/500
28/28 [==============================] - 2s 69ms/step - loss: 0.6338 - f1_score:
0.8068 - val_loss: 2.1882 - val_f1_score: 0.5280
Epoch 119/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5445 - f1_score:
0.8494 - val_loss: 2.0349 - val_f1_score: 0.5253
Epoch 120/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6102 - f1_score:
0.8183 - val_loss: 2.2323 - val_f1_score: 0.5132
Epoch 121/500
```

```
28/28 [==============================] - 2s 69ms/step - loss: 0.6351 - f1_score:
0.8147 - val_loss: 2.2601 - val_f1_score: 0.5136
Epoch 122/500
28/28 [==============================] - 2s 67ms/step - loss: 0.6299 - f1_score:
0.8127 - val_loss: 2.0590 - val_f1_score: 0.5075
Epoch 123/500
28/28 [==============================] - 2s 75ms/step - loss: 0.5685 - f1_score:
0.8377 - val_loss: 2.1381 - val_f1_score: 0.4858
Epoch 124/500
28/28 [==============================] - 2s 67ms/step - loss: 0.4917 - f1_score:
0.8627 - val_loss: 2.0682 - val_f1_score: 0.5002
Epoch 125/500
28/28 [==============================] - 2s 66ms/step - loss: 0.5088 - f1_score:
0.8582 - val_loss: 2.0592 - val_f1_score: 0.5083
Epoch 126/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4715 - f1_score:
0.8672 - val_loss: 1.9870 - val_f1_score: 0.5269
Epoch 127/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4873 - f1_score:
0.8588 - val_loss: 2.1528 - val_f1_score: 0.5106
Epoch 128/500
28/28 [==============================] - 2s 69ms/step - loss: 0.6809 - f1_score:
0.8023 - val_loss: 2.4336 - val_f1_score: 0.4887
Epoch 129/500
28/28 [==============================] - 2s 74ms/step - loss: 0.5584 - f1_score:
0.8362 - val_loss: 2.1768 - val_f1_score: 0.5163
Epoch 130/500
28/28 [==============================] - 2s 65ms/step - loss: 0.5033 - f1_score:
0.8582 - val_loss: 2.0646 - val_f1_score: 0.5317
Epoch 131/500
28/28 [==============================] - 2s 69ms/step - loss: 0.4704 - f1_score:
0.8625 - val_loss: 2.2587 - val_f1_score: 0.5258
Epoch 132/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4855 - f1_score:
0.8675 - val_loss: 2.0767 - val_f1_score: 0.5376
Epoch 133/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4139 - f1_score:
0.8925 - val_loss: 2.1827 - val_f1_score: 0.5401
Epoch 134/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4068 - f1_score:
0.8916 - val_loss: 2.0685 - val_f1_score: 0.5351
Epoch 135/500
28/28 [==============================] - ETA: 0s - loss: 0.3962 - f1_score:
0.8939

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
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```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 396ms/step - loss: 0.3962 -
f1_score: 0.8939 - val_loss: 2.1644 - val_f1_score: 0.5475
Epoch 136/500
28/28 [==============================] - 2s 71ms/step - loss: 0.4056 - f1_score:
0.8865 - val_loss: 2.1717 - val_f1_score: 0.5368
Epoch 137/500
28/28 [==============================] - 2s 71ms/step - loss: 0.4803 - f1_score:
0.8622 - val_loss: 2.3056 - val_f1_score: 0.5011
Epoch 138/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4917 - f1_score:
0.8572 - val_loss: 2.1210 - val_f1_score: 0.5303
Epoch 139/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4582 - f1_score:
0.8697 - val_loss: 2.2093 - val_f1_score: 0.5086
Epoch 140/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6910 - f1_score:
0.7849 - val_loss: 2.1210 - val_f1_score: 0.5169
Epoch 141/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4884 - f1_score:
0.8590 - val_loss: 2.0959 - val_f1_score: 0.5163
Epoch 142/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3792 - f1_score:
0.9004 - val_loss: 2.2045 - val_f1_score: 0.5288
Epoch 143/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3779 - f1_score:
0.9008 - val_loss: 2.3561 - val_f1_score: 0.5066
Epoch 144/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3745 - f1_score:
0.8947 - val_loss: 2.3301 - val_f1_score: 0.5198
Epoch 145/500
28/28 [==============================] - 2s 71ms/step - loss: 0.4113 - f1_score:
0.8896 - val_loss: 2.2401 - val_f1_score: 0.5098
Epoch 146/500
28/28 [==============================] - 2s 70ms/step - loss: 0.4246 - f1_score:
0.8813 - val_loss: 2.3208 - val_f1_score: 0.5198
Epoch 147/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3941 - f1_score:
0.8927 - val_loss: 2.1702 - val_f1_score: 0.5025
Epoch 148/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3740 - f1_score:
0.8990 - val_loss: 2.2355 - val_f1_score: 0.5135
Epoch 149/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4186 - f1_score:
0.8850 - val_loss: 2.2572 - val_f1_score: 0.5085
Epoch 150/500
```

```
28/28 [==============================] - 2s 71ms/step - loss: 0.3907 - f1_score:
0.8887 - val_loss: 2.2479 - val_f1_score: 0.5226
Epoch 151/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3654 - f1_score:
0.9046 - val_loss: 2.1291 - val_f1_score: 0.5387
Epoch 152/500
28/28 [==============================] - 2s 71ms/step - loss: 0.4251 - f1_score:
0.8812 - val_loss: 2.3739 - val_f1_score: 0.5103
Epoch 153/500
28/28 [==============================] - 2s 69ms/step - loss: 0.4219 - f1_score:
0.8776 - val_loss: 2.2649 - val_f1_score: 0.5355
Epoch 154/500
28/28 [==============================] - 2s 73ms/step - loss: 0.3536 - f1_score:
0.9068 - val_loss: 2.3379 - val_f1_score: 0.5128
Epoch 155/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3315 - f1_score:
0.9184 - val_loss: 2.3396 - val_f1_score: 0.5357
Epoch 156/500
28/28 [==============================] - 2s 67ms/step - loss: 0.4622 - f1_score:
0.8675 - val_loss: 2.4284 - val_f1_score: 0.4825
Epoch 157/500
28/28 [==============================] - 2s 66ms/step - loss: 0.5848 - f1_score:
0.8207 - val_loss: 2.3933 - val_f1_score: 0.5401
Epoch 158/500
28/28 [==============================] - 2s 71ms/step - loss: 1.3638 - f1_score:
0.6381 - val_loss: 2.1398 - val_f1_score: 0.5028
Epoch 159/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6431 - f1_score:
0.8106 - val_loss: 2.1449 - val_f1_score: 0.5299
Epoch 160/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6607 - f1_score:
0.8073 - val_loss: 2.2881 - val_f1_score: 0.5058
Epoch 161/500
28/28 [==============================] - 2s 68ms/step - loss: 0.5608 - f1_score:
0.8358 - val_loss: 2.1289 - val_f1_score: 0.5410
Epoch 162/500
28/28 [==============================] - 2s 69ms/step - loss: 0.4273 - f1_score:
0.8790 - val_loss: 2.1987 - val_f1_score: 0.5364
Epoch 163/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3500 - f1_score:
0.9059 - val_loss: 2.1351 - val_f1_score: 0.5255
Epoch 164/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3136 - f1_score:
0.9239 - val_loss: 2.0998 - val_f1_score: 0.5360
Epoch 165/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2847 - f1_score:
0.9309 - val_loss: 2.1778 - val_f1_score: 0.5422
Epoch 166/500
```

```
28/28 [==============================] - ETA: 0s - loss: 0.2807 - f1_score:
0.9382

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INFO:tensorflow:Assets written to: 1 LSTM/assets

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28/28 [==============================] - 13s 489ms/step - loss: 0.2807 -
f1_score: 0.9382 - val_loss: 2.2052 - val_f1_score: 0.5567
Epoch 167/500
28/28 [==============================] - ETA: 0s - loss: 0.2738 - f1_score:
0.9351

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 404ms/step - loss: 0.2738 -
f1_score: 0.9351 - val_loss: 2.2782 - val_f1_score: 0.5592
Epoch 168/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2642 - f1_score:
0.9446 - val_loss: 2.3392 - val_f1_score: 0.5159
Epoch 169/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2720 - f1_score:
0.9374 - val_loss: 2.2732 - val_f1_score: 0.5399
Epoch 170/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2501 - f1_score:
0.9433 - val_loss: 2.3206 - val_f1_score: 0.5487
Epoch 171/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2679 - f1_score:
0.9388 - val_loss: 2.2911 - val_f1_score: 0.5384
Epoch 172/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3180 - f1_score:
0.9245 - val_loss: 2.2436 - val_f1_score: 0.5520
Epoch 173/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3617 - f1_score:
0.9017 - val_loss: 2.2131 - val_f1_score: 0.5581
Epoch 174/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3415 - f1_score:
0.9095 - val_loss: 2.2314 - val_f1_score: 0.5591
Epoch 175/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3197 - f1_score:
0.9179 - val_loss: 2.3203 - val_f1_score: 0.5339
Epoch 176/500
```

```
28/28 [==============================] - 2s 66ms/step - loss: 0.3087 - f1_score:
0.9249 - val_loss: 2.2838 - val_f1_score: 0.5290
Epoch 177/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2594 - f1_score:
0.9433 - val_loss: 2.4260 - val_f1_score: 0.5309
Epoch 178/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2697 - f1_score:
0.9416 - val_loss: 2.4063 - val_f1_score: 0.5279
Epoch 179/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2271 - f1_score:
0.9545 - val_loss: 2.5345 - val_f1_score: 0.4905
Epoch 180/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2158 - f1_score:
0.9594 - val_loss: 2.3969 - val_f1_score: 0.5472
Epoch 181/500
28/28 [==============================] - 2s 72ms/step - loss: 0.5125 - f1_score:
0.8624 - val_loss: 3.2375 - val_f1_score: 0.4369
Epoch 182/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6979 - f1_score:
0.7909 - val_loss: 2.4162 - val_f1_score: 0.5008
Epoch 183/500
28/28 [==============================] - 2s 68ms/step - loss: 0.4144 - f1_score:
0.8797 - val_loss: 2.2874 - val_f1_score: 0.5318
Epoch 184/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3497 - f1_score:
0.9059 - val_loss: 2.2731 - val_f1_score: 0.5259
Epoch 185/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2623 - f1_score:
0.9386 - val_loss: 2.3885 - val_f1_score: 0.5294
Epoch 186/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2306 - f1_score:
0.9554 - val_loss: 2.3656 - val_f1_score: 0.5200
Epoch 187/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2348 - f1_score:
0.9472 - val_loss: 2.3024 - val_f1_score: 0.5325
Epoch 188/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2357 - f1_score:
0.9490 - val_loss: 2.4266 - val_f1_score: 0.5127
Epoch 189/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2359 - f1_score:
0.9506 - val_loss: 2.3972 - val_f1_score: 0.5466
Epoch 190/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2150 - f1_score:
0.9557 - val_loss: 2.4539 - val_f1_score: 0.5313
Epoch 191/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2267 - f1_score:
0.9470 - val_loss: 2.4512 - val_f1_score: 0.5188
Epoch 192/500
```

```
28/28 [==============================] - 2s 67ms/step - loss: 0.3081 - f1_score:
0.9171 - val_loss: 2.4413 - val_f1_score: 0.5084
Epoch 193/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3145 - f1_score:
0.9222 - val_loss: 2.4855 - val_f1_score: 0.5229
Epoch 194/500
28/28 [==============================] - 2s 68ms/step - loss: 0.4024 - f1_score:
0.8879 - val_loss: 2.4697 - val_f1_score: 0.4900
Epoch 195/500
28/28 [==============================] - 2s 67ms/step - loss: 0.4993 - f1_score:
0.8638 - val_loss: 2.5181 - val_f1_score: 0.5414
Epoch 196/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3555 - f1_score:
0.9029 - val_loss: 2.2464 - val_f1_score: 0.5246
Epoch 197/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2566 - f1_score:
0.9412 - val_loss: 2.5090 - val_f1_score: 0.5209
Epoch 198/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2591 - f1_score:
0.9387 - val_loss: 2.3170 - val_f1_score: 0.5364
Epoch 199/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1944 - f1_score:
0.9669 - val_loss: 2.2613 - val_f1_score: 0.5528
Epoch 200/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2988 - f1_score:
0.9212 - val_loss: 2.5412 - val_f1_score: 0.4891
Epoch 201/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3007 - f1_score:
0.9243 - val_loss: 2.5138 - val_f1_score: 0.5244
Epoch 202/500
28/28 [==============================] - ETA: 0s - loss: 0.2895 - f1_score:
0.9242

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2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 11s 409ms/step - loss: 0.2895 -
f1_score: 0.9242 - val_loss: 2.3376 - val_f1_score: 0.5637
Epoch 203/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2470 - f1_score:
0.9456 - val_loss: 2.4174 - val_f1_score: 0.5343
Epoch 204/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2535 - f1_score:
0.9384 - val_loss: 2.5010 - val_f1_score: 0.5225
Epoch 205/500
```

```
28/28 [==============================] - 2s 66ms/step - loss: 0.2254 - f1_score:
0.9487 - val_loss: 2.4173 - val_f1_score: 0.5403
Epoch 206/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2325 - f1_score:
0.9511 - val_loss: 2.4789 - val_f1_score: 0.5159
Epoch 207/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1809 - f1_score:
0.9674 - val_loss: 2.4176 - val_f1_score: 0.5473
Epoch 208/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1784 - f1_score:
0.9688 - val_loss: 2.5449 - val_f1_score: 0.5310
Epoch 209/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2024 - f1_score:
0.9546 - val_loss: 2.5882 - val_f1_score: 0.5105
Epoch 210/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2081 - f1_score:
0.9606 - val_loss: 2.5424 - val_f1_score: 0.5477
Epoch 211/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2604 - f1_score:
0.9336 - val_loss: 2.5535 - val_f1_score: 0.5064
Epoch 212/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2497 - f1_score:
0.9439 - val_loss: 2.4315 - val_f1_score: 0.5311
Epoch 213/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3221 - f1_score:
0.9204 - val_loss: 2.4770 - val_f1_score: 0.5336
Epoch 214/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2812 - f1_score:
0.9313 - val_loss: 2.5970 - val_f1_score: 0.5442
Epoch 215/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2564 - f1_score:
0.9347 - val_loss: 2.6770 - val_f1_score: 0.5087
Epoch 216/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2058 - f1_score:
0.9595 - val_loss: 2.4871 - val_f1_score: 0.5549
Epoch 217/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2146 - f1_score:
0.9548 - val_loss: 2.4394 - val_f1_score: 0.5622
Epoch 218/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2423 - f1_score:
0.9370 - val_loss: 2.7665 - val_f1_score: 0.5067
Epoch 219/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2309 - f1_score:
0.9468 - val_loss: 2.6114 - val_f1_score: 0.5068
Epoch 220/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2367 - f1_score:
0.9456 - val_loss: 2.6333 - val_f1_score: 0.5091
Epoch 221/500
```

```
28/28 [==============================] - 2s 71ms/step - loss: 0.2887 - f1_score:
0.9292 - val_loss: 2.6304 - val_f1_score: 0.5235
Epoch 222/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2399 - f1_score:
0.9517 - val_loss: 2.4839 - val_f1_score: 0.5430
Epoch 223/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2307 - f1_score:
0.9513 - val_loss: 2.7672 - val_f1_score: 0.5132
Epoch 224/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0492 - f1_score:
0.7630 - val_loss: 3.0846 - val_f1_score: 0.4286
Epoch 225/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2916 - f1_score:
0.6486 - val_loss: 2.4554 - val_f1_score: 0.5331
Epoch 226/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4546 - f1_score:
0.8661 - val_loss: 2.4137 - val_f1_score: 0.5052
Epoch 227/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2814 - f1_score:
0.9329 - val_loss: 2.4314 - val_f1_score: 0.5375
Epoch 228/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2546 - f1_score:
0.9412 - val_loss: 2.4954 - val_f1_score: 0.5130
Epoch 229/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3448 - f1_score:
0.9126 - val_loss: 2.3082 - val_f1_score: 0.5440
Epoch 230/500
28/28 [==============================] - ETA: 0s - loss: 0.2381 - f1_score:
0.9454

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

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28/28 [==============================] - 13s 464ms/step - loss: 0.2381 -
f1_score: 0.9454 - val_loss: 2.3552 - val_f1_score: 0.5804
Epoch 231/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2101 - f1_score:
0.9530 - val_loss: 2.4457 - val_f1_score: 0.5183
Epoch 232/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1778 - f1_score:
0.9650 - val_loss: 2.4009 - val_f1_score: 0.5197
Epoch 233/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1541 - f1_score:
0.9762 - val_loss: 2.3400 - val_f1_score: 0.5727
Epoch 234/500
```

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28/28 [==============================] - 2s 65ms/step - loss: 0.1445 - f1_score:
0.9840 - val_loss: 2.3605 - val_f1_score: 0.5528
Epoch 235/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1435 - f1_score:
0.9776 - val_loss: 2.3430 - val_f1_score: 0.5683
Epoch 236/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1520 - f1_score:
0.9783 - val_loss: 2.4630 - val_f1_score: 0.5432
Epoch 237/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1654 - f1_score:
0.9754 - val_loss: 2.4804 - val_f1_score: 0.5345
Epoch 238/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1477 - f1_score:
0.9788 - val_loss: 2.5495 - val_f1_score: 0.5573
Epoch 239/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1503 - f1_score:
0.9777 - val_loss: 2.4755 - val_f1_score: 0.5537
Epoch 240/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1527 - f1_score:
0.9773 - val_loss: 2.6029 - val_f1_score: 0.5228
Epoch 241/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1966 - f1_score:
0.9615 - val_loss: 2.5895 - val_f1_score: 0.5317
Epoch 242/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2209 - f1_score:
0.9528 - val_loss: 2.6080 - val_f1_score: 0.5169
Epoch 243/500
28/28 [==============================] - 2s 69ms/step - loss: 0.5741 - f1_score:
0.8481 - val_loss: 2.7706 - val_f1_score: 0.4931
Epoch 244/500
28/28 [==============================] - 2s 70ms/step - loss: 0.5301 - f1_score:
0.8556 - val_loss: 2.4584 - val_f1_score: 0.5297
Epoch 245/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3312 - f1_score:
0.9137 - val_loss: 2.4870 - val_f1_score: 0.5458
Epoch 246/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2149 - f1_score:
0.9554 - val_loss: 2.3714 - val_f1_score: 0.5372
Epoch 247/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1893 - f1_score:
0.9625 - val_loss: 2.3797 - val_f1_score: 0.5612
Epoch 248/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1743 - f1_score:
0.9686 - val_loss: 2.2971 - val_f1_score: 0.5414
Epoch 249/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2080 - f1_score:
0.9589 - val_loss: 2.3860 - val_f1_score: 0.5460
Epoch 250/500
```

```
28/28 [==============================] - 2s 74ms/step - loss: 0.3794 - f1_score:
0.9096 - val_loss: 2.3896 - val_f1_score: 0.5616
Epoch 251/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4404 - f1_score:
0.8849 - val_loss: 2.5807 - val_f1_score: 0.5251
Epoch 252/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4434 - f1_score:
0.8782 - val_loss: 2.2697 - val_f1_score: 0.5613
Epoch 253/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2940 - f1_score:
0.9307 - val_loss: 2.3694 - val_f1_score: 0.5397
Epoch 254/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2187 - f1_score:
0.9509 - val_loss: 2.5815 - val_f1_score: 0.5132
Epoch 255/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2374 - f1_score:
0.9471 - val_loss: 2.4223 - val_f1_score: 0.5618
Epoch 256/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1638 - f1_score:
0.9720 - val_loss: 2.4325 - val_f1_score: 0.5492
Epoch 257/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1461 - f1_score:
0.9747 - val_loss: 2.4667 - val_f1_score: 0.5509
Epoch 258/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1504 - f1_score:
0.9761 - val_loss: 2.5471 - val_f1_score: 0.5357
Epoch 259/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1342 - f1_score:
0.9829 - val_loss: 2.4528 - val_f1_score: 0.5558
Epoch 260/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1244 - f1_score:
0.9871 - val_loss: 2.5809 - val_f1_score: 0.5461
Epoch 261/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1163 - f1_score:
0.9909 - val_loss: 2.5495 - val_f1_score: 0.5402
Epoch 262/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1209 - f1_score:
0.9874 - val_loss: 2.4950 - val_f1_score: 0.5565
Epoch 263/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1242 - f1_score:
0.9850 - val_loss: 2.5011 - val_f1_score: 0.5577
Epoch 264/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1201 - f1_score:
0.9853 - val_loss: 2.4575 - val_f1_score: 0.5705
Epoch 265/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1295 - f1_score:
0.9825 - val_loss: 2.5311 - val_f1_score: 0.5392
Epoch 266/500
```

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28/28 [==============================] - 2s 78ms/step - loss: 0.1142 - f1_score:
0.9898 - val_loss: 2.5646 - val_f1_score: 0.5527
Epoch 267/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1092 - f1_score:
0.9897 - val_loss: 2.6503 - val_f1_score: 0.5590
Epoch 268/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1211 - f1_score:
0.9876 - val_loss: 2.6894 - val_f1_score: 0.5329
Epoch 269/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2993 - f1_score:
0.9266 - val_loss: 2.8282 - val_f1_score: 0.5007
Epoch 270/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4873 - f1_score:
0.8675 - val_loss: 2.7163 - val_f1_score: 0.5339
Epoch 271/500
28/28 [==============================] - 2s 71ms/step - loss: 0.4123 - f1_score:
0.8824 - val_loss: 2.4717 - val_f1_score: 0.5309
Epoch 272/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3209 - f1_score:
0.9099 - val_loss: 2.5450 - val_f1_score: 0.5513
Epoch 273/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2185 - f1_score:
0.9510 - val_loss: 2.6896 - val_f1_score: 0.5241
Epoch 274/500
28/28 [==============================] - ETA: 0s - loss: 0.1653 - f1_score:
0.9712

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

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28/28 [==============================] - 12s 424ms/step - loss: 0.1653 -
f1_score: 0.9712 - val_loss: 2.4126 - val_f1_score: 0.5994
Epoch 275/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1488 - f1_score:
0.9740 - val_loss: 2.6011 - val_f1_score: 0.5588
Epoch 276/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1299 - f1_score:
0.9874 - val_loss: 2.6020 - val_f1_score: 0.5489
Epoch 277/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1381 - f1_score:
0.9799 - val_loss: 2.5074 - val_f1_score: 0.5732
Epoch 278/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1181 - f1_score:
0.9881 - val_loss: 2.4830 - val_f1_score: 0.5507
Epoch 279/500
```

```
28/28 [==============================] - 2s 67ms/step - loss: 0.1200 - f1_score:
0.9849 - val_loss: 2.6095 - val_f1_score: 0.5502
Epoch 280/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1082 - f1_score:
0.9912 - val_loss: 2.5726 - val_f1_score: 0.5675
Epoch 281/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1091 - f1_score:
0.9908 - val_loss: 2.6231 - val_f1_score: 0.5467
Epoch 282/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1051 - f1_score:
0.9892 - val_loss: 2.5803 - val_f1_score: 0.5617
Epoch 283/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1172 - f1_score:
0.9855 - val_loss: 2.6671 - val_f1_score: 0.5403
Epoch 284/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1145 - f1_score:
0.9874 - val_loss: 2.5894 - val_f1_score: 0.5581
Epoch 285/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1177 - f1_score:
0.9861 - val_loss: 2.6273 - val_f1_score: 0.5443
Epoch 286/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1248 - f1_score:
0.9834 - val_loss: 2.6521 - val_f1_score: 0.5336
Epoch 287/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1063 - f1_score:
0.9888 - val_loss: 2.6495 - val_f1_score: 0.5645
Epoch 288/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1781 - f1_score:
0.9604 - val_loss: 2.9723 - val_f1_score: 0.5243
Epoch 289/500
28/28 [==============================] - 2s 71ms/step - loss: 0.5076 - f1_score:
0.8655 - val_loss: 2.7397 - val_f1_score: 0.5091
Epoch 290/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2879 - f1_score:
0.9284 - val_loss: 2.7293 - val_f1_score: 0.5352
Epoch 291/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1979 - f1_score:
0.9600 - val_loss: 2.6752 - val_f1_score: 0.5366
Epoch 292/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1523 - f1_score:
0.9767 - val_loss: 2.8043 - val_f1_score: 0.5166
Epoch 293/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1348 - f1_score:
0.9767 - val_loss: 2.6196 - val_f1_score: 0.5678
Epoch 294/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1554 - f1_score:
0.9744 - val_loss: 2.8152 - val_f1_score: 0.5417
Epoch 295/500
```

```
28/28 [==============================] - 2s 70ms/step - loss: 0.1887 - f1_score:
0.9606 - val_loss: 2.8225 - val_f1_score: 0.5595
Epoch 296/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3000 - f1_score:
0.9174 - val_loss: 2.7546 - val_f1_score: 0.4995
Epoch 297/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4949 - f1_score:
0.8756 - val_loss: 2.8264 - val_f1_score: 0.5206
Epoch 298/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3931 - f1_score:
0.8965 - val_loss: 2.4233 - val_f1_score: 0.5410
Epoch 299/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2053 - f1_score:
0.9572 - val_loss: 2.6094 - val_f1_score: 0.5276
Epoch 300/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1551 - f1_score:
0.9742 - val_loss: 2.5802 - val_f1_score: 0.5299
Epoch 301/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1316 - f1_score:
0.9788 - val_loss: 2.6055 - val_f1_score: 0.5652
Epoch 302/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1614 - f1_score:
0.9678 - val_loss: 2.5055 - val_f1_score: 0.5717
Epoch 303/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1539 - f1_score:
0.9723 - val_loss: 2.7197 - val_f1_score: 0.5528
Epoch 304/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1253 - f1_score:
0.9828 - val_loss: 2.6951 - val_f1_score: 0.5327
Epoch 305/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1375 - f1_score:
0.9787 - val_loss: 2.8093 - val_f1_score: 0.5546
Epoch 306/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1290 - f1_score:
0.9820 - val_loss: 2.5990 - val_f1_score: 0.5555
Epoch 307/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1667 - f1_score:
0.9688 - val_loss: 2.6448 - val_f1_score: 0.5442
Epoch 308/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2205 - f1_score:
0.9456 - val_loss: 2.8169 - val_f1_score: 0.5185
Epoch 309/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1804 - f1_score:
0.9612 - val_loss: 2.9086 - val_f1_score: 0.5350
Epoch 310/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2894 - f1_score:
0.9315 - val_loss: 2.8623 - val_f1_score: 0.5296
Epoch 311/500
```

```
28/28 [==============================] - 2s 73ms/step - loss: 0.2315 - f1_score:
0.9517 - val_loss: 2.6968 - val_f1_score: 0.5599
Epoch 312/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1299 - f1_score:
0.9828 - val_loss: 2.5384 - val_f1_score: 0.5743
Epoch 313/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1096 - f1_score:
0.9866 - val_loss: 2.4746 - val_f1_score: 0.5699
Epoch 314/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1119 - f1_score:
0.9870 - val_loss: 2.5400 - val_f1_score: 0.5751
Epoch 315/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1014 - f1_score:
0.9923 - val_loss: 2.5463 - val_f1_score: 0.5812
Epoch 316/500
28/28 [==============================] - 2s 70ms/step - loss: 0.0966 - f1_score:
0.9938 - val_loss: 2.4841 - val_f1_score: 0.5660
Epoch 317/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0974 - f1_score:
0.9918 - val_loss: 2.6950 - val_f1_score: 0.5508
Epoch 318/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1017 - f1_score:
0.9906 - val_loss: 2.6675 - val_f1_score: 0.5684
Epoch 319/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1036 - f1_score:
0.9893 - val_loss: 2.6801 - val_f1_score: 0.5563
Epoch 320/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1229 - f1_score:
0.9828 - val_loss: 2.8502 - val_f1_score: 0.5623
Epoch 321/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2406 - f1_score:
0.9414 - val_loss: 2.6149 - val_f1_score: 0.5406
Epoch 322/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1813 - f1_score:
0.9639 - val_loss: 2.7805 - val_f1_score: 0.5457
Epoch 323/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2379 - f1_score:
0.9466 - val_loss: 3.4417 - val_f1_score: 0.4394
Epoch 324/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7054 - f1_score:
0.8151 - val_loss: 2.6622 - val_f1_score: 0.5533
Epoch 325/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3648 - f1_score:
0.9007 - val_loss: 2.9358 - val_f1_score: 0.5177
Epoch 326/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3783 - f1_score:
0.8990 - val_loss: 2.7355 - val_f1_score: 0.5556
Epoch 327/500
```

```
28/28 [==============================] - 2s 75ms/step - loss: 0.2033 - f1_score:
0.9570 - val_loss: 2.7002 - val_f1_score: 0.5258
Epoch 328/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2478 - f1_score:
0.9402 - val_loss: 2.5777 - val_f1_score: 0.5895
Epoch 329/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1953 - f1_score:
0.9573 - val_loss: 2.5790 - val_f1_score: 0.5594
Epoch 330/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1576 - f1_score:
0.9679 - val_loss: 2.7334 - val_f1_score: 0.5351
Epoch 331/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1274 - f1_score:
0.9827 - val_loss: 2.7246 - val_f1_score: 0.5377
Epoch 332/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1101 - f1_score:
0.9870 - val_loss: 2.7882 - val_f1_score: 0.5414
Epoch 333/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1305 - f1_score:
0.9796 - val_loss: 2.6266 - val_f1_score: 0.5583
Epoch 334/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1064 - f1_score:
0.9902 - val_loss: 2.6829 - val_f1_score: 0.5635
Epoch 335/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0932 - f1_score:
0.9939 - val_loss: 2.5998 - val_f1_score: 0.5521
Epoch 336/500
28/28 [==============================] - 2s 68ms/step - loss: 0.0976 - f1_score:
0.9895 - val_loss: 2.7094 - val_f1_score: 0.5803
Epoch 337/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1463 - f1_score:
0.9767 - val_loss: 2.8936 - val_f1_score: 0.5525
Epoch 338/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1555 - f1_score:
0.9701 - val_loss: 2.6399 - val_f1_score: 0.5602
Epoch 339/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1241 - f1_score:
0.9849 - val_loss: 2.6059 - val_f1_score: 0.5653
Epoch 340/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1163 - f1_score:
0.9831 - val_loss: 2.8600 - val_f1_score: 0.5486
Epoch 341/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1478 - f1_score:
0.9744 - val_loss: 2.8901 - val_f1_score: 0.5344
Epoch 342/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1197 - f1_score:
0.9840 - val_loss: 2.6105 - val_f1_score: 0.5588
Epoch 343/500
```

```
28/28 [==============================] - 2s 81ms/step - loss: 0.1003 - f1_score:
0.9892 - val_loss: 2.8663 - val_f1_score: 0.5784
Epoch 344/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0966 - f1_score:
0.9940 - val_loss: 2.7192 - val_f1_score: 0.5491
Epoch 345/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0901 - f1_score:
0.9934 - val_loss: 2.8110 - val_f1_score: 0.5652
Epoch 346/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0926 - f1_score:
0.9918 - val_loss: 2.8524 - val_f1_score: 0.5769
Epoch 347/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0851 - f1_score:
0.9957 - val_loss: 2.7695 - val_f1_score: 0.5812
Epoch 348/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0827 - f1_score:
0.9957 - val_loss: 2.7380 - val_f1_score: 0.5871
Epoch 349/500
28/28 [==============================] - 2s 76ms/step - loss: 0.0875 - f1_score:
0.9944 - val_loss: 2.9269 - val_f1_score: 0.5558
Epoch 350/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0921 - f1_score:
0.9923 - val_loss: 2.8224 - val_f1_score: 0.5714
Epoch 351/500
28/28 [==============================] - 2s 75ms/step - loss: 0.0933 - f1_score:
0.9937 - val_loss: 2.9279 - val_f1_score: 0.5583
Epoch 352/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1011 - f1_score:
0.9892 - val_loss: 2.8769 - val_f1_score: 0.5614
Epoch 353/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1173 - f1_score:
0.9839 - val_loss: 2.8116 - val_f1_score: 0.5483
Epoch 354/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2590 - f1_score:
0.9388 - val_loss: 3.1296 - val_f1_score: 0.5173
Epoch 355/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4829 - f1_score:
0.8750 - val_loss: 3.2403 - val_f1_score: 0.4833
Epoch 356/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5842 - f1_score:
0.8565 - val_loss: 2.9594 - val_f1_score: 0.5140
Epoch 357/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2154 - f1_score:
0.9473 - val_loss: 2.6450 - val_f1_score: 0.5612
Epoch 358/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1785 - f1_score:
0.9617 - val_loss: 2.6092 - val_f1_score: 0.5749
Epoch 359/500
```

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28/28 [==============================] - 2s 72ms/step - loss: 0.1707 - f1_score:
0.9623 - val_loss: 2.6407 - val_f1_score: 0.5726
Epoch 360/500
28/28 [==============================] - 2s 71ms/step - loss: 1.5147 - f1_score:
0.7042 - val_loss: 3.1129 - val_f1_score: 0.3875
Epoch 361/500
28/28 [==============================] - 2s 73ms/step - loss: 1.3565 - f1_score:
0.6261 - val_loss: 2.4215 - val_f1_score: 0.5270
Epoch 362/500
28/28 [==============================] - 2s 72ms/step - loss: 0.5291 - f1_score:
0.8495 - val_loss: 2.3877 - val_f1_score: 0.5658
Epoch 363/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2416 - f1_score:
0.9432 - val_loss: 2.3379 - val_f1_score: 0.5788
Epoch 364/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1677 - f1_score:
0.9740 - val_loss: 2.5399 - val_f1_score: 0.5417
Epoch 365/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1681 - f1_score:
0.9660 - val_loss: 2.3979 - val_f1_score: 0.5888
Epoch 366/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1501 - f1_score:
0.9749 - val_loss: 2.4524 - val_f1_score: 0.5734
Epoch 367/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1556 - f1_score:
0.9740 - val_loss: 2.5601 - val_f1_score: 0.5641
Epoch 368/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1289 - f1_score:
0.9813 - val_loss: 2.5341 - val_f1_score: 0.5566
Epoch 369/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1194 - f1_score:
0.9853 - val_loss: 2.5994 - val_f1_score: 0.5505
Epoch 370/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1318 - f1_score:
0.9815 - val_loss: 2.6241 - val_f1_score: 0.5308
Epoch 371/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1596 - f1_score:
0.9685 - val_loss: 2.7903 - val_f1_score: 0.5432
Epoch 372/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1696 - f1_score:
0.9679 - val_loss: 2.5412 - val_f1_score: 0.5645
Epoch 373/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1165 - f1_score:
0.9858 - val_loss: 2.5295 - val_f1_score: 0.5673
Epoch 374/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0965 - f1_score:
0.9929 - val_loss: 2.5993 - val_f1_score: 0.5531
Epoch 375/500
```

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28/28 [==============================] - 2s 76ms/step - loss: 0.0964 - f1_score:
0.9924 - val_loss: 2.6172 - val_f1_score: 0.5699
Epoch 376/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0920 - f1_score:
0.9935 - val_loss: 2.7984 - val_f1_score: 0.5456
Epoch 377/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0861 - f1_score:
0.9981 - val_loss: 2.6432 - val_f1_score: 0.5664
Epoch 378/500
28/28 [==============================] - 2s 77ms/step - loss: 0.0869 - f1_score:
0.9965 - val_loss: 2.6555 - val_f1_score: 0.5874
Epoch 379/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0894 - f1_score:
0.9953 - val_loss: 2.5775 - val_f1_score: 0.5806
Epoch 380/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0875 - f1_score:
0.9936 - val_loss: 2.7138 - val_f1_score: 0.5419
Epoch 381/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0858 - f1_score:
0.9956 - val_loss: 2.6294 - val_f1_score: 0.5553
Epoch 382/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0807 - f1_score:
0.9965 - val_loss: 2.7200 - val_f1_score: 0.5513
Epoch 383/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0829 - f1_score:
0.9962 - val_loss: 2.6533 - val_f1_score: 0.5820
Epoch 384/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0836 - f1_score:
0.9959 - val_loss: 2.5589 - val_f1_score: 0.5623
Epoch 385/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0918 - f1_score:
0.9927 - val_loss: 2.7622 - val_f1_score: 0.5486
Epoch 386/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0890 - f1_score:
0.9947 - val_loss: 2.6562 - val_f1_score: 0.5736
Epoch 387/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0937 - f1_score:
0.9919 - val_loss: 2.7076 - val_f1_score: 0.5653
Epoch 388/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0987 - f1_score:
0.9914 - val_loss: 2.8734 - val_f1_score: 0.5551
Epoch 389/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0853 - f1_score:
0.9940 - val_loss: 2.8689 - val_f1_score: 0.5243
Epoch 390/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0821 - f1_score:
0.9959 - val_loss: 2.7971 - val_f1_score: 0.5475
Epoch 391/500
```

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28/28 [==============================] - 2s 71ms/step - loss: 0.0821 - f1_score:
0.9949 - val_loss: 2.7533 - val_f1_score: 0.5440
Epoch 392/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0772 - f1_score:
0.9983 - val_loss: 2.8030 - val_f1_score: 0.5442
Epoch 393/500
28/28 [==============================] - 2s 80ms/step - loss: 0.0750 - f1_score:
0.9985 - val_loss: 2.7757 - val_f1_score: 0.5565
Epoch 394/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0738 - f1_score:
0.9987 - val_loss: 2.7766 - val_f1_score: 0.5477
Epoch 395/500
28/28 [==============================] - 2s 75ms/step - loss: 0.0789 - f1_score:
0.9949 - val_loss: 2.8384 - val_f1_score: 0.5533
Epoch 396/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1008 - f1_score:
0.9888 - val_loss: 2.9030 - val_f1_score: 0.5513
Epoch 397/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4958 - f1_score:
0.8780 - val_loss: 3.0043 - val_f1_score: 0.5018
Epoch 398/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5304 - f1_score:
0.8458 - val_loss: 2.9014 - val_f1_score: 0.4916
Epoch 399/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4191 - f1_score:
0.8860 - val_loss: 2.5603 - val_f1_score: 0.5551
Epoch 400/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3323 - f1_score:
0.9180 - val_loss: 2.7912 - val_f1_score: 0.5119
Epoch 401/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2609 - f1_score:
0.9308 - val_loss: 2.6556 - val_f1_score: 0.5024
Epoch 402/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2667 - f1_score:
0.9407 - val_loss: 2.5721 - val_f1_score: 0.5451
Epoch 403/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1845 - f1_score:
0.9537 - val_loss: 2.6981 - val_f1_score: 0.5531
Epoch 404/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1549 - f1_score:
0.9728 - val_loss: 2.5694 - val_f1_score: 0.5807
Epoch 405/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1285 - f1_score:
0.9798 - val_loss: 2.5224 - val_f1_score: 0.5741
Epoch 406/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1585 - f1_score:
0.9760 - val_loss: 2.7391 - val_f1_score: 0.5511
Epoch 407/500
```

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28/28 [==============================] - 2s 78ms/step - loss: 0.1506 - f1_score:
0.9682 - val_loss: 2.7595 - val_f1_score: 0.5560
Epoch 408/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1313 - f1_score:
0.9805 - val_loss: 2.6769 - val_f1_score: 0.5629
Epoch 409/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1076 - f1_score:
0.9892 - val_loss: 2.7682 - val_f1_score: 0.5728
Epoch 410/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1508 - f1_score:
0.9701 - val_loss: 2.8078 - val_f1_score: 0.5451
Epoch 411/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1259 - f1_score:
0.9803 - val_loss: 2.7264 - val_f1_score: 0.5593
Epoch 412/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1138 - f1_score:
0.9842 - val_loss: 2.6963 - val_f1_score: 0.5672
Epoch 413/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0952 - f1_score:
0.9932 - val_loss: 2.7535 - val_f1_score: 0.5707
Epoch 414/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1025 - f1_score:
0.9896 - val_loss: 2.8036 - val_f1_score: 0.5494
Epoch 415/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0853 - f1_score:
0.9963 - val_loss: 2.6888 - val_f1_score: 0.5757
Epoch 416/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0776 - f1_score:
0.9959 - val_loss: 2.8608 - val_f1_score: 0.5584
Epoch 417/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0739 - f1_score:
0.9977 - val_loss: 2.8124 - val_f1_score: 0.5662
Epoch 418/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0755 - f1_score:
0.9967 - val_loss: 2.8622 - val_f1_score: 0.5511
Epoch 419/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0730 - f1_score:
0.9988 - val_loss: 2.7307 - val_f1_score: 0.5814
Epoch 420/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0747 - f1_score:
0.9985 - val_loss: 2.7182 - val_f1_score: 0.5807
Epoch 421/500
28/28 [==============================] - 2s 72ms/step - loss: 0.0752 - f1_score:
0.9962 - val_loss: 2.7778 - val_f1_score: 0.5657
Epoch 422/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0764 - f1_score:
0.9957 - val_loss: 2.8517 - val_f1_score: 0.5377
Epoch 423/500
```

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28/28 [==============================] - 2s 72ms/step - loss: 0.0770 - f1_score:
0.9969 - val_loss: 2.8672 - val_f1_score: 0.5510
Epoch 424/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1380 - f1_score:
0.9795 - val_loss: 3.0515 - val_f1_score: 0.5509
Epoch 425/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2997 - f1_score:
0.9252 - val_loss: 3.0436 - val_f1_score: 0.5035
Epoch 426/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2984 - f1_score:
0.9275 - val_loss: 2.9485 - val_f1_score: 0.5339
Epoch 427/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3259 - f1_score:
0.9180 - val_loss: 2.8274 - val_f1_score: 0.5743
Epoch 428/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2827 - f1_score:
0.9340 - val_loss: 2.8880 - val_f1_score: 0.5549
Epoch 429/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2092 - f1_score:
0.9515 - val_loss: 2.5881 - val_f1_score: 0.5695
Epoch 430/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1400 - f1_score:
0.9736 - val_loss: 2.6519 - val_f1_score: 0.5829
Epoch 431/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1042 - f1_score:
0.9877 - val_loss: 2.6033 - val_f1_score: 0.5912
Epoch 432/500
28/28 [==============================] - ETA: 0s - loss: 0.0865 - f1_score:
0.9940

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 12s 441ms/step - loss: 0.0865 -
f1_score: 0.9940 - val_loss: 2.5042 - val_f1_score: 0.6090
Epoch 433/500
28/28 [==============================] - 2s 64ms/step - loss: 0.0854 - f1_score:
0.9933 - val_loss: 2.4726 - val_f1_score: 0.5812
Epoch 434/500
28/28 [==============================] - ETA: 0s - loss: 0.0871 - f1_score:
0.9943

WARNING:absl:Found untraced functions such as lstm_cell_1_layer_call_fn,
lstm_cell_1_layer_call_and_return_conditional_losses while saving (showing 2 of
2). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 LSTM/assets

28/28 [==============================] - 10s 360ms/step - loss: 0.0871 -
f1_score: 0.9943 - val_loss: 2.5357 - val_f1_score: 0.6095
Epoch 435/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0802 - f1_score:
0.9958 - val_loss: 2.6240 - val_f1_score: 0.5905
Epoch 436/500
28/28 [==============================] - 2s 68ms/step - loss: 0.0799 - f1_score:
0.9953 - val_loss: 2.5622 - val_f1_score: 0.5793
Epoch 437/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0780 - f1_score:
0.9956 - val_loss: 2.6823 - val_f1_score: 0.5853
Epoch 438/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0754 - f1_score:
0.9978 - val_loss: 2.7646 - val_f1_score: 0.5693
Epoch 439/500
28/28 [==============================] - 2s 67ms/step - loss: 0.0732 - f1_score:
0.9985 - val_loss: 2.7025 - val_f1_score: 0.5740
Epoch 440/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0733 - f1_score:
0.9975 - val_loss: 2.7285 - val_f1_score: 0.5705
Epoch 441/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0710 - f1_score:
0.9983 - val_loss: 2.7494 - val_f1_score: 0.5830
Epoch 442/500
28/28 [==============================] - 2s 67ms/step - loss: 0.0803 - f1_score:
0.9948 - val_loss: 2.7983 - val_f1_score: 0.5897
Epoch 443/500
28/28 [==============================] - 2s 68ms/step - loss: 0.0763 - f1_score:
0.9966 - val_loss: 2.7517 - val_f1_score: 0.5675
Epoch 444/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0786 - f1_score:
0.9957 - val_loss: 2.7802 - val_f1_score: 0.5577
Epoch 445/500
28/28 [==============================] - 2s 70ms/step - loss: 0.0917 - f1_score:
0.9923 - val_loss: 2.7335 - val_f1_score: 0.5866
Epoch 446/500
28/28 [==============================] - 2s 66ms/step - loss: 0.0923 - f1_score:
0.9922 - val_loss: 2.9696 - val_f1_score: 0.5560
Epoch 447/500
28/28 [==============================] - 2s 72ms/step - loss: 0.4959 - f1_score:
0.8837 - val_loss: 3.3562 - val_f1_score: 0.5004
Epoch 448/500
28/28 [==============================] - 2s 69ms/step - loss: 0.5688 - f1_score:
0.8559 - val_loss: 2.5271 - val_f1_score: 0.5549
Epoch 449/500
```

```
28/28 [==============================] - 2s 67ms/step - loss: 0.2683 - f1_score:
0.9341 - val_loss: 2.7468 - val_f1_score: 0.5719
Epoch 450/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1913 - f1_score:
0.9574 - val_loss: 2.7350 - val_f1_score: 0.5333
Epoch 451/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1435 - f1_score:
0.9730 - val_loss: 2.6158 - val_f1_score: 0.5465
Epoch 452/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1399 - f1_score:
0.9767 - val_loss: 2.7904 - val_f1_score: 0.5557
Epoch 453/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2035 - f1_score:
0.9537 - val_loss: 2.7422 - val_f1_score: 0.5460
Epoch 454/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1439 - f1_score:
0.9725 - val_loss: 2.6765 - val_f1_score: 0.5601
Epoch 455/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1229 - f1_score:
0.9777 - val_loss: 2.8150 - val_f1_score: 0.5710
Epoch 456/500
28/28 [==============================] - 2s 70ms/step - loss: 0.0959 - f1_score:
0.9913 - val_loss: 2.7849 - val_f1_score: 0.5615
Epoch 457/500
28/28 [==============================] - 2s 68ms/step - loss: 0.0815 - f1_score:
0.9935 - val_loss: 2.6979 - val_f1_score: 0.5760
Epoch 458/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1910 - f1_score:
0.9620 - val_loss: 2.7346 - val_f1_score: 0.5733
Epoch 459/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2458 - f1_score:
0.9400 - val_loss: 2.9102 - val_f1_score: 0.5578
Epoch 460/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2077 - f1_score:
0.9529 - val_loss: 2.6957 - val_f1_score: 0.5596
Epoch 461/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1947 - f1_score:
0.9560 - val_loss: 2.7206 - val_f1_score: 0.5619
Epoch 462/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1302 - f1_score:
0.9763 - val_loss: 2.7053 - val_f1_score: 0.5820
Epoch 463/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1182 - f1_score:
0.9835 - val_loss: 2.6622 - val_f1_score: 0.5910
Epoch 464/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1107 - f1_score:
0.9823 - val_loss: 3.0013 - val_f1_score: 0.5259
Epoch 465/500
```

```
28/28 [==============================] - 2s 81ms/step - loss: 0.1607 - f1_score:
0.9716 - val_loss: 2.7185 - val_f1_score: 0.5719
Epoch 466/500
28/28 [==============================] - 2s 84ms/step - loss: 0.1170 - f1_score:
0.9864 - val_loss: 2.9408 - val_f1_score: 0.5563
Epoch 467/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1080 - f1_score:
0.9872 - val_loss: 2.9070 - val_f1_score: 0.5680
Epoch 468/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1076 - f1_score:
0.9869 - val_loss: 2.8035 - val_f1_score: 0.5897
Epoch 469/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0875 - f1_score:
0.9932 - val_loss: 2.8003 - val_f1_score: 0.5704
Epoch 470/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1145 - f1_score:
0.9817 - val_loss: 2.7828 - val_f1_score: 0.5829
Epoch 471/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1578 - f1_score:
0.9684 - val_loss: 2.8445 - val_f1_score: 0.5634
Epoch 472/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2273 - f1_score:
0.9464 - val_loss: 3.0005 - val_f1_score: 0.5699
Epoch 473/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2153 - f1_score:
0.9499 - val_loss: 2.7220 - val_f1_score: 0.5872
Epoch 474/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1479 - f1_score:
0.9734 - val_loss: 2.7413 - val_f1_score: 0.5701
Epoch 475/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1067 - f1_score:
0.9862 - val_loss: 2.7588 - val_f1_score: 0.5753
Epoch 476/500
28/28 [==============================] - 2s 68ms/step - loss: 0.0891 - f1_score:
0.9904 - val_loss: 2.7490 - val_f1_score: 0.5832
Epoch 477/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0755 - f1_score:
0.9953 - val_loss: 2.8026 - val_f1_score: 0.5683
Epoch 478/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0722 - f1_score:
0.9981 - val_loss: 2.7828 - val_f1_score: 0.5868
Epoch 479/500
28/28 [==============================] - 2s 69ms/step - loss: 0.0706 - f1_score:
0.9964 - val_loss: 2.8177 - val_f1_score: 0.5840
Epoch 480/500
28/28 [==============================] - 2s 70ms/step - loss: 0.0713 - f1_score:
0.9981 - val_loss: 2.8975 - val_f1_score: 0.5610
Epoch 481/500
```

```
28/28 [==============================] - 2s 73ms/step - loss: 0.0729 - f1_score:
0.9966 - val_loss: 2.7945 - val_f1_score: 0.5850
Epoch 482/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0733 - f1_score:
0.9965 - val_loss: 2.8323 - val_f1_score: 0.5917
Epoch 483/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0700 - f1_score:
0.9988 - val_loss: 2.9207 - val_f1_score: 0.5711
Epoch 484/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0708 - f1_score:
0.9978 - val_loss: 2.9023 - val_f1_score: 0.5454
Epoch 485/500
28/28 [==============================] - 2s 75ms/step - loss: 0.0698 - f1_score:
0.9981 - val_loss: 2.8459 - val_f1_score: 0.5749
Epoch 486/500
28/28 [==============================] - 2s 81ms/step - loss: 0.0755 - f1_score:
0.9956 - val_loss: 2.8687 - val_f1_score: 0.5804
Epoch 487/500
28/28 [==============================] - 2s 73ms/step - loss: 0.0753 - f1_score:
0.9961 - val_loss: 2.8357 - val_f1_score: 0.6014
Epoch 488/500
28/28 [==============================] - 2s 75ms/step - loss: 0.0693 - f1_score:
0.9991 - val_loss: 2.9118 - val_f1_score: 0.5612
Epoch 489/500
28/28 [==============================] - 2s 74ms/step - loss: 0.0682 - f1_score:
0.9976 - val_loss: 2.9204 - val_f1_score: 0.5718
Epoch 490/500
28/28 [==============================] - 2s 70ms/step - loss: 0.0745 - f1_score:
0.9958 - val_loss: 2.9316 - val_f1_score: 0.5582
Epoch 491/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0772 - f1_score:
0.9957 - val_loss: 3.0224 - val_f1_score: 0.5642
Epoch 492/500
28/28 [==============================] - 2s 71ms/step - loss: 0.0767 - f1_score:
0.9951 - val_loss: 3.1906 - val_f1_score: 0.5601
Epoch 493/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1722 - f1_score:
0.9635 - val_loss: 2.7684 - val_f1_score: 0.6057
Epoch 494/500
28/28 [==============================] - 2s 72ms/step - loss: 0.4660 - f1_score:
0.8838 - val_loss: 3.5603 - val_f1_score: 0.4710
Epoch 495/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6238 - f1_score:
0.8418 - val_loss: 2.6823 - val_f1_score: 0.5541
Epoch 496/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2505 - f1_score:
0.9331 - val_loss: 2.7315 - val_f1_score: 0.5655
Epoch 497/500
```

```
28/28 [==============================] - 2s 70ms/step - loss: 0.1900 - f1_score:
0.9557 - val_loss: 2.7267 - val_f1_score: 0.5611
Epoch 498/500
28/28 [==============================] - 2s 86ms/step - loss: 0.1854 - f1_score:
0.9574 - val_loss: 3.1649 - val_f1_score: 0.4950
Epoch 499/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1691 - f1_score:
0.9659 - val_loss: 2.5804 - val_f1_score: 0.5657
Epoch 500/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1261 - f1_score:
0.9800 - val_loss: 2.6916 - val_f1_score: 0.5520
```

[135]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 12ms/step
              precision    recall  f1-score   support

         AXE      0.500     0.375     0.429         8
    BACKPACK      0.625     0.833     0.714         6
  BASKETBALL      0.769     1.000     0.870        10
         BEE      0.800     0.400     0.533        10
        BELT      0.500     0.750     0.600         4
        BITE      0.600     0.375     0.462         8
   BREAKFAST      0.333     0.333     0.333         6
      CANCER      1.000     0.875     0.933         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.857     1.000     0.923         6
        DARK      0.800     1.000     0.889         4
        DEAF      0.167     0.167     0.167         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      0.714     0.625     0.667         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      1.000     0.375     0.545         8
         DOG      0.429     0.500     0.462         6
    DOWNSIZE      0.857     0.750     0.800         8
        DRAG      0.400     0.500     0.444         4
         EAT      1.000     0.500     0.667         6
        EDIT      0.667     1.000     0.800         6
    ELEVATOR      0.500     0.500     0.500         8
        FINE      0.400     0.500     0.444         4
       FLOAT      0.000     0.000     0.000         4
   FOREIGNER      0.500     0.667     0.571         6
       GUESS      0.750     0.750     0.750         8
   HALLOWEEN      1.000     1.000     1.000         8
```

```
    HOSPITAL      0.571     0.667     0.615         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.500     0.250     0.333         4
        LOCK      0.571     0.500     0.533         8
       LUNCH      0.500     0.375     0.429         8
       MAPLE      0.500     0.750     0.600         4
        MEAT      0.375     0.500     0.429         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     0.750     0.857         8
       MOVIE      0.500     1.000     0.667         8
        NOON      0.625     0.625     0.625         8
       PARTY      0.667     0.750     0.706         8
     PATIENT      0.333     0.333     0.333         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.600     1.000     0.750         6
ROCKINGCHAIR      0.778     0.875     0.824         8
       SHAVE      0.400     0.400     0.400        10
        SINK      0.111     0.167     0.133         6
     SQUEEZE      0.000     0.000     0.000         4
        THEY      0.167     0.250     0.200         4
       TWINS      0.273     0.375     0.316         8
     WHATFOR      1.000     0.500     0.667        10

    accuracy                          0.586       324
   macro avg      0.576     0.567     0.552       324
weighted avg      0.612     0.586     0.578       324
```

```
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[60]:
```
reconstructed_model = tf.keras.models.load_model("1 LSTM")
```

```
2023-09-11 19:43:31.131895: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
```

```
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-11 19:43:35.130479: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 541 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[61]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm_1 (LSTM)               (None, 125)               262500

 dropout_2 (Dropout)         (None, 125)               0

 dense_2 (Dense)             (None, 70)                8820

 dropout_3 (Dropout)         (None, 70)                0

 dense_3 (Dense)             (None, 50)                3550

=================================================================
Total params: 274,870
Trainable params: 274,870
Non-trainable params: 0
_________________________________________________________________
```

[62]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[62]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
LSTM
input:
(None, 130, 399)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 70)
Dropout
input:
(None, 70)
output:
(None, 70)
Dense
input:
(None, 70)
output:
(None, 50)

[63]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[63]:

[64]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
2023-09-11 19:44:46.694251: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [==============================] - 8s 53ms/step - loss: 2.5357 - f1_score:
0.6095
```

[64]:
```
[2.5357143878936768, 0.6095041632652283]
```

[140]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 13ms/step - loss: 0.0613 - f1_score:
0.9996
```

[140]:
```
[0.0613335482776165, 0.9995744228363037]
```

[141]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 11ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.750     0.300     0.429        10
        BELT      0.750     0.750     0.750         4
        BITE      0.333     0.125     0.182         8
   BREAKFAST      0.667     0.667     0.667         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      0.667     1.000     0.800         6
```

CONFUSED	0.750	1.000	0.857	6
DARK	1.000	1.000	1.000	4
DEAF	0.167	0.167	0.167	6
DECIDE	1.000	0.667	0.800	6
DEMAND	0.857	0.750	0.800	8
DEVELOP	0.400	0.333	0.364	6
DINNER	0.750	0.375	0.500	8
DOG	0.357	0.833	0.500	6
DOWNSIZE	0.857	0.750	0.800	8
DRAG	0.400	0.500	0.444	4
EAT	0.750	1.000	0.857	6
EDIT	0.667	1.000	0.800	6
ELEVATOR	0.364	0.500	0.421	8
FINE	0.400	0.500	0.444	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.800	0.667	0.727	6
GUESS	0.667	0.750	0.706	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.667	0.667	0.667	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.750	0.750	0.750	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.833	0.625	0.714	8
LUNCH	0.400	0.500	0.444	8
MAPLE	0.429	0.750	0.545	4
MEAT	0.455	0.833	0.588	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.375	0.545	8
MOVIE	0.600	0.750	0.667	8
NOON	0.875	0.875	0.875	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.500	0.333	0.400	6
RAZOR	0.250	0.250	0.250	4
RIVER	0.364	0.667	0.471	6
ROCKINGCHAIR	0.875	0.875	0.875	8
SHAVE	0.333	0.200	0.250	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.167	0.250	0.200	4
THEY	0.500	0.500	0.500	4
TWINS	0.625	0.625	0.625	8
WHATFOR	0.833	0.500	0.625	10
accuracy			0.633	324
macro avg	0.630	0.628	0.610	324
weighted avg	0.652	0.633	0.621	324

3.2 Hyperparameter Tuning 2 LSTM Layers

[122]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'elu', 'gelu', 'relu'],
            default='relu')
        model = Sequential()
        model.add(
            LSTM(units=hp.Int('units_1',
                              min_value=50,
                              max_value=200,
                              step=25,
                              default=100),
                 return_sequences=True,
                 input_shape=self.input_shape,
                 kernel_regularizer=regularizers.l2(
                     hp.Float('regularizer_1',
                              min_value=1e-4,
                              max_value=1e-2,
                              sampling='LOG',
                              default=.001))))
        model.add(
            LSTM(units=hp.Int('units_2',
                              min_value=50,
                              max_value=200,
                              step=25,
                              default=100),
                 return_sequences=False,
                 kernel_regularizer=regularizers.l2(
                     hp.Float('regularizer_2',
```

```
                                min_value=1e-4,
                                max_value=1e-2,
                                sampling='LOG',
                                default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.65,
                step=0.05,
            )))
        model.add(
            Dense(units=hp.Int('units_4',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=80),
                  activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))

        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.0005)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

[123]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2
```

```
tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='2_LSTM',
    overwrite=False)
```

[124]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 9
dense_activation (Choice)
{'default': 'relu', 'conditions': [], 'values': ['selu', 'mish', 'elu', 'gelu',
'relu'], 'ordered': False}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_1 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
units_2 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_2 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_1 (Float)
{'default': 0.65, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_4 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0005, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
```

[125]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[127]:
```
tuner.search(Xtrain,
             Ytrain,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 34m 50s]
val_f1_score: 0.6502597630023956

Best val_f1_score So Far: 0.6583000123500824
Total elapsed time: 18h 58m 55s
INFO:tensorflow:Oracle triggered exit
```

[ ]:
```
best_model = tuner.get_best_models(num_models=3)[0]
```

[129]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0670 summary
Hyperparameters:
dense_activation: gelu
units_1: 150
regularizer_1: 0.005097339455115072
units_2: 175
regularizer_2: 0.0019526565349868704
dropout_1: 0.15000000000000002
units_4: 100
dropout_2: 0.2
learning_rate: 0.00018769757435735312
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.6583000123500824

Trial 0724 summary
Hyperparameters:
dense_activation: relu
units_1: 150
regularizer_1: 0.00036156986755960413
units_2: 200
regularizer_2: 0.0011089404108766622
dropout_1: 0.6000000000000001
```

```
units_4: 90
dropout_2: 0.2
learning_rate: 0.00022620443736150013
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6502597630023956

Trial 0671 summary
Hyperparameters:
dense_activation: mish
units_1: 200
regularizer_1: 0.0007178100162785227
units_2: 125
regularizer_2: 0.004619877302974764
dropout_1: 0.0
units_4: 80
dropout_2: 0.15000000000000002
learning_rate: 0.0002716245165009012
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.6502099633216858

Trial 0599 summary
Hyperparameters:
dense_activation: mish
units_1: 200
regularizer_1: 0.00018432140445718035
units_2: 150
regularizer_2: 0.0015359876270177853
dropout_1: 0.05
units_4: 120
dropout_2: 0.35000000000000003
learning_rate: 0.0001792680161103088
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0595
Score: 0.6492046415805817

Trial 0598 summary
Hyperparameters:
dense_activation: selu
```

```
units_1: 125
regularizer_1: 0.00017775537216490074
units_2: 150
regularizer_2: 0.000478885980924279
dropout_1: 0.5
units_4: 100
dropout_2: 0.0
learning_rate: 0.0002452567376517019
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0597
Score: 0.643221914768219

Trial 0700 summary
Hyperparameters:
dense_activation: selu
units_1: 50
regularizer_1: 0.0011505259458996322
units_2: 200
regularizer_2: 0.008944020651975486
dropout_1: 0.65
units_4: 120
dropout_2: 0.15000000000000002
learning_rate: 0.00035845621874936584
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.6387543380260468

Trial 0426 summary
Hyperparameters:
dense_activation: elu
units_1: 75
regularizer_1: 0.00012604817165131596
units_2: 175
regularizer_2: 0.0019295941277227592
dropout_1: 0.15000000000000002
units_4: 90
dropout_2: 0.45
learning_rate: 0.00015268051524971711
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
```

```
tuner/trial_id: 0425
Score: 0.6292676031589508

Trial 0714 summary
Hyperparameters:
dense_activation: mish
units_1: 150
regularizer_1: 0.00036558483095598383
units_2: 125
regularizer_2: 0.00019304990364239636
dropout_1: 0.0
units_4: 90
dropout_2: 0.15000000000000002
learning_rate: 0.0002572585549661078
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0709
Score: 0.6221782863140106

Trial 0693 summary
Hyperparameters:
dense_activation: selu
units_1: 50
regularizer_1: 0.0011505259458996322
units_2: 200
regularizer_2: 0.008944020651975486
dropout_1: 0.65
units_4: 120
dropout_2: 0.15000000000000002
learning_rate: 0.00035845621874936584
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0685
Score: 0.6134630143642426

Trial 0715 summary
Hyperparameters:
dense_activation: selu
units_1: 150
regularizer_1: 0.0016234807421441969
units_2: 200
regularizer_2: 0.002188989938568995
dropout_1: 0.55
units_4: 80
```

```
dropout_2: 0.55
learning_rate: 0.00035029019305339175
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0707
Score: 0.6128946840763092
```

[130]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 2s 43ms/step - loss: 2.3504 - f1_score:
0.6702
```

[131]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 2s 26ms/step - loss: 0.2579 - f1_score:
1.0000
```

[132]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (None, 130, 150)          330000

 lstm_1 (LSTM)               (None, 175)               228200

 dropout (Dropout)           (None, 175)               0

 dense (Dense)               (None, 100)               17600

 dropout_1 (Dropout)         (None, 100)               0

 dense_1 (Dense)             (None, 50)                5050

=================================================================
Total params: 580,850
Trainable params: 580,850
Non-trainable params: 0
_________________________________________________________________
```

[133]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[133]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
LSTM
input:
(None, 130, 399)
output:
(None, 130, 150)
LSTM
input:
(None, 130, 150)
output:
(None, 175)
Dropout
input:
(None, 175)
output:
(None, 175)
Dense
input:
(None, 175)
output:
(None, 100)
Dropout
input:
(None, 100)
output:
(None, 100)
Dense
input:
(None, 100)
output:
(None, 50)

[135]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(best_model, legend=True, font=font)
```

[135]:

LSTM
Dropout
Dense

[136]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 23ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.800     0.400     0.533        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.500     0.667         8
   BREAKFAST      1.000     0.667     0.800         6
      CANCER      0.857     0.750     0.800         8
   CHRISTMAS      0.800     0.667     0.727         6
    CONFUSED      0.667     0.667     0.667         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.182     0.333     0.235         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      1.000     1.000     1.000         8
     DEVELOP      0.500     0.500     0.500         6
      DINNER      1.000     0.625     0.769         8
         DOG      0.400     0.333     0.364         6
    DOWNSIZE      0.800     1.000     0.889         8
        DRAG      0.571     1.000     0.727         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      0.308     0.500     0.381         8
        FINE      0.500     0.250     0.333         4
       FLOAT      0.500     0.500     0.500         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.667     0.750     0.706         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.571     0.667     0.615         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.750     0.750     0.750         4
      KNIGHT      0.000     0.000     0.000         4
        LOCK      1.000     0.500     0.667         8
       LUNCH      0.444     0.500     0.471         8
       MAPLE      0.667     1.000     0.800         4
        MEAT      0.400     0.667     0.500         6
    MECHANIC      0.571     1.000     0.727         4
```

```
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.467     0.875     0.609         8
        NOON      1.000     1.000     1.000         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.571     0.667     0.615         6
       RAZOR      0.500     0.500     0.500         4
       RIVER      0.500     0.667     0.571         6
ROCKINGCHAIR      0.889     1.000     0.941         8
       SHAVE      0.667     0.600     0.632        10
        SINK      0.333     0.167     0.222         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.500     0.750     0.600         4
       TWINS      0.667     0.750     0.706         8
     WHATFOR      0.714     0.500     0.588        10

    accuracy                          0.694       324
   macro avg      0.692     0.684     0.670       324
weighted avg      0.722     0.694     0.690       324


/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[137]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[138]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 LSTM/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[139]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
```

```
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 6.6801 - f1_score:
0.0100

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 27s 779ms/step - loss: 6.6801 -
f1_score: 0.0100 - val_loss: 6.4788 - val_f1_score: 0.0029
Epoch 2/500
28/28 [==============================] - 4s 133ms/step - loss: 6.3016 -
f1_score: 0.0111 - val_loss: 6.1084 - val_f1_score: 0.0011
Epoch 3/500
28/28 [==============================] - 4s 133ms/step - loss: 5.9561 -
f1_score: 0.0123 - val_loss: 5.7865 - val_f1_score: 0.0012
Epoch 4/500
28/28 [==============================] - 4s 136ms/step - loss: 5.6554 -
f1_score: 0.0070 - val_loss: 5.5168 - val_f1_score: 0.0012
Epoch 5/500
28/28 [==============================] - 4s 136ms/step - loss: 5.4015 -
f1_score: 0.0088 - val_loss: 5.2824 - val_f1_score: 5.5172e-04
Epoch 6/500
28/28 [==============================] - ETA: 0s - loss: 5.1823 - f1_score:
0.0114

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 652ms/step - loss: 5.1823 -
f1_score: 0.0114 - val_loss: 5.0818 - val_f1_score: 0.0072
Epoch 7/500
28/28 [==============================] - 4s 135ms/step - loss: 4.9960 -
f1_score: 0.0117 - val_loss: 4.9185 - val_f1_score: 0.0012
```

```
Epoch 8/500
28/28 [==============================] - 4s 137ms/step - loss: 4.8379 -
f1_score: 0.0109 - val_loss: 4.7754 - val_f1_score: 0.0012
Epoch 9/500
28/28 [==============================] - 4s 146ms/step - loss: 4.7171 -
f1_score: 0.0124 - val_loss: 4.6635 - val_f1_score: 0.0059
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 4.5900 - f1_score:
0.0158

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 686ms/step - loss: 4.5900 -
f1_score: 0.0158 - val_loss: 4.5330 - val_f1_score: 0.0111
Epoch 11/500
28/28 [==============================] - 4s 135ms/step - loss: 4.4634 -
f1_score: 0.0160 - val_loss: 4.4508 - val_f1_score: 0.0076
Epoch 12/500
28/28 [==============================] - 4s 137ms/step - loss: 4.3266 -
f1_score: 0.0196 - val_loss: 4.2533 - val_f1_score: 0.0105
Epoch 13/500
28/28 [==============================] - ETA: 0s - loss: 4.2005 - f1_score:
0.0270

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 682ms/step - loss: 4.2005 -
f1_score: 0.0270 - val_loss: 4.1400 - val_f1_score: 0.0197
Epoch 14/500
28/28 [==============================] - ETA: 0s - loss: 4.0471 - f1_score:
0.0419

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets
```

```
INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 691ms/step - loss: 4.0471 -
f1_score: 0.0419 - val_loss: 3.9293 - val_f1_score: 0.0211
Epoch 15/500
28/28 [==============================] - 4s 136ms/step - loss: 3.9175 -
f1_score: 0.0492 - val_loss: 3.7676 - val_f1_score: 0.0208
Epoch 16/500
28/28 [==============================] - ETA: 0s - loss: 3.7872 - f1_score:
0.0666

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 700ms/step - loss: 3.7872 -
f1_score: 0.0666 - val_loss: 3.6633 - val_f1_score: 0.0478
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 3.6934 - f1_score:
0.0678

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 615ms/step - loss: 3.6934 -
f1_score: 0.0678 - val_loss: 3.5757 - val_f1_score: 0.0511
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 3.5666 - f1_score:
0.1006

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 624ms/step - loss: 3.5666 -
f1_score: 0.1006 - val_loss: 3.4329 - val_f1_score: 0.0660
Epoch 19/500
```

```
28/28 [==============================] - ETA: 0s - loss: 3.4315 - f1_score:
0.1072

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 16s 580ms/step - loss: 3.4315 -
f1_score: 0.1072 - val_loss: 3.3173 - val_f1_score: 0.0997
Epoch 20/500
28/28 [==============================] - ETA: 0s - loss: 3.3325 - f1_score:
0.1267

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 668ms/step - loss: 3.3325 -
f1_score: 0.1267 - val_loss: 3.2650 - val_f1_score: 0.1016
Epoch 21/500
28/28 [==============================] - 4s 135ms/step - loss: 3.2320 -
f1_score: 0.1389 - val_loss: 3.4105 - val_f1_score: 0.0889
Epoch 22/500
28/28 [==============================] - ETA: 0s - loss: 3.1506 - f1_score:
0.1492

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 16s 587ms/step - loss: 3.1506 -
f1_score: 0.1492 - val_loss: 3.0208 - val_f1_score: 0.1692
Epoch 23/500
28/28 [==============================] - 4s 135ms/step - loss: 3.0396 -
f1_score: 0.1892 - val_loss: 3.1745 - val_f1_score: 0.1303
Epoch 24/500
28/28 [==============================] - 4s 141ms/step - loss: 3.0064 -
f1_score: 0.1834 - val_loss: 2.9341 - val_f1_score: 0.1652
Epoch 25/500
```

```
28/28 [==============================] - ETA: 0s - loss: 2.8532 - f1_score:
0.2204

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 622ms/step - loss: 2.8532 -
f1_score: 0.2204 - val_loss: 2.8277 - val_f1_score: 0.1822
Epoch 26/500
28/28 [==============================] - ETA: 0s - loss: 2.8133 - f1_score:
0.2350

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 698ms/step - loss: 2.8133 -
f1_score: 0.2350 - val_loss: 2.9033 - val_f1_score: 0.2270
Epoch 27/500
28/28 [==============================] - 4s 134ms/step - loss: 2.6910 -
f1_score: 0.2519 - val_loss: 2.8313 - val_f1_score: 0.2051
Epoch 28/500
28/28 [==============================] - 4s 138ms/step - loss: 2.6864 -
f1_score: 0.2758 - val_loss: 2.8544 - val_f1_score: 0.1929
Epoch 29/500
28/28 [==============================] - 4s 141ms/step - loss: 2.5895 -
f1_score: 0.2801 - val_loss: 2.7596 - val_f1_score: 0.2128
Epoch 30/500
28/28 [==============================] - ETA: 0s - loss: 2.4663 - f1_score:
0.3190

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 629ms/step - loss: 2.4663 -
f1_score: 0.3190 - val_loss: 2.6942 - val_f1_score: 0.2595
Epoch 31/500
```

```
28/28 [==============================] - 4s 134ms/step - loss: 2.4416 -
f1_score: 0.3230 - val_loss: 2.6373 - val_f1_score: 0.2470
Epoch 32/500
28/28 [==============================] - ETA: 0s - loss: 2.3505 - f1_score:
0.3551

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 26s 959ms/step - loss: 2.3505 -
f1_score: 0.3551 - val_loss: 2.6352 - val_f1_score: 0.2712
Epoch 33/500
28/28 [==============================] - ETA: 0s - loss: 2.3928 - f1_score:
0.3425

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 636ms/step - loss: 2.3928 -
f1_score: 0.3425 - val_loss: 2.6229 - val_f1_score: 0.2914
Epoch 34/500
28/28 [==============================] - ETA: 0s - loss: 2.2855 - f1_score:
0.3717

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 646ms/step - loss: 2.2855 -
f1_score: 0.3717 - val_loss: 2.5393 - val_f1_score: 0.3057
Epoch 35/500
28/28 [==============================] - 4s 133ms/step - loss: 2.2226 -
f1_score: 0.3839 - val_loss: 2.4613 - val_f1_score: 0.3032
Epoch 36/500
28/28 [==============================] - 4s 137ms/step - loss: 2.1682 -
f1_score: 0.3846 - val_loss: 2.6356 - val_f1_score: 0.2872
Epoch 37/500
```

```
28/28 [==============================] - ETA: 0s - loss: 2.1084 - f1_score:
0.4143

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 632ms/step - loss: 2.1084 -
f1_score: 0.4143 - val_loss: 2.5307 - val_f1_score: 0.3155
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 2.0946 - f1_score:
0.4265

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 22s 800ms/step - loss: 2.0946 -
f1_score: 0.4265 - val_loss: 2.4923 - val_f1_score: 0.3228
Epoch 39/500
28/28 [==============================] - 4s 135ms/step - loss: 2.0381 -
f1_score: 0.4433 - val_loss: 2.6995 - val_f1_score: 0.2994
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 2.0269 - f1_score:
0.4362

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 619ms/step - loss: 2.0269 -
f1_score: 0.4362 - val_loss: 2.4539 - val_f1_score: 0.3415
Epoch 41/500
28/28 [==============================] - ETA: 0s - loss: 2.0286 - f1_score:
0.4529

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
```

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lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 705ms/step - loss: 2.0286 -
f1_score: 0.4529 - val_loss: 2.4276 - val_f1_score: 0.3570
Epoch 42/500
28/28 [==============================] - ETA: 0s - loss: 1.9524 - f1_score:
0.4542

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 673ms/step - loss: 1.9524 -
f1_score: 0.4542 - val_loss: 2.3539 - val_f1_score: 0.3846
Epoch 43/500
28/28 [==============================] - ETA: 0s - loss: 1.9335 - f1_score:
0.4676

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 659ms/step - loss: 1.9335 -
f1_score: 0.4676 - val_loss: 2.3286 - val_f1_score: 0.3885
Epoch 44/500
28/28 [==============================] - 4s 136ms/step - loss: 1.8438 -
f1_score: 0.5039 - val_loss: 2.4068 - val_f1_score: 0.3573
Epoch 45/500
28/28 [==============================] - 4s 143ms/step - loss: 1.8185 -
f1_score: 0.5113 - val_loss: 2.2914 - val_f1_score: 0.3724
Epoch 46/500
28/28 [==============================] - 4s 143ms/step - loss: 1.7359 -
f1_score: 0.5243 - val_loss: 2.3250 - val_f1_score: 0.3762
Epoch 47/500
28/28 [==============================] - 4s 141ms/step - loss: 1.7530 -
f1_score: 0.5286 - val_loss: 2.2511 - val_f1_score: 0.3714
Epoch 48/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.7393 - f1_score:
0.5311

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 20s 720ms/step - loss: 1.7393 -
f1_score: 0.5311 - val_loss: 2.1996 - val_f1_score: 0.4181
Epoch 49/500
28/28 [==============================] - 4s 136ms/step - loss: 1.6331 -
f1_score: 0.5701 - val_loss: 2.1552 - val_f1_score: 0.4145
Epoch 50/500
28/28 [==============================] - ETA: 0s - loss: 1.6100 - f1_score:
0.5884

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 654ms/step - loss: 1.6100 -
f1_score: 0.5884 - val_loss: 2.2036 - val_f1_score: 0.4195
Epoch 51/500
28/28 [==============================] - 4s 144ms/step - loss: 1.6157 -
f1_score: 0.5717 - val_loss: 2.2042 - val_f1_score: 0.3999
Epoch 52/500
28/28 [==============================] - ETA: 0s - loss: 1.5467 - f1_score:
0.5959

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 645ms/step - loss: 1.5467 -
f1_score: 0.5959 - val_loss: 2.1566 - val_f1_score: 0.4334
Epoch 53/500
28/28 [==============================] - 4s 136ms/step - loss: 1.6290 -
f1_score: 0.5718 - val_loss: 2.2421 - val_f1_score: 0.4102
Epoch 54/500
```

```
28/28 [==============================] - 4s 141ms/step - loss: 1.5496 -
f1_score: 0.5943 - val_loss: 2.1804 - val_f1_score: 0.4256
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 1.4647 - f1_score:
0.6246

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 20s 753ms/step - loss: 1.4647 -
f1_score: 0.6246 - val_loss: 2.1769 - val_f1_score: 0.4636
Epoch 56/500
28/28 [==============================] - 4s 136ms/step - loss: 1.4138 -
f1_score: 0.6447 - val_loss: 2.1404 - val_f1_score: 0.4613
Epoch 57/500
28/28 [==============================] - 4s 139ms/step - loss: 1.4153 -
f1_score: 0.6459 - val_loss: 2.0511 - val_f1_score: 0.4584
Epoch 58/500
28/28 [==============================] - 4s 141ms/step - loss: 1.7902 -
f1_score: 0.5526 - val_loss: 2.3224 - val_f1_score: 0.3790
Epoch 59/500
28/28 [==============================] - 4s 140ms/step - loss: 1.5315 -
f1_score: 0.5947 - val_loss: 2.0689 - val_f1_score: 0.4539
Epoch 60/500
28/28 [==============================] - ETA: 0s - loss: 1.3549 - f1_score:
0.6586

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 775ms/step - loss: 1.3549 -
f1_score: 0.6586 - val_loss: 2.0636 - val_f1_score: 0.4912
Epoch 61/500
28/28 [==============================] - 4s 140ms/step - loss: 1.2947 -
f1_score: 0.6882 - val_loss: 2.0478 - val_f1_score: 0.4677
Epoch 62/500
28/28 [==============================] - 4s 139ms/step - loss: 1.2485 -
f1_score: 0.7003 - val_loss: 1.9630 - val_f1_score: 0.4693
Epoch 63/500
28/28 [==============================] - 4s 140ms/step - loss: 1.2200 -
```

```
f1_score: 0.7055 - val_loss: 2.1012 - val_f1_score: 0.4843
Epoch 64/500
28/28 [==============================] - 4s 140ms/step - loss: 1.2213 -
f1_score: 0.7070 - val_loss: 2.1136 - val_f1_score: 0.4855
Epoch 65/500
28/28 [==============================] - 4s 144ms/step - loss: 1.2063 -
f1_score: 0.7075 - val_loss: 2.1299 - val_f1_score: 0.4823
Epoch 66/500
28/28 [==============================] - 4s 145ms/step - loss: 1.1782 -
f1_score: 0.7200 - val_loss: 2.2653 - val_f1_score: 0.4580
Epoch 67/500
28/28 [==============================] - 4s 162ms/step - loss: 1.1460 -
f1_score: 0.7221 - val_loss: 2.0670 - val_f1_score: 0.4883
Epoch 68/500
28/28 [==============================] - 4s 154ms/step - loss: 1.2006 -
f1_score: 0.7107 - val_loss: 2.0391 - val_f1_score: 0.4876
Epoch 69/500
28/28 [==============================] - ETA: 0s - loss: 1.1977 - f1_score:
0.7044

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 25s 933ms/step - loss: 1.1977 -
f1_score: 0.7044 - val_loss: 1.9992 - val_f1_score: 0.5256
Epoch 70/500
28/28 [==============================] - 4s 136ms/step - loss: 1.1392 -
f1_score: 0.7329 - val_loss: 2.1032 - val_f1_score: 0.4899
Epoch 71/500
28/28 [==============================] - 4s 138ms/step - loss: 1.0931 -
f1_score: 0.7500 - val_loss: 2.0236 - val_f1_score: 0.4978
Epoch 72/500
28/28 [==============================] - 4s 140ms/step - loss: 1.1082 -
f1_score: 0.7412 - val_loss: 2.1632 - val_f1_score: 0.5013
Epoch 73/500
28/28 [==============================] - 4s 146ms/step - loss: 1.0739 -
f1_score: 0.7568 - val_loss: 2.0647 - val_f1_score: 0.4722
Epoch 74/500
28/28 [==============================] - 4s 142ms/step - loss: 1.1024 -
f1_score: 0.7370 - val_loss: 1.9998 - val_f1_score: 0.4993
Epoch 75/500
28/28 [==============================] - 4s 144ms/step - loss: 1.1218 -
f1_score: 0.7315 - val_loss: 2.0432 - val_f1_score: 0.5188
Epoch 76/500
```

```
28/28 [==============================] - 4s 142ms/step - loss: 1.2325 -
f1_score: 0.7050 - val_loss: 2.2061 - val_f1_score: 0.4782
Epoch 77/500
28/28 [==============================] - 4s 143ms/step - loss: 1.1565 -
f1_score: 0.7066 - val_loss: 2.2286 - val_f1_score: 0.4591
Epoch 78/500
28/28 [==============================] - 4s 146ms/step - loss: 1.0638 -
f1_score: 0.7533 - val_loss: 1.9280 - val_f1_score: 0.5124
Epoch 79/500
28/28 [==============================] - 5s 164ms/step - loss: 1.0141 -
f1_score: 0.7683 - val_loss: 2.0411 - val_f1_score: 0.5251
Epoch 80/500
28/28 [==============================] - 5s 172ms/step - loss: 0.9695 -
f1_score: 0.7829 - val_loss: 2.3660 - val_f1_score: 0.4373
Epoch 81/500
28/28 [==============================] - 5s 168ms/step - loss: 1.0478 -
f1_score: 0.7598 - val_loss: 2.0926 - val_f1_score: 0.4890
Epoch 82/500
28/28 [==============================] - 5s 176ms/step - loss: 0.9054 -
f1_score: 0.8024 - val_loss: 2.0000 - val_f1_score: 0.4940
Epoch 83/500
28/28 [==============================] - 4s 148ms/step - loss: 0.8863 -
f1_score: 0.8116 - val_loss: 2.0714 - val_f1_score: 0.5103
Epoch 84/500
28/28 [==============================] - 4s 143ms/step - loss: 0.8646 -
f1_score: 0.8164 - val_loss: 2.1146 - val_f1_score: 0.5248
Epoch 85/500
28/28 [==============================] - 4s 145ms/step - loss: 0.8245 -
f1_score: 0.8296 - val_loss: 2.1734 - val_f1_score: 0.4934
Epoch 86/500
28/28 [==============================] - 4s 145ms/step - loss: 0.8776 -
f1_score: 0.8148 - val_loss: 2.1825 - val_f1_score: 0.4957
Epoch 87/500
28/28 [==============================] - 4s 144ms/step - loss: 0.8691 -
f1_score: 0.8218 - val_loss: 2.2693 - val_f1_score: 0.4745
Epoch 88/500
28/28 [==============================] - 4s 145ms/step - loss: 0.8606 -
f1_score: 0.8220 - val_loss: 2.3047 - val_f1_score: 0.4657
Epoch 89/500
28/28 [==============================] - 4s 144ms/step - loss: 1.0227 -
f1_score: 0.7661 - val_loss: 2.1960 - val_f1_score: 0.4784
Epoch 90/500
28/28 [==============================] - ETA: 0s - loss: 0.9687 - f1_score:
0.7823

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
```

```
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 755ms/step - loss: 0.9687 -
f1_score: 0.7823 - val_loss: 2.0529 - val_f1_score: 0.5656
Epoch 91/500
28/28 [==============================] - 4s 144ms/step - loss: 0.8253 -
f1_score: 0.8321 - val_loss: 2.0721 - val_f1_score: 0.5392
Epoch 92/500
28/28 [==============================] - 4s 147ms/step - loss: 0.8423 -
f1_score: 0.8266 - val_loss: 2.1663 - val_f1_score: 0.5020
Epoch 93/500
28/28 [==============================] - ETA: 0s - loss: 0.8534 - f1_score:
0.8198

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 17s 632ms/step - loss: 0.8534 -
f1_score: 0.8198 - val_loss: 2.0175 - val_f1_score: 0.5789
Epoch 94/500
28/28 [==============================] - 4s 136ms/step - loss: 0.7234 -
f1_score: 0.8640 - val_loss: 2.1634 - val_f1_score: 0.5455
Epoch 95/500
28/28 [==============================] - 4s 140ms/step - loss: 0.7600 -
f1_score: 0.8532 - val_loss: 2.1063 - val_f1_score: 0.5559
Epoch 96/500
28/28 [==============================] - 4s 141ms/step - loss: 0.8378 -
f1_score: 0.8245 - val_loss: 2.1775 - val_f1_score: 0.5348
Epoch 97/500
28/28 [==============================] - 4s 142ms/step - loss: 0.8490 -
f1_score: 0.8188 - val_loss: 2.0948 - val_f1_score: 0.5381
Epoch 98/500
28/28 [==============================] - 4s 145ms/step - loss: 0.7516 -
f1_score: 0.8626 - val_loss: 2.1511 - val_f1_score: 0.5147
Epoch 99/500
28/28 [==============================] - 4s 147ms/step - loss: 0.7057 -
f1_score: 0.8742 - val_loss: 2.1848 - val_f1_score: 0.5457
Epoch 100/500
28/28 [==============================] - 4s 145ms/step - loss: 0.6816 -
f1_score: 0.8816 - val_loss: 2.1370 - val_f1_score: 0.5263
Epoch 101/500
```

```
28/28 [==============================] - 4s 149ms/step - loss: 0.7274 -
f1_score: 0.8636 - val_loss: 2.1841 - val_f1_score: 0.5433
Epoch 102/500
28/28 [==============================] - 4s 145ms/step - loss: 0.6986 -
f1_score: 0.8677 - val_loss: 2.1662 - val_f1_score: 0.5524
Epoch 103/500
28/28 [==============================] - 4s 146ms/step - loss: 0.6489 -
f1_score: 0.8946 - val_loss: 2.1981 - val_f1_score: 0.5471
Epoch 104/500
28/28 [==============================] - 4s 150ms/step - loss: 0.5945 -
f1_score: 0.9079 - val_loss: 2.0642 - val_f1_score: 0.5572
Epoch 105/500
28/28 [==============================] - 4s 145ms/step - loss: 0.6230 -
f1_score: 0.8946 - val_loss: 2.2593 - val_f1_score: 0.5270
Epoch 106/500
28/28 [==============================] - 4s 155ms/step - loss: 0.7052 -
f1_score: 0.8672 - val_loss: 2.3023 - val_f1_score: 0.5302
Epoch 107/500
28/28 [==============================] - ETA: 0s - loss: 0.6650 - f1_score:
0.8776

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 716ms/step - loss: 0.6650 -
f1_score: 0.8776 - val_loss: 2.0790 - val_f1_score: 0.5833
Epoch 108/500
28/28 [==============================] - 4s 138ms/step - loss: 0.7095 -
f1_score: 0.8638 - val_loss: 2.0925 - val_f1_score: 0.5436
Epoch 109/500
28/28 [==============================] - 4s 141ms/step - loss: 0.6787 -
f1_score: 0.8745 - val_loss: 2.2065 - val_f1_score: 0.5307
Epoch 110/500
28/28 [==============================] - 4s 142ms/step - loss: 0.6765 -
f1_score: 0.8730 - val_loss: 2.1086 - val_f1_score: 0.5638
Epoch 111/500
28/28 [==============================] - 4s 142ms/step - loss: 0.5923 -
f1_score: 0.8998 - val_loss: 2.2153 - val_f1_score: 0.5347
Epoch 112/500
28/28 [==============================] - 4s 144ms/step - loss: 0.5736 -
f1_score: 0.9094 - val_loss: 2.2898 - val_f1_score: 0.5512
Epoch 113/500
28/28 [==============================] - 4s 143ms/step - loss: 0.6635 -
f1_score: 0.8865 - val_loss: 2.3402 - val_f1_score: 0.5542
```

```
Epoch 114/500
28/28 [==============================] - 4s 146ms/step - loss: 0.6071 -
f1_score: 0.8971 - val_loss: 2.2044 - val_f1_score: 0.5677
Epoch 115/500
28/28 [==============================] - 4s 143ms/step - loss: 0.6786 -
f1_score: 0.8778 - val_loss: 2.3240 - val_f1_score: 0.5086
Epoch 116/500
28/28 [==============================] - 4s 144ms/step - loss: 0.6552 -
f1_score: 0.8818 - val_loss: 2.1701 - val_f1_score: 0.5545
Epoch 117/500
28/28 [==============================] - 4s 147ms/step - loss: 0.5999 -
f1_score: 0.9003 - val_loss: 2.2026 - val_f1_score: 0.5610
Epoch 118/500
28/28 [==============================] - 4s 148ms/step - loss: 0.5930 -
f1_score: 0.8991 - val_loss: 2.1083 - val_f1_score: 0.5728
Epoch 119/500
28/28 [==============================] - ETA: 0s - loss: 0.5463 - f1_score:
0.9251

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 25s 905ms/step - loss: 0.5463 -
f1_score: 0.9251 - val_loss: 2.0750 - val_f1_score: 0.6146
Epoch 120/500
28/28 [==============================] - 4s 136ms/step - loss: 0.5066 -
f1_score: 0.9317 - val_loss: 2.1869 - val_f1_score: 0.5517
Epoch 121/500
28/28 [==============================] - 4s 138ms/step - loss: 0.5479 -
f1_score: 0.9169 - val_loss: 2.1802 - val_f1_score: 0.5865
Epoch 122/500
28/28 [==============================] - 4s 150ms/step - loss: 0.5323 -
f1_score: 0.9208 - val_loss: 2.3183 - val_f1_score: 0.5483
Epoch 123/500
28/28 [==============================] - 4s 155ms/step - loss: 0.5523 -
f1_score: 0.9152 - val_loss: 2.2344 - val_f1_score: 0.5599
Epoch 124/500
28/28 [==============================] - 4s 150ms/step - loss: 0.7473 -
f1_score: 0.8579 - val_loss: 2.2867 - val_f1_score: 0.5285
Epoch 125/500
28/28 [==============================] - 4s 161ms/step - loss: 0.8930 -
f1_score: 0.8098 - val_loss: 2.3785 - val_f1_score: 0.4863
Epoch 126/500
28/28 [==============================] - 4s 148ms/step - loss: 0.6467 -
```

```
f1_score: 0.8814 - val_loss: 2.2780 - val_f1_score: 0.5583
Epoch 127/500
28/28 [==============================] - 4s 153ms/step - loss: 0.5655 -
f1_score: 0.9142 - val_loss: 2.2547 - val_f1_score: 0.5823
Epoch 128/500
28/28 [==============================] - 4s 156ms/step - loss: 0.5651 -
f1_score: 0.9067 - val_loss: 2.2849 - val_f1_score: 0.5583
Epoch 129/500
28/28 [==============================] - 4s 155ms/step - loss: 0.5911 -
f1_score: 0.9039 - val_loss: 2.1603 - val_f1_score: 0.5634
Epoch 130/500
28/28 [==============================] - 4s 154ms/step - loss: 0.6308 -
f1_score: 0.8872 - val_loss: 2.2548 - val_f1_score: 0.5583
Epoch 131/500
28/28 [==============================] - 4s 152ms/step - loss: 0.5728 -
f1_score: 0.9135 - val_loss: 2.2814 - val_f1_score: 0.5407
Epoch 132/500
28/28 [==============================] - 4s 150ms/step - loss: 0.8618 -
f1_score: 0.8207 - val_loss: 2.3700 - val_f1_score: 0.5568
Epoch 133/500
28/28 [==============================] - 4s 146ms/step - loss: 0.5667 -
f1_score: 0.9097 - val_loss: 2.4353 - val_f1_score: 0.5466
Epoch 134/500
28/28 [==============================] - 4s 146ms/step - loss: 0.5889 -
f1_score: 0.9043 - val_loss: 2.1732 - val_f1_score: 0.5633
Epoch 135/500
28/28 [==============================] - 4s 148ms/step - loss: 0.5453 -
f1_score: 0.9092 - val_loss: 2.2592 - val_f1_score: 0.5671
Epoch 136/500
28/28 [==============================] - 4s 151ms/step - loss: 0.4808 -
f1_score: 0.9359 - val_loss: 2.2271 - val_f1_score: 0.5771
Epoch 137/500
28/28 [==============================] - 5s 166ms/step - loss: 0.4397 -
f1_score: 0.9568 - val_loss: 2.2822 - val_f1_score: 0.5878
Epoch 138/500
28/28 [==============================] - 5s 175ms/step - loss: 0.4301 -
f1_score: 0.9550 - val_loss: 2.2485 - val_f1_score: 0.5590
Epoch 139/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4285 -
f1_score: 0.9574 - val_loss: 2.2653 - val_f1_score: 0.5828
Epoch 140/500
28/28 [==============================] - 4s 151ms/step - loss: 0.4217 -
f1_score: 0.9581 - val_loss: 2.1894 - val_f1_score: 0.5798
Epoch 141/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4075 -
f1_score: 0.9606 - val_loss: 2.2005 - val_f1_score: 0.5934
Epoch 142/500
28/28 [==============================] - 5s 173ms/step - loss: 0.3857 -
```

```
f1_score: 0.9743 - val_loss: 2.3645 - val_f1_score: 0.5673
Epoch 143/500
28/28 [==============================] - 4s 155ms/step - loss: 0.3811 -
f1_score: 0.9717 - val_loss: 2.4197 - val_f1_score: 0.5563
Epoch 144/500
28/28 [==============================] - 4s 148ms/step - loss: 0.3703 -
f1_score: 0.9748 - val_loss: 2.3154 - val_f1_score: 0.5763
Epoch 145/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3774 -
f1_score: 0.9716 - val_loss: 2.3290 - val_f1_score: 0.5877
Epoch 146/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3879 -
f1_score: 0.9664 - val_loss: 2.5602 - val_f1_score: 0.5386
Epoch 147/500
28/28 [==============================] - 5s 170ms/step - loss: 0.4045 -
f1_score: 0.9581 - val_loss: 2.4662 - val_f1_score: 0.5833
Epoch 148/500
28/28 [==============================] - 4s 160ms/step - loss: 0.6665 -
f1_score: 0.8803 - val_loss: 2.4861 - val_f1_score: 0.5332
Epoch 149/500
28/28 [==============================] - 4s 152ms/step - loss: 0.7489 -
f1_score: 0.8528 - val_loss: 2.5347 - val_f1_score: 0.5470
Epoch 150/500
28/28 [==============================] - 4s 161ms/step - loss: 0.6365 -
f1_score: 0.8886 - val_loss: 2.7924 - val_f1_score: 0.4928
Epoch 151/500
28/28 [==============================] - 4s 152ms/step - loss: 0.5333 -
f1_score: 0.9157 - val_loss: 2.2947 - val_f1_score: 0.5636
Epoch 152/500
28/28 [==============================] - 4s 146ms/step - loss: 0.4757 -
f1_score: 0.9357 - val_loss: 2.4269 - val_f1_score: 0.5196
Epoch 153/500
28/28 [==============================] - 4s 154ms/step - loss: 0.5068 -
f1_score: 0.9296 - val_loss: 2.2404 - val_f1_score: 0.5839
Epoch 154/500
28/28 [==============================] - 4s 145ms/step - loss: 0.4202 -
f1_score: 0.9525 - val_loss: 2.3242 - val_f1_score: 0.5638
Epoch 155/500
28/28 [==============================] - 4s 145ms/step - loss: 0.4385 -
f1_score: 0.9529 - val_loss: 2.3364 - val_f1_score: 0.5681
Epoch 156/500
28/28 [==============================] - 4s 145ms/step - loss: 0.5799 -
f1_score: 0.9068 - val_loss: 2.2968 - val_f1_score: 0.5672
Epoch 157/500
28/28 [==============================] - 4s 145ms/step - loss: 0.4499 -
f1_score: 0.9466 - val_loss: 2.3688 - val_f1_score: 0.5631
Epoch 158/500
28/28 [==============================] - 4s 154ms/step - loss: 0.4859 -
```

```
f1_score: 0.9350 - val_loss: 2.4781 - val_f1_score: 0.5296
Epoch 159/500
28/28 [==============================] - 4s 147ms/step - loss: 0.4240 -
f1_score: 0.9551 - val_loss: 2.3250 - val_f1_score: 0.5729
Epoch 160/500
28/28 [==============================] - 4s 144ms/step - loss: 0.3722 -
f1_score: 0.9695 - val_loss: 2.3365 - val_f1_score: 0.5724
Epoch 161/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3568 -
f1_score: 0.9763 - val_loss: 2.4605 - val_f1_score: 0.5622
Epoch 162/500
28/28 [==============================] - 4s 149ms/step - loss: 0.3838 -
f1_score: 0.9651 - val_loss: 2.3689 - val_f1_score: 0.5807
Epoch 163/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3791 -
f1_score: 0.9690 - val_loss: 2.3536 - val_f1_score: 0.5895
Epoch 164/500
28/28 [==============================] - 4s 145ms/step - loss: 0.3867 -
f1_score: 0.9584 - val_loss: 2.4051 - val_f1_score: 0.5708
Epoch 165/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3619 -
f1_score: 0.9738 - val_loss: 2.4004 - val_f1_score: 0.5523
Epoch 166/500
28/28 [==============================] - ETA: 0s - loss: 0.3320 - f1_score:
0.9824

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

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28/28 [==============================] - 21s 780ms/step - loss: 0.3320 -
f1_score: 0.9824 - val_loss: 2.3042 - val_f1_score: 0.6166
Epoch 167/500
28/28 [==============================] - 4s 139ms/step - loss: 0.3385 -
f1_score: 0.9791 - val_loss: 2.4812 - val_f1_score: 0.5918
Epoch 168/500
28/28 [==============================] - 4s 142ms/step - loss: 0.3407 -
f1_score: 0.9758 - val_loss: 2.7535 - val_f1_score: 0.5456
Epoch 169/500
28/28 [==============================] - 4s 146ms/step - loss: 0.4635 -
f1_score: 0.9430 - val_loss: 2.5209 - val_f1_score: 0.5619
Epoch 170/500
28/28 [==============================] - 4s 148ms/step - loss: 0.6021 -
f1_score: 0.8906 - val_loss: 2.6002 - val_f1_score: 0.5277
Epoch 171/500
```

```
28/28 [==============================] - 4s 145ms/step - loss: 0.5679 -
f1_score: 0.9064 - val_loss: 2.3531 - val_f1_score: 0.5834
Epoch 172/500
28/28 [==============================] - 4s 148ms/step - loss: 0.9617 -
f1_score: 0.7937 - val_loss: 2.7458 - val_f1_score: 0.4834
Epoch 173/500
28/28 [==============================] - 4s 147ms/step - loss: 0.9780 -
f1_score: 0.7846 - val_loss: 2.3531 - val_f1_score: 0.5723
Epoch 174/500
28/28 [==============================] - 4s 149ms/step - loss: 0.5387 -
f1_score: 0.9155 - val_loss: 2.2484 - val_f1_score: 0.5802
Epoch 175/500
28/28 [==============================] - 4s 151ms/step - loss: 0.4209 -
f1_score: 0.9563 - val_loss: 2.2367 - val_f1_score: 0.5684
Epoch 176/500
28/28 [==============================] - ETA: 0s - loss: 0.3625 - f1_score:
0.9710

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 755ms/step - loss: 0.3625 -
f1_score: 0.9710 - val_loss: 2.1521 - val_f1_score: 0.6174
Epoch 177/500
28/28 [==============================] - 4s 137ms/step - loss: 0.3633 -
f1_score: 0.9707 - val_loss: 2.3850 - val_f1_score: 0.5907
Epoch 178/500
28/28 [==============================] - 4s 145ms/step - loss: 0.4191 -
f1_score: 0.9517 - val_loss: 2.1718 - val_f1_score: 0.6080
Epoch 179/500
28/28 [==============================] - 4s 144ms/step - loss: 0.4848 -
f1_score: 0.9402 - val_loss: 2.7028 - val_f1_score: 0.5423
Epoch 180/500
28/28 [==============================] - 4s 144ms/step - loss: 0.6517 -
f1_score: 0.8875 - val_loss: 2.2340 - val_f1_score: 0.6032
Epoch 181/500
28/28 [==============================] - 4s 145ms/step - loss: 0.4062 -
f1_score: 0.9598 - val_loss: 2.2480 - val_f1_score: 0.5794
Epoch 182/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3332 -
f1_score: 0.9823 - val_loss: 2.2541 - val_f1_score: 0.5727
Epoch 183/500
28/28 [==============================] - 4s 151ms/step - loss: 0.3194 -
f1_score: 0.9852 - val_loss: 2.3585 - val_f1_score: 0.6035
```

```
Epoch 184/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3083 -
f1_score: 0.9898 - val_loss: 2.2958 - val_f1_score: 0.6059
Epoch 185/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3057 -
f1_score: 0.9907 - val_loss: 2.3009 - val_f1_score: 0.6078
Epoch 186/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2973 -
f1_score: 0.9908 - val_loss: 2.3161 - val_f1_score: 0.6043
Epoch 187/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2981 -
f1_score: 0.9915 - val_loss: 2.3399 - val_f1_score: 0.5877
Epoch 188/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2882 -
f1_score: 0.9923 - val_loss: 2.3851 - val_f1_score: 0.5927
Epoch 189/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2843 -
f1_score: 0.9962 - val_loss: 2.4929 - val_f1_score: 0.5890
Epoch 190/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2841 -
f1_score: 0.9940 - val_loss: 2.4100 - val_f1_score: 0.5862
Epoch 191/500
28/28 [==============================] - 4s 157ms/step - loss: 0.2792 -
f1_score: 0.9942 - val_loss: 2.4096 - val_f1_score: 0.5966
Epoch 192/500
28/28 [==============================] - 4s 153ms/step - loss: 0.2777 -
f1_score: 0.9947 - val_loss: 2.3419 - val_f1_score: 0.6122
Epoch 193/500
28/28 [==============================] - ETA: 0s - loss: 0.3046 - f1_score:
0.9861

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 769ms/step - loss: 0.3046 -
f1_score: 0.9861 - val_loss: 2.4010 - val_f1_score: 0.6194
Epoch 194/500
28/28 [==============================] - 4s 137ms/step - loss: 0.2997 -
f1_score: 0.9880 - val_loss: 2.3699 - val_f1_score: 0.6164
Epoch 195/500
28/28 [==============================] - 4s 141ms/step - loss: 0.3281 -
f1_score: 0.9783 - val_loss: 2.4723 - val_f1_score: 0.5914
Epoch 196/500
28/28 [==============================] - 4s 148ms/step - loss: 0.3247 -
```

```
f1_score: 0.9771 - val_loss: 2.4530 - val_f1_score: 0.5886
Epoch 197/500
28/28 [==============================] - 4s 145ms/step - loss: 0.3658 -
f1_score: 0.9663 - val_loss: 2.5423 - val_f1_score: 0.5566
Epoch 198/500
28/28 [==============================] - 4s 144ms/step - loss: 0.3739 -
f1_score: 0.9640 - val_loss: 2.4381 - val_f1_score: 0.5957
Epoch 199/500
28/28 [==============================] - 4s 145ms/step - loss: 0.3510 -
f1_score: 0.9686 - val_loss: 2.4169 - val_f1_score: 0.5848
Epoch 200/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3485 -
f1_score: 0.9687 - val_loss: 2.4630 - val_f1_score: 0.5959
Epoch 201/500
28/28 [==============================] - 4s 150ms/step - loss: 0.3530 -
f1_score: 0.9674 - val_loss: 2.6169 - val_f1_score: 0.5452
Epoch 202/500
28/28 [==============================] - 4s 154ms/step - loss: 0.6215 -
f1_score: 0.8933 - val_loss: 3.1592 - val_f1_score: 0.4597
Epoch 203/500
28/28 [==============================] - 4s 151ms/step - loss: 0.8923 -
f1_score: 0.8175 - val_loss: 2.8102 - val_f1_score: 0.5029
Epoch 204/500
28/28 [==============================] - 4s 152ms/step - loss: 0.4892 -
f1_score: 0.9266 - val_loss: 2.3222 - val_f1_score: 0.5648
Epoch 205/500
28/28 [==============================] - 4s 149ms/step - loss: 0.3698 -
f1_score: 0.9626 - val_loss: 2.3591 - val_f1_score: 0.5968
Epoch 206/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3228 -
f1_score: 0.9796 - val_loss: 2.4423 - val_f1_score: 0.5867
Epoch 207/500
28/28 [==============================] - 5s 171ms/step - loss: 0.5278 -
f1_score: 0.9320 - val_loss: 2.5253 - val_f1_score: 0.5353
Epoch 208/500
28/28 [==============================] - 5s 175ms/step - loss: 0.5497 -
f1_score: 0.9091 - val_loss: 2.1415 - val_f1_score: 0.6117
Epoch 209/500
28/28 [==============================] - 5s 178ms/step - loss: 0.4033 -
f1_score: 0.9516 - val_loss: 2.3729 - val_f1_score: 0.6088
Epoch 210/500
28/28 [==============================] - 6s 199ms/step - loss: 0.3947 -
f1_score: 0.9548 - val_loss: 2.3845 - val_f1_score: 0.5905
Epoch 211/500
28/28 [==============================] - 5s 188ms/step - loss: 0.3276 -
f1_score: 0.9812 - val_loss: 2.3361 - val_f1_score: 0.5967
Epoch 212/500
28/28 [==============================] - 4s 157ms/step - loss: 0.3008 -
```

```
f1_score: 0.9858 - val_loss: 2.3372 - val_f1_score: 0.5832
Epoch 213/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2944 -
f1_score: 0.9853 - val_loss: 2.4016 - val_f1_score: 0.5851
Epoch 214/500
28/28 [==============================] - 4s 150ms/step - loss: 0.2744 -
f1_score: 0.9968 - val_loss: 2.4455 - val_f1_score: 0.5848
Epoch 215/500
28/28 [==============================] - 4s 159ms/step - loss: 0.2709 -
f1_score: 0.9954 - val_loss: 2.3942 - val_f1_score: 0.6050
Epoch 216/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2650 -
f1_score: 0.9981 - val_loss: 2.3701 - val_f1_score: 0.6085
Epoch 217/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2631 -
f1_score: 0.9946 - val_loss: 2.4224 - val_f1_score: 0.5830
Epoch 218/500
28/28 [==============================] - 4s 156ms/step - loss: 0.2575 -
f1_score: 0.9973 - val_loss: 2.4629 - val_f1_score: 0.6044
Epoch 219/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2571 -
f1_score: 0.9982 - val_loss: 2.4709 - val_f1_score: 0.6119
Epoch 220/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2538 -
f1_score: 0.9988 - val_loss: 2.4183 - val_f1_score: 0.6001
Epoch 221/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2525 -
f1_score: 0.9973 - val_loss: 2.4418 - val_f1_score: 0.5988
Epoch 222/500
28/28 [==============================] - 4s 150ms/step - loss: 0.2556 -
f1_score: 0.9936 - val_loss: 2.5091 - val_f1_score: 0.6062
Epoch 223/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2488 -
f1_score: 0.9985 - val_loss: 2.4496 - val_f1_score: 0.5974
Epoch 224/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2468 -
f1_score: 0.9993 - val_loss: 2.4586 - val_f1_score: 0.6019
Epoch 225/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2447 -
f1_score: 0.9988 - val_loss: 2.5062 - val_f1_score: 0.6024
Epoch 226/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2442 -
f1_score: 0.9989 - val_loss: 2.4756 - val_f1_score: 0.6043
Epoch 227/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2457 -
f1_score: 0.9977 - val_loss: 2.5303 - val_f1_score: 0.5933
Epoch 228/500
28/28 [==============================] - 4s 150ms/step - loss: 0.2400 -
```

```
f1_score: 0.9993 - val_loss: 2.6315 - val_f1_score: 0.5884
Epoch 229/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2402 -
f1_score: 0.9980 - val_loss: 2.6264 - val_f1_score: 0.5816
Epoch 230/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2388 -
f1_score: 0.9996 - val_loss: 2.5133 - val_f1_score: 0.6087
Epoch 231/500
28/28 [==============================] - 4s 152ms/step - loss: 0.2377 -
f1_score: 0.9988 - val_loss: 2.6037 - val_f1_score: 0.5988
Epoch 232/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2571 -
f1_score: 0.9919 - val_loss: 2.8003 - val_f1_score: 0.5570
Epoch 233/500
28/28 [==============================] - 4s 146ms/step - loss: 1.2091 -
f1_score: 0.7699 - val_loss: 2.6366 - val_f1_score: 0.5350
Epoch 234/500
28/28 [==============================] - 4s 147ms/step - loss: 0.8294 -
f1_score: 0.8264 - val_loss: 2.3296 - val_f1_score: 0.5290
Epoch 235/500
28/28 [==============================] - 4s 148ms/step - loss: 0.5797 -
f1_score: 0.8845 - val_loss: 2.0618 - val_f1_score: 0.6193
Epoch 236/500
28/28 [==============================] - 4s 150ms/step - loss: 0.4285 -
f1_score: 0.9431 - val_loss: 2.1817 - val_f1_score: 0.6002
Epoch 237/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4078 -
f1_score: 0.9530 - val_loss: 2.4681 - val_f1_score: 0.5590
Epoch 238/500
28/28 [==============================] - 5s 191ms/step - loss: 0.4420 -
f1_score: 0.9352 - val_loss: 2.4611 - val_f1_score: 0.5596
Epoch 239/500
28/28 [==============================] - 5s 185ms/step - loss: 0.4405 -
f1_score: 0.9422 - val_loss: 2.3792 - val_f1_score: 0.5835
Epoch 240/500
28/28 [==============================] - 5s 191ms/step - loss: 0.3242 -
f1_score: 0.9772 - val_loss: 2.2908 - val_f1_score: 0.6017
Epoch 241/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2940 -
f1_score: 0.9852 - val_loss: 2.5068 - val_f1_score: 0.5926
Epoch 242/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2772 -
f1_score: 0.9901 - val_loss: 2.3742 - val_f1_score: 0.5955
Epoch 243/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2571 -
f1_score: 0.9957 - val_loss: 2.4270 - val_f1_score: 0.6140
Epoch 244/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2506 -
```

```
f1_score: 0.9968 - val_loss: 2.4106 - val_f1_score: 0.5964
Epoch 245/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2480 -
f1_score: 0.9982 - val_loss: 2.4849 - val_f1_score: 0.6050
Epoch 246/500
28/28 [==============================] - ETA: 0s - loss: 0.2443 - f1_score:
0.9989

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 756ms/step - loss: 0.2443 -
f1_score: 0.9989 - val_loss: 2.4943 - val_f1_score: 0.6271
Epoch 247/500
28/28 [==============================] - ETA: 0s - loss: 0.2444 - f1_score:
0.9973

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 24s 883ms/step - loss: 0.2444 -
f1_score: 0.9973 - val_loss: 2.3883 - val_f1_score: 0.6297
Epoch 248/500
28/28 [==============================] - 4s 137ms/step - loss: 0.2438 -
f1_score: 0.9961 - val_loss: 2.4684 - val_f1_score: 0.6185
Epoch 249/500
28/28 [==============================] - 4s 138ms/step - loss: 0.2353 -
f1_score: 0.9984 - val_loss: 2.5066 - val_f1_score: 0.6166
Epoch 250/500
28/28 [==============================] - 4s 140ms/step - loss: 0.2359 -
f1_score: 0.9989 - val_loss: 2.4627 - val_f1_score: 0.6049
Epoch 251/500
28/28 [==============================] - 4s 141ms/step - loss: 0.2362 -
f1_score: 0.9985 - val_loss: 2.5274 - val_f1_score: 0.6044
Epoch 252/500
28/28 [==============================] - 4s 141ms/step - loss: 0.2337 -
f1_score: 0.9980 - val_loss: 2.5612 - val_f1_score: 0.6237
Epoch 253/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2350 -
f1_score: 0.9969 - val_loss: 2.5098 - val_f1_score: 0.6240
```

```
Epoch 254/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2324 -
f1_score: 0.9977 - val_loss: 2.5529 - val_f1_score: 0.6085
Epoch 255/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2327 -
f1_score: 0.9984 - val_loss: 2.4754 - val_f1_score: 0.6177
Epoch 256/500
28/28 [==============================] - 4s 143ms/step - loss: 0.2470 -
f1_score: 0.9939 - val_loss: 2.4839 - val_f1_score: 0.5972
Epoch 257/500
28/28 [==============================] - 4s 143ms/step - loss: 0.6726 -
f1_score: 0.8810 - val_loss: 2.9669 - val_f1_score: 0.5398
Epoch 258/500
28/28 [==============================] - 4s 146ms/step - loss: 0.8874 -
f1_score: 0.8197 - val_loss: 2.2733 - val_f1_score: 0.5727
Epoch 259/500
28/28 [==============================] - 4s 144ms/step - loss: 0.5960 -
f1_score: 0.8859 - val_loss: 2.3867 - val_f1_score: 0.5940
Epoch 260/500
28/28 [==============================] - 4s 145ms/step - loss: 0.3978 -
f1_score: 0.9475 - val_loss: 2.3420 - val_f1_score: 0.5667
Epoch 261/500
28/28 [==============================] - 4s 144ms/step - loss: 0.3366 -
f1_score: 0.9679 - val_loss: 2.2172 - val_f1_score: 0.6109
Epoch 262/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2859 -
f1_score: 0.9865 - val_loss: 2.4026 - val_f1_score: 0.5657
Epoch 263/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2599 -
f1_score: 0.9939 - val_loss: 2.3868 - val_f1_score: 0.6141
Epoch 264/500
28/28 [==============================] - ETA: 0s - loss: 0.2510 - f1_score:
0.9961

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 769ms/step - loss: 0.2510 -
f1_score: 0.9961 - val_loss: 2.3034 - val_f1_score: 0.6347
Epoch 265/500
28/28 [==============================] - 4s 137ms/step - loss: 0.2481 -
f1_score: 0.9958 - val_loss: 2.3669 - val_f1_score: 0.6304
Epoch 266/500
28/28 [==============================] - 4s 140ms/step - loss: 0.2373 -
```

```
f1_score: 0.9979 - val_loss: 2.4714 - val_f1_score: 0.6236
Epoch 267/500
28/28 [==============================] - ETA: 0s - loss: 0.2355 - f1_score:
0.9979

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 16s 605ms/step - loss: 0.2355 -
f1_score: 0.9979 - val_loss: 2.3928 - val_f1_score: 0.6386
Epoch 268/500
28/28 [==============================] - 4s 138ms/step - loss: 0.2302 -
f1_score: 0.9992 - val_loss: 2.4406 - val_f1_score: 0.6179
Epoch 269/500
28/28 [==============================] - 4s 141ms/step - loss: 0.2277 -
f1_score: 0.9993 - val_loss: 2.5004 - val_f1_score: 0.6275
Epoch 270/500
28/28 [==============================] - 4s 141ms/step - loss: 0.2293 -
f1_score: 0.9993 - val_loss: 2.4447 - val_f1_score: 0.6265
Epoch 271/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2268 -
f1_score: 0.9996 - val_loss: 2.4669 - val_f1_score: 0.6257
Epoch 272/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2238 -
f1_score: 0.9989 - val_loss: 2.5221 - val_f1_score: 0.6324
Epoch 273/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2227 -
f1_score: 0.9992 - val_loss: 2.5509 - val_f1_score: 0.6208
Epoch 274/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2213 -
f1_score: 0.9996 - val_loss: 2.5419 - val_f1_score: 0.6230
Epoch 275/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2212 -
f1_score: 0.9992 - val_loss: 2.4891 - val_f1_score: 0.6318
Epoch 276/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2207 -
f1_score: 0.9993 - val_loss: 2.5353 - val_f1_score: 0.6319
Epoch 277/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2193 -
f1_score: 0.9985 - val_loss: 2.4613 - val_f1_score: 0.6206
Epoch 278/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2190 -
f1_score: 0.9996 - val_loss: 2.5896 - val_f1_score: 0.6343
Epoch 279/500
```

```
28/28 [==============================] - 4s 151ms/step - loss: 0.2623 -
f1_score: 0.9844 - val_loss: 2.6467 - val_f1_score: 0.5649
Epoch 280/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3586 -
f1_score: 0.9564 - val_loss: 2.8373 - val_f1_score: 0.5402
Epoch 281/500
28/28 [==============================] - 4s 146ms/step - loss: 0.7312 -
f1_score: 0.8651 - val_loss: 2.6357 - val_f1_score: 0.5347
Epoch 282/500
28/28 [==============================] - 4s 146ms/step - loss: 0.7005 -
f1_score: 0.8567 - val_loss: 2.2535 - val_f1_score: 0.5547
Epoch 283/500
28/28 [==============================] - 4s 149ms/step - loss: 0.4713 -
f1_score: 0.9252 - val_loss: 2.2706 - val_f1_score: 0.5807
Epoch 284/500
28/28 [==============================] - 4s 154ms/step - loss: 0.3695 -
f1_score: 0.9514 - val_loss: 2.4010 - val_f1_score: 0.5654
Epoch 285/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3055 -
f1_score: 0.9749 - val_loss: 2.3093 - val_f1_score: 0.6138
Epoch 286/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2580 -
f1_score: 0.9899 - val_loss: 2.3262 - val_f1_score: 0.6238
Epoch 287/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2589 -
f1_score: 0.9916 - val_loss: 2.3626 - val_f1_score: 0.5952
Epoch 288/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2976 -
f1_score: 0.9764 - val_loss: 2.4238 - val_f1_score: 0.5962
Epoch 289/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2858 -
f1_score: 0.9786 - val_loss: 2.3732 - val_f1_score: 0.6116
Epoch 290/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3620 -
f1_score: 0.9578 - val_loss: 2.3042 - val_f1_score: 0.6206
Epoch 291/500
28/28 [==============================] - 4s 152ms/step - loss: 0.3833 -
f1_score: 0.9452 - val_loss: 2.6372 - val_f1_score: 0.5819
Epoch 292/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3218 -
f1_score: 0.9668 - val_loss: 2.3409 - val_f1_score: 0.6236
Epoch 293/500
28/28 [==============================] - ETA: 0s - loss: 0.2704 - f1_score:
0.9855

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
```

```
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 31s 1s/step - loss: 0.2704 - f1_score:
0.9855 - val_loss: 2.2947 - val_f1_score: 0.6507
Epoch 294/500
28/28 [==============================] - 4s 135ms/step - loss: 0.2451 -
f1_score: 0.9926 - val_loss: 2.4189 - val_f1_score: 0.6008
Epoch 295/500
28/28 [==============================] - 4s 139ms/step - loss: 0.2330 -
f1_score: 0.9966 - val_loss: 2.2817 - val_f1_score: 0.6266
Epoch 296/500
28/28 [==============================] - 4s 141ms/step - loss: 0.2354 -
f1_score: 0.9937 - val_loss: 2.2719 - val_f1_score: 0.6263
Epoch 297/500
28/28 [==============================] - 4s 143ms/step - loss: 0.2316 -
f1_score: 0.9973 - val_loss: 2.4403 - val_f1_score: 0.6193
Epoch 298/500
28/28 [==============================] - 4s 142ms/step - loss: 0.2206 -
f1_score: 0.9996 - val_loss: 2.3398 - val_f1_score: 0.6330
Epoch 299/500
28/28 [==============================] - 4s 152ms/step - loss: 0.2140 -
f1_score: 1.0000 - val_loss: 2.3304 - val_f1_score: 0.6385
Epoch 300/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2150 -
f1_score: 0.9990 - val_loss: 2.3886 - val_f1_score: 0.6347
Epoch 301/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2148 -
f1_score: 0.9990 - val_loss: 2.3484 - val_f1_score: 0.6403
Epoch 302/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2126 -
f1_score: 0.9985 - val_loss: 2.4356 - val_f1_score: 0.6389
Epoch 303/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2097 -
f1_score: 1.0000 - val_loss: 2.4509 - val_f1_score: 0.6185
Epoch 304/500
28/28 [==============================] - 4s 144ms/step - loss: 0.2090 -
f1_score: 0.9996 - val_loss: 2.4147 - val_f1_score: 0.6349
Epoch 305/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2068 -
f1_score: 1.0000 - val_loss: 2.4794 - val_f1_score: 0.6261
Epoch 306/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2074 -
f1_score: 0.9992 - val_loss: 2.4564 - val_f1_score: 0.6308
Epoch 307/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2048 -
```

```
f1_score: 0.9996 - val_loss: 2.4974 - val_f1_score: 0.6284
Epoch 308/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2042 -
f1_score: 0.9996 - val_loss: 2.4485 - val_f1_score: 0.6290
Epoch 309/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2053 -
f1_score: 0.9980 - val_loss: 2.5863 - val_f1_score: 0.6191
Epoch 310/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2032 -
f1_score: 0.9997 - val_loss: 2.5844 - val_f1_score: 0.6075
Epoch 311/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2021 -
f1_score: 0.9989 - val_loss: 2.5703 - val_f1_score: 0.6056
Epoch 312/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2007 -
f1_score: 0.9996 - val_loss: 2.5704 - val_f1_score: 0.6412
Epoch 313/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2002 -
f1_score: 0.9991 - val_loss: 2.4581 - val_f1_score: 0.6414
Epoch 314/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1990 -
f1_score: 0.9993 - val_loss: 2.5641 - val_f1_score: 0.6278
Epoch 315/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1983 -
f1_score: 1.0000 - val_loss: 2.6144 - val_f1_score: 0.6314
Epoch 316/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1983 -
f1_score: 0.9988 - val_loss: 2.5681 - val_f1_score: 0.6376
Epoch 317/500
28/28 [==============================] - ETA: 0s - loss: 0.1979 - f1_score:
0.9988

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 19s 712ms/step - loss: 0.1979 -
f1_score: 0.9988 - val_loss: 2.5253 - val_f1_score: 0.6523
Epoch 318/500
28/28 [==============================] - 4s 137ms/step - loss: 0.1956 -
f1_score: 1.0000 - val_loss: 2.5773 - val_f1_score: 0.6137
Epoch 319/500
28/28 [==============================] - 4s 141ms/step - loss: 0.1940 -
f1_score: 1.0000 - val_loss: 2.5535 - val_f1_score: 0.6366
Epoch 320/500
```

```
28/28 [==============================] - 4s 143ms/step - loss: 0.1932 -
f1_score: 0.9996 - val_loss: 2.5613 - val_f1_score: 0.6229
Epoch 321/500
28/28 [==============================] - 4s 143ms/step - loss: 0.1909 -
f1_score: 1.0000 - val_loss: 2.5944 - val_f1_score: 0.6369
Epoch 322/500
28/28 [==============================] - 4s 144ms/step - loss: 0.1928 -
f1_score: 0.9989 - val_loss: 2.6351 - val_f1_score: 0.6235
Epoch 323/500
28/28 [==============================] - 4s 143ms/step - loss: 0.1914 -
f1_score: 0.9996 - val_loss: 2.6633 - val_f1_score: 0.6170
Epoch 324/500
28/28 [==============================] - 4s 144ms/step - loss: 0.1912 -
f1_score: 0.9992 - val_loss: 2.5343 - val_f1_score: 0.6349
Epoch 325/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1907 -
f1_score: 0.9993 - val_loss: 2.7113 - val_f1_score: 0.6357
Epoch 326/500
28/28 [==============================] - 4s 147ms/step - loss: 0.8084 -
f1_score: 0.8968 - val_loss: 3.8326 - val_f1_score: 0.3751
Epoch 327/500
28/28 [==============================] - 4s 145ms/step - loss: 1.4354 -
f1_score: 0.6778 - val_loss: 2.2435 - val_f1_score: 0.5716
Epoch 328/500
28/28 [==============================] - 4s 145ms/step - loss: 0.9815 -
f1_score: 0.7845 - val_loss: 2.4784 - val_f1_score: 0.5018
Epoch 329/500
28/28 [==============================] - 4s 148ms/step - loss: 0.8632 -
f1_score: 0.8052 - val_loss: 1.9758 - val_f1_score: 0.5746
Epoch 330/500
28/28 [==============================] - 4s 159ms/step - loss: 0.4454 -
f1_score: 0.9253 - val_loss: 2.1356 - val_f1_score: 0.5929
Epoch 331/500
28/28 [==============================] - 4s 152ms/step - loss: 0.3077 -
f1_score: 0.9751 - val_loss: 2.2263 - val_f1_score: 0.5853
Epoch 332/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2685 -
f1_score: 0.9844 - val_loss: 2.1193 - val_f1_score: 0.6182
Epoch 333/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2622 -
f1_score: 0.9826 - val_loss: 2.2546 - val_f1_score: 0.6301
Epoch 334/500
28/28 [==============================] - 4s 148ms/step - loss: 0.3095 -
f1_score: 0.9695 - val_loss: 2.1978 - val_f1_score: 0.6212
Epoch 335/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3415 -
f1_score: 0.9572 - val_loss: 2.0771 - val_f1_score: 0.6089
Epoch 336/500
```

```
28/28 [==============================] - 4s 147ms/step - loss: 0.2600 -
f1_score: 0.9808 - val_loss: 2.2342 - val_f1_score: 0.6023
Epoch 337/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2415 -
f1_score: 0.9919 - val_loss: 2.1365 - val_f1_score: 0.6315
Epoch 338/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2161 -
f1_score: 0.9986 - val_loss: 2.1940 - val_f1_score: 0.6474
Epoch 339/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2116 -
f1_score: 0.9978 - val_loss: 2.1760 - val_f1_score: 0.6329
Epoch 340/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2068 -
f1_score: 0.9996 - val_loss: 2.2408 - val_f1_score: 0.6249
Epoch 341/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2048 -
f1_score: 0.9996 - val_loss: 2.2121 - val_f1_score: 0.6319
Epoch 342/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2060 -
f1_score: 0.9980 - val_loss: 2.1128 - val_f1_score: 0.6333
Epoch 343/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2033 -
f1_score: 0.9996 - val_loss: 2.2438 - val_f1_score: 0.6336
Epoch 344/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2009 -
f1_score: 0.9991 - val_loss: 2.2505 - val_f1_score: 0.6316
Epoch 345/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1986 -
f1_score: 0.9996 - val_loss: 2.2492 - val_f1_score: 0.6213
Epoch 346/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1969 -
f1_score: 0.9996 - val_loss: 2.2897 - val_f1_score: 0.6281
Epoch 347/500
28/28 [==============================] - 4s 150ms/step - loss: 0.1973 -
f1_score: 0.9996 - val_loss: 2.2667 - val_f1_score: 0.6277
Epoch 348/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1957 -
f1_score: 1.0000 - val_loss: 2.3412 - val_f1_score: 0.6308
Epoch 349/500
28/28 [==============================] - 4s 158ms/step - loss: 0.1943 -
f1_score: 0.9996 - val_loss: 2.3836 - val_f1_score: 0.6211
Epoch 350/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1934 -
f1_score: 0.9988 - val_loss: 2.3513 - val_f1_score: 0.6218
Epoch 351/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1956 -
f1_score: 0.9981 - val_loss: 2.4852 - val_f1_score: 0.5999
Epoch 352/500
```

```
28/28 [==============================] - 4s 148ms/step - loss: 0.3813 -
f1_score: 0.9472 - val_loss: 2.6088 - val_f1_score: 0.5972
Epoch 353/500
28/28 [==============================] - 4s 148ms/step - loss: 0.7655 -
f1_score: 0.8607 - val_loss: 2.4955 - val_f1_score: 0.5450
Epoch 354/500
28/28 [==============================] - 4s 148ms/step - loss: 0.7590 -
f1_score: 0.8400 - val_loss: 2.0197 - val_f1_score: 0.5845
Epoch 355/500
28/28 [==============================] - 4s 148ms/step - loss: 0.3878 -
f1_score: 0.9429 - val_loss: 2.2477 - val_f1_score: 0.5624
Epoch 356/500
28/28 [==============================] - 4s 147ms/step - loss: 0.3033 -
f1_score: 0.9702 - val_loss: 2.2735 - val_f1_score: 0.5878
Epoch 357/500
28/28 [==============================] - 4s 150ms/step - loss: 0.2522 -
f1_score: 0.9876 - val_loss: 2.1007 - val_f1_score: 0.6359
Epoch 358/500
28/28 [==============================] - 4s 149ms/step - loss: 0.2249 -
f1_score: 0.9939 - val_loss: 2.1799 - val_f1_score: 0.6191
Epoch 359/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2158 -
f1_score: 0.9973 - val_loss: 2.2597 - val_f1_score: 0.6011
Epoch 360/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2083 -
f1_score: 0.9982 - val_loss: 2.2430 - val_f1_score: 0.6283
Epoch 361/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2047 -
f1_score: 0.9986 - val_loss: 2.1654 - val_f1_score: 0.6254
Epoch 362/500
28/28 [==============================] - 4s 153ms/step - loss: 0.2009 -
f1_score: 0.9992 - val_loss: 2.2962 - val_f1_score: 0.6106
Epoch 363/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1977 -
f1_score: 0.9993 - val_loss: 2.3269 - val_f1_score: 0.6242
Epoch 364/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1958 -
f1_score: 0.9991 - val_loss: 2.3013 - val_f1_score: 0.6305
Epoch 365/500
28/28 [==============================] - 4s 160ms/step - loss: 0.1942 -
f1_score: 0.9996 - val_loss: 2.3146 - val_f1_score: 0.6323
Epoch 366/500
28/28 [==============================] - 4s 150ms/step - loss: 0.1926 -
f1_score: 0.9996 - val_loss: 2.3365 - val_f1_score: 0.6192
Epoch 367/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1915 -
f1_score: 1.0000 - val_loss: 2.3349 - val_f1_score: 0.6316
Epoch 368/500
```

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28/28 [==============================] - 4s 148ms/step - loss: 0.1909 -
f1_score: 0.9997 - val_loss: 2.5378 - val_f1_score: 0.6096
Epoch 369/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1920 -
f1_score: 0.9992 - val_loss: 2.4260 - val_f1_score: 0.6070
Epoch 370/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1889 -
f1_score: 1.0000 - val_loss: 2.3467 - val_f1_score: 0.6183
Epoch 371/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1880 -
f1_score: 0.9996 - val_loss: 2.3506 - val_f1_score: 0.6241
Epoch 372/500
28/28 [==============================] - 4s 155ms/step - loss: 0.1877 -
f1_score: 0.9992 - val_loss: 2.3834 - val_f1_score: 0.6172
Epoch 373/500
28/28 [==============================] - 4s 154ms/step - loss: 0.1863 -
f1_score: 0.9997 - val_loss: 2.4118 - val_f1_score: 0.6134
Epoch 374/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1834 -
f1_score: 1.0000 - val_loss: 2.4223 - val_f1_score: 0.6131
Epoch 375/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1834 -
f1_score: 1.0000 - val_loss: 2.4487 - val_f1_score: 0.5949
Epoch 376/500
28/28 [==============================] - 4s 150ms/step - loss: 0.1828 -
f1_score: 1.0000 - val_loss: 2.4144 - val_f1_score: 0.6201
Epoch 377/500
28/28 [==============================] - 4s 152ms/step - loss: 0.1835 -
f1_score: 0.9996 - val_loss: 2.5096 - val_f1_score: 0.6039
Epoch 378/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1802 -
f1_score: 1.0000 - val_loss: 2.5260 - val_f1_score: 0.6086
Epoch 379/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1805 -
f1_score: 1.0000 - val_loss: 2.5713 - val_f1_score: 0.6014
Epoch 380/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1794 -
f1_score: 1.0000 - val_loss: 2.4132 - val_f1_score: 0.6219
Epoch 381/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1789 -
f1_score: 1.0000 - val_loss: 2.4749 - val_f1_score: 0.6128
Epoch 382/500
28/28 [==============================] - 4s 154ms/step - loss: 0.1781 -
f1_score: 0.9997 - val_loss: 2.5192 - val_f1_score: 0.6236
Epoch 383/500
28/28 [==============================] - 4s 159ms/step - loss: 0.1763 -
f1_score: 1.0000 - val_loss: 2.5416 - val_f1_score: 0.6206
Epoch 384/500
```

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28/28 [==============================] - 4s 156ms/step - loss: 0.1771 -
f1_score: 0.9996 - val_loss: 2.5247 - val_f1_score: 0.6122
Epoch 385/500
28/28 [==============================] - 4s 152ms/step - loss: 0.1760 -
f1_score: 0.9992 - val_loss: 2.5388 - val_f1_score: 0.6034
Epoch 386/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1774 -
f1_score: 0.9989 - val_loss: 2.5716 - val_f1_score: 0.6059
Epoch 387/500
28/28 [==============================] - 4s 152ms/step - loss: 0.1872 -
f1_score: 0.9952 - val_loss: 2.6205 - val_f1_score: 0.5999
Epoch 388/500
28/28 [==============================] - 4s 149ms/step - loss: 0.3043 -
f1_score: 0.9644 - val_loss: 3.0797 - val_f1_score: 0.5405
Epoch 389/500
28/28 [==============================] - 4s 147ms/step - loss: 0.8959 -
f1_score: 0.8184 - val_loss: 3.0940 - val_f1_score: 0.4454
Epoch 390/500
28/28 [==============================] - 4s 148ms/step - loss: 0.6121 -
f1_score: 0.8806 - val_loss: 2.1966 - val_f1_score: 0.6011
Epoch 391/500
28/28 [==============================] - 4s 146ms/step - loss: 0.3122 -
f1_score: 0.9569 - val_loss: 2.1777 - val_f1_score: 0.5917
Epoch 392/500
28/28 [==============================] - 4s 156ms/step - loss: 0.3066 -
f1_score: 0.9621 - val_loss: 2.2422 - val_f1_score: 0.5772
Epoch 393/500
28/28 [==============================] - 4s 155ms/step - loss: 0.3219 -
f1_score: 0.9580 - val_loss: 2.4924 - val_f1_score: 0.5576
Epoch 394/500
28/28 [==============================] - 4s 155ms/step - loss: 0.2730 -
f1_score: 0.9744 - val_loss: 2.3130 - val_f1_score: 0.5890
Epoch 395/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2252 -
f1_score: 0.9880 - val_loss: 2.3929 - val_f1_score: 0.6018
Epoch 396/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2598 -
f1_score: 0.9779 - val_loss: 2.2911 - val_f1_score: 0.5802
Epoch 397/500
28/28 [==============================] - 4s 158ms/step - loss: 0.2276 -
f1_score: 0.9886 - val_loss: 2.3946 - val_f1_score: 0.6016
Epoch 398/500
28/28 [==============================] - 5s 176ms/step - loss: 0.2608 -
f1_score: 0.9766 - val_loss: 2.4670 - val_f1_score: 0.6015
Epoch 399/500
28/28 [==============================] - 4s 156ms/step - loss: 0.2263 -
f1_score: 0.9876 - val_loss: 2.3321 - val_f1_score: 0.6180
Epoch 400/500
```

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28/28 [==============================] - 4s 157ms/step - loss: 0.2268 -
f1_score: 0.9880 - val_loss: 2.3357 - val_f1_score: 0.6025
Epoch 401/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2099 -
f1_score: 0.9910 - val_loss: 2.3128 - val_f1_score: 0.6241
Epoch 402/500
28/28 [==============================] - 4s 154ms/step - loss: 0.2191 -
f1_score: 0.9911 - val_loss: 2.1859 - val_f1_score: 0.6353
Epoch 403/500
28/28 [==============================] - 4s 151ms/step - loss: 0.2212 -
f1_score: 0.9889 - val_loss: 2.2339 - val_f1_score: 0.6427
Epoch 404/500
28/28 [==============================] - 4s 150ms/step - loss: 0.4060 -
f1_score: 0.9384 - val_loss: 2.5000 - val_f1_score: 0.6022
Epoch 405/500
28/28 [==============================] - 4s 150ms/step - loss: 0.3144 -
f1_score: 0.9588 - val_loss: 2.2838 - val_f1_score: 0.6333
Epoch 406/500
28/28 [==============================] - 4s 151ms/step - loss: 0.7798 -
f1_score: 0.8519 - val_loss: 2.3964 - val_f1_score: 0.5571
Epoch 407/500
28/28 [==============================] - 4s 154ms/step - loss: 0.4404 -
f1_score: 0.9231 - val_loss: 2.3403 - val_f1_score: 0.5754
Epoch 408/500
28/28 [==============================] - 4s 149ms/step - loss: 0.3053 -
f1_score: 0.9626 - val_loss: 2.0943 - val_f1_score: 0.6217
Epoch 409/500
28/28 [==============================] - 4s 153ms/step - loss: 0.2365 -
f1_score: 0.9881 - val_loss: 2.2047 - val_f1_score: 0.6358
Epoch 410/500
28/28 [==============================] - 5s 163ms/step - loss: 0.2180 -
f1_score: 0.9907 - val_loss: 2.2551 - val_f1_score: 0.6289
Epoch 411/500
28/28 [==============================] - 4s 154ms/step - loss: 0.3577 -
f1_score: 0.9524 - val_loss: 2.4420 - val_f1_score: 0.6072
Epoch 412/500
28/28 [==============================] - 4s 156ms/step - loss: 0.2858 -
f1_score: 0.9705 - val_loss: 2.2962 - val_f1_score: 0.6243
Epoch 413/500
28/28 [==============================] - ETA: 0s - loss: 0.2320 - f1_score:
0.9852

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets
```

```
INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 21s 791ms/step - loss: 0.2320 -
f1_score: 0.9852 - val_loss: 2.1672 - val_f1_score: 0.6542
Epoch 414/500
28/28 [==============================] - ETA: 0s - loss: 0.2511 - f1_score:
0.9797

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 18s 644ms/step - loss: 0.2511 -
f1_score: 0.9797 - val_loss: 2.2175 - val_f1_score: 0.6693
Epoch 415/500
28/28 [==============================] - 4s 138ms/step - loss: 0.2006 -
f1_score: 0.9964 - val_loss: 2.1583 - val_f1_score: 0.6505
Epoch 416/500
28/28 [==============================] - 4s 142ms/step - loss: 0.1909 -
f1_score: 0.9982 - val_loss: 2.1805 - val_f1_score: 0.6457
Epoch 417/500
28/28 [==============================] - 4s 142ms/step - loss: 0.1878 -
f1_score: 0.9984 - val_loss: 2.1220 - val_f1_score: 0.6689
Epoch 418/500
28/28 [==============================] - 4s 142ms/step - loss: 0.1839 -
f1_score: 0.9992 - val_loss: 2.1859 - val_f1_score: 0.6507
Epoch 419/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1820 -
f1_score: 0.9996 - val_loss: 2.2050 - val_f1_score: 0.6609
Epoch 420/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1812 -
f1_score: 1.0000 - val_loss: 2.1872 - val_f1_score: 0.6502
Epoch 421/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1786 -
f1_score: 1.0000 - val_loss: 2.2030 - val_f1_score: 0.6667
Epoch 422/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1777 -
f1_score: 1.0000 - val_loss: 2.2005 - val_f1_score: 0.6646
Epoch 423/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1772 -
f1_score: 0.9997 - val_loss: 2.2537 - val_f1_score: 0.6516
Epoch 424/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1771 -
f1_score: 0.9980 - val_loss: 2.2832 - val_f1_score: 0.6490
Epoch 425/500
```

```
28/28 [==============================] - 4s 160ms/step - loss: 0.1754 -
f1_score: 1.0000 - val_loss: 2.2883 - val_f1_score: 0.6440
Epoch 426/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1745 -
f1_score: 0.9996 - val_loss: 2.2452 - val_f1_score: 0.6533
Epoch 427/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1743 -
f1_score: 1.0000 - val_loss: 2.2779 - val_f1_score: 0.6542
Epoch 428/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1734 -
f1_score: 1.0000 - val_loss: 2.3735 - val_f1_score: 0.6516
Epoch 429/500
28/28 [==============================] - 4s 157ms/step - loss: 0.1722 -
f1_score: 0.9996 - val_loss: 2.2908 - val_f1_score: 0.6544
Epoch 430/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1715 -
f1_score: 0.9997 - val_loss: 2.3187 - val_f1_score: 0.6547
Epoch 431/500
28/28 [==============================] - 4s 153ms/step - loss: 0.1692 -
f1_score: 1.0000 - val_loss: 2.3501 - val_f1_score: 0.6448
Epoch 432/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1696 -
f1_score: 1.0000 - val_loss: 2.3576 - val_f1_score: 0.6506
Epoch 433/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1685 -
f1_score: 1.0000 - val_loss: 2.3251 - val_f1_score: 0.6569
Epoch 434/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1678 -
f1_score: 1.0000 - val_loss: 2.3832 - val_f1_score: 0.6483
Epoch 435/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1666 -
f1_score: 1.0000 - val_loss: 2.3379 - val_f1_score: 0.6550
Epoch 436/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1670 -
f1_score: 0.9992 - val_loss: 2.3452 - val_f1_score: 0.6345
Epoch 437/500
28/28 [==============================] - 4s 153ms/step - loss: 0.1650 -
f1_score: 1.0000 - val_loss: 2.3544 - val_f1_score: 0.6455
Epoch 438/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1653 -
f1_score: 1.0000 - val_loss: 2.3642 - val_f1_score: 0.6557
Epoch 439/500
28/28 [==============================] - 4s 151ms/step - loss: 0.1643 -
f1_score: 1.0000 - val_loss: 2.3901 - val_f1_score: 0.6526
Epoch 440/500
28/28 [==============================] - 4s 158ms/step - loss: 0.1638 -
f1_score: 1.0000 - val_loss: 2.3897 - val_f1_score: 0.6530
Epoch 441/500
```

```
28/28 [==============================] - 4s 155ms/step - loss: 0.1629 -
f1_score: 1.0000 - val_loss: 2.3327 - val_f1_score: 0.6538
Epoch 442/500
28/28 [==============================] - 4s 155ms/step - loss: 0.1622 -
f1_score: 1.0000 - val_loss: 2.3962 - val_f1_score: 0.6370
Epoch 443/500
28/28 [==============================] - 4s 154ms/step - loss: 0.1624 -
f1_score: 0.9996 - val_loss: 2.4140 - val_f1_score: 0.6395
Epoch 444/500
28/28 [==============================] - 4s 150ms/step - loss: 0.1620 -
f1_score: 0.9995 - val_loss: 2.4335 - val_f1_score: 0.6450
Epoch 445/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1610 -
f1_score: 1.0000 - val_loss: 2.4862 - val_f1_score: 0.6395
Epoch 446/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1595 -
f1_score: 1.0000 - val_loss: 2.4986 - val_f1_score: 0.6396
Epoch 447/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1589 -
f1_score: 1.0000 - val_loss: 2.4937 - val_f1_score: 0.6369
Epoch 448/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1590 -
f1_score: 1.0000 - val_loss: 2.5083 - val_f1_score: 0.6342
Epoch 449/500
28/28 [==============================] - 4s 152ms/step - loss: 0.1575 -
f1_score: 1.0000 - val_loss: 2.4703 - val_f1_score: 0.6374
Epoch 450/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1583 -
f1_score: 0.9997 - val_loss: 2.4179 - val_f1_score: 0.6388
Epoch 451/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1573 -
f1_score: 1.0000 - val_loss: 2.7042 - val_f1_score: 0.6148
Epoch 452/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1578 -
f1_score: 0.9993 - val_loss: 2.5560 - val_f1_score: 0.6533
Epoch 453/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1572 -
f1_score: 1.0000 - val_loss: 2.6151 - val_f1_score: 0.6020
Epoch 454/500
28/28 [==============================] - 4s 158ms/step - loss: 1.2424 -
f1_score: 0.7662 - val_loss: 2.6340 - val_f1_score: 0.4815
Epoch 455/500
28/28 [==============================] - 5s 176ms/step - loss: 0.7544 -
f1_score: 0.8264 - val_loss: 2.0955 - val_f1_score: 0.5810
Epoch 456/500
28/28 [==============================] - 4s 149ms/step - loss: 0.3684 -
f1_score: 0.9394 - val_loss: 2.1764 - val_f1_score: 0.5947
Epoch 457/500
```

```
28/28 [==============================] - 4s 147ms/step - loss: 0.2657 -
f1_score: 0.9742 - val_loss: 2.0015 - val_f1_score: 0.6479
Epoch 458/500
28/28 [==============================] - 4s 153ms/step - loss: 0.2205 -
f1_score: 0.9879 - val_loss: 2.1499 - val_f1_score: 0.6347
Epoch 459/500
28/28 [==============================] - 4s 150ms/step - loss: 0.3386 -
f1_score: 0.9491 - val_loss: 2.2144 - val_f1_score: 0.5987
Epoch 460/500
28/28 [==============================] - 4s 148ms/step - loss: 0.2896 -
f1_score: 0.9645 - val_loss: 2.2043 - val_f1_score: 0.6154
Epoch 461/500
28/28 [==============================] - 4s 149ms/step - loss: 0.2517 -
f1_score: 0.9731 - val_loss: 2.4796 - val_f1_score: 0.5937
Epoch 462/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2328 -
f1_score: 0.9805 - val_loss: 2.2031 - val_f1_score: 0.6310
Epoch 463/500
28/28 [==============================] - 5s 173ms/step - loss: 0.2781 -
f1_score: 0.9670 - val_loss: 1.9423 - val_f1_score: 0.6334
Epoch 464/500
28/28 [==============================] - 4s 161ms/step - loss: 0.2298 -
f1_score: 0.9806 - val_loss: 1.9856 - val_f1_score: 0.6661
Epoch 465/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1964 -
f1_score: 0.9927 - val_loss: 1.9855 - val_f1_score: 0.6587
Epoch 466/500
28/28 [==============================] - 4s 151ms/step - loss: 0.1968 -
f1_score: 0.9915 - val_loss: 2.2391 - val_f1_score: 0.6502
Epoch 467/500
28/28 [==============================] - 4s 147ms/step - loss: 0.2363 -
f1_score: 0.9798 - val_loss: 2.6182 - val_f1_score: 0.5612
Epoch 468/500
28/28 [==============================] - 4s 145ms/step - loss: 0.2473 -
f1_score: 0.9753 - val_loss: 2.3555 - val_f1_score: 0.5960
Epoch 469/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2096 -
f1_score: 0.9890 - val_loss: 2.2104 - val_f1_score: 0.6467
Epoch 470/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1799 -
f1_score: 0.9972 - val_loss: 2.1143 - val_f1_score: 0.6533
Epoch 471/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1735 -
f1_score: 0.9980 - val_loss: 2.2053 - val_f1_score: 0.6604
Epoch 472/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1685 -
f1_score: 0.9988 - val_loss: 2.1248 - val_f1_score: 0.6672
Epoch 473/500
```

```
28/28 [==============================] - 4s 146ms/step - loss: 0.1688 -
f1_score: 0.9988 - val_loss: 2.1725 - val_f1_score: 0.6675
Epoch 474/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1650 -
f1_score: 0.9996 - val_loss: 2.2102 - val_f1_score: 0.6561
Epoch 475/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1626 -
f1_score: 1.0000 - val_loss: 2.2563 - val_f1_score: 0.6518
Epoch 476/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1611 -
f1_score: 0.9996 - val_loss: 2.2405 - val_f1_score: 0.6628
Epoch 477/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1607 -
f1_score: 1.0000 - val_loss: 2.2723 - val_f1_score: 0.6610
Epoch 478/500
28/28 [==============================] - 4s 147ms/step - loss: 0.1597 -
f1_score: 1.0000 - val_loss: 2.2852 - val_f1_score: 0.6621
Epoch 479/500
28/28 [==============================] - 5s 164ms/step - loss: 0.1590 -
f1_score: 0.9996 - val_loss: 2.3188 - val_f1_score: 0.6615
Epoch 480/500
28/28 [==============================] - 4s 158ms/step - loss: 0.1582 -
f1_score: 1.0000 - val_loss: 2.3796 - val_f1_score: 0.6451
Epoch 481/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1577 -
f1_score: 0.9996 - val_loss: 2.3310 - val_f1_score: 0.6685
Epoch 482/500
28/28 [==============================] - ETA: 0s - loss: 0.1561 - f1_score:
1.0000

WARNING:absl:Found untraced functions such as lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses, lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 LSTM/assets

INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [==============================] - 22s 827ms/step - loss: 0.1561 -
f1_score: 1.0000 - val_loss: 2.2822 - val_f1_score: 0.6815
Epoch 483/500
28/28 [==============================] - 4s 144ms/step - loss: 0.1554 -
f1_score: 1.0000 - val_loss: 2.3229 - val_f1_score: 0.6774
Epoch 484/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1552 -
f1_score: 1.0000 - val_loss: 2.3794 - val_f1_score: 0.6629
Epoch 485/500
28/28 [==============================] - 5s 163ms/step - loss: 0.1543 -
f1_score: 1.0000 - val_loss: 2.3746 - val_f1_score: 0.6650
```

```
Epoch 486/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1533 -
f1_score: 1.0000 - val_loss: 2.4071 - val_f1_score: 0.6512
Epoch 487/500
28/28 [==============================] - 4s 151ms/step - loss: 0.1532 -
f1_score: 0.9997 - val_loss: 2.3540 - val_f1_score: 0.6591
Epoch 488/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1517 -
f1_score: 1.0000 - val_loss: 2.4634 - val_f1_score: 0.6560
Epoch 489/500
28/28 [==============================] - 4s 153ms/step - loss: 0.1520 -
f1_score: 1.0000 - val_loss: 2.3927 - val_f1_score: 0.6648
Epoch 490/500
28/28 [==============================] - 4s 156ms/step - loss: 0.1508 -
f1_score: 1.0000 - val_loss: 2.4104 - val_f1_score: 0.6701
Epoch 491/500
28/28 [==============================] - 4s 148ms/step - loss: 0.1508 -
f1_score: 1.0000 - val_loss: 2.3828 - val_f1_score: 0.6514
Epoch 492/500
28/28 [==============================] - 4s 149ms/step - loss: 0.1507 -
f1_score: 0.9992 - val_loss: 2.4098 - val_f1_score: 0.6501
Epoch 493/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1493 -
f1_score: 1.0000 - val_loss: 2.4715 - val_f1_score: 0.6537
Epoch 494/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1486 -
f1_score: 1.0000 - val_loss: 2.4365 - val_f1_score: 0.6567
Epoch 495/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1479 -
f1_score: 1.0000 - val_loss: 2.4530 - val_f1_score: 0.6454
Epoch 496/500
28/28 [==============================] - 4s 145ms/step - loss: 0.1472 -
f1_score: 1.0000 - val_loss: 2.4459 - val_f1_score: 0.6448
Epoch 497/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1465 -
f1_score: 1.0000 - val_loss: 2.4219 - val_f1_score: 0.6561
Epoch 498/500
28/28 [==============================] - 4s 158ms/step - loss: 0.1459 -
f1_score: 1.0000 - val_loss: 2.5038 - val_f1_score: 0.6576
Epoch 499/500
28/28 [==============================] - 4s 153ms/step - loss: 0.1455 -
f1_score: 1.0000 - val_loss: 2.5033 - val_f1_score: 0.6591
Epoch 500/500
28/28 [==============================] - 4s 146ms/step - loss: 0.1445 -
f1_score: 1.0000 - val_loss: 2.5402 - val_f1_score: 0.6469
```

[140]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 23ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      1.000     0.800     0.889        10
         BEE      0.600     0.300     0.400        10
        BELT      0.800     1.000     0.889         4
        BITE      1.000     0.625     0.769         8
   BREAKFAST      0.500     1.000     0.667         6
      CANCER      1.000     0.875     0.933         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.200     0.167     0.182         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.625     0.769         8
     DEVELOP      0.667     0.333     0.444         6
      DINNER      0.833     0.625     0.714         8
         DOG      0.375     0.500     0.429         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.667     0.500     0.571         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.500     0.833     0.625         6
    ELEVATOR      0.300     0.375     0.333         8
        FINE      0.250     0.500     0.333         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.667     0.750     0.706         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.667     0.667     0.667         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.600     0.750     0.667         8
       LUNCH      0.714     0.625     0.667         8
       MAPLE      0.500     1.000     0.667         4
        MEAT      0.400     0.667     0.500         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.125     0.222         8
       MOVIE      0.368     0.875     0.519         8
        NOON      0.727     1.000     0.842         8
```

```
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.250     0.167     0.200         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.667     1.000     0.800         8
       SHAVE      0.778     0.700     0.737        10
        SINK      0.333     0.333     0.333         6
     SQUEEZE      0.667     0.500     0.571         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.333     0.125     0.182         8
     WHATFOR      1.000     0.400     0.571        10

    accuracy                          0.667       324
   macro avg      0.694     0.663     0.647       324
weighted avg      0.709     0.667     0.655       324
```

[141]:
```
reconstructed_model = tf.keras.models.load_model("2 LSTM")
```

[142]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm_2 (LSTM)               (None, 130, 150)          330000

 lstm_3 (LSTM)               (None, 175)               228200

 dropout_2 (Dropout)         (None, 175)               0

 dense_2 (Dense)             (None, 100)               17600

 dropout_3 (Dropout)         (None, 100)               0

 dense_3 (Dense)             (None, 50)                5050

=================================================================
Total params: 580,850
Trainable params: 580,850
Non-trainable params: 0
_________________________________________________________________
```

[143]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[143]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
LSTM
input:
(None, 130, 399)
output:
(None, 130, 150)
LSTM
input:
(None, 130, 150)
output:
(None, 175)
Dropout
input:
(None, 175)
output:
(None, 175)
Dense
input:
(None, 175)
output:
(None, 100)
Dropout
input:
(None, 100)
output:
(None, 100)
Dense
input:
(None, 100)
output:
(None, 50)

[144]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[144]:

LSTM
Dropout
Dense

[147]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '2 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[148]:
```
hist_df = pd.read_csv('2 LSTM/history.csv', index_col=0)
hist_df.tail()
```

[148]:

	loss	f1_score	val_loss	val_f1_score
495	0.147245	1.0	2.445876	0.644810
496	0.146496	1.0	2.421929	0.656080
497	0.145896	1.0	2.503781	0.657559
498	0.145472	1.0	2.503274	0.659128
499	0.144498	1.0	2.540223	0.646852

[149]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
```

```
plt.grid()
plt.show()
```

[150]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
```

```
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')

plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[151]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 24ms/step - loss: 2.2822 - f1_score:
0.6815
```

[151]: [2.282166004180908, 0.6814804077148438]

[152]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 2s 25ms/step - loss: 0.1515 - f1_score:
1.0000
```

[152]: [0.15145191550254822, 1.0]

[153]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 22ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      1.000     0.800     0.889        10
         BEE      0.600     0.300     0.400        10
        BELT      0.800     1.000     0.889         4
        BITE      1.000     0.750     0.857         8
   BREAKFAST      0.600     1.000     0.750         6
      CANCER      1.000     0.875     0.933         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.333     0.333     0.333         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.875     0.933         8
     DEVELOP      0.667     0.333     0.444         6
      DINNER      0.667     0.750     0.706         8
         DOG      0.429     0.500     0.462         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.667     0.500     0.571         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.556     0.833     0.667         6
    ELEVATOR      0.364     0.500     0.421         8
        FINE      0.333     0.500     0.400         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.667     0.750     0.706         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.667     0.667     0.667         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.600     0.750     0.667         8
       LUNCH      0.714     0.625     0.667         8
       MAPLE      0.500     1.000     0.667         4
        MEAT      0.444     0.667     0.533         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.375     0.750     0.500         8
        NOON      0.800     1.000     0.889         8
```

```
       PARTY      0.667     0.750     0.706         8
     PATIENT      0.750     0.500     0.600         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.778     0.700     0.737        10
        SINK      0.400     0.333     0.364         6
     SQUEEZE      0.667     0.500     0.571         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.750     0.375     0.500         8
     WHATFOR      1.000     0.500     0.667        10

    accuracy                          0.701       324
   macro avg      0.720     0.693     0.681       324
weighted avg      0.736     0.701     0.693       324
```

3.3 Hyperparameter Tuning 3 LSTM Layers

[119]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
↪Dropout, SpatialDropout1D, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'elu', 'gelu', 'relu'],
            default='relu')
        model = Sequential()

        model.add(
            LSTM(units=hp.Int('units_1',
                              min_value=50,
                              max_value=200,
                              step=25,
```

```
                            default=100),
            return_sequences=True,
            input_shape=self.input_shape,
            kernel_regularizer=regularizers.l2(
                hp.Float('regularizer_1',
                            min_value=1e-4,
                            max_value=1e-2,
                            sampling='LOG',
                            default=.001))))
    model.add(
        LSTM(units=hp.Int('units_2',
                            min_value=50,
                            max_value=200,
                            step=25,
                            default=100),
            return_sequences=True,
            kernel_regularizer=regularizers.l2(
                hp.Float('regularizer_2',
                            min_value=1e-4,
                            max_value=1e-2,
                            sampling='LOG',
                            default=.001))))
    model.add(
        LSTM(units=hp.Int('units_3',
                            min_value=50,
                            max_value=200,
                            step=25,
                            default=100),
            return_sequences=False,
            kernel_regularizer=regularizers.l2(
                hp.Float('regularizer_3',
                            min_value=1e-4,
                            max_value=1e-2,
                            sampling='LOG',
                            default=.001))))
    model.add(
        Dropout(rate=hp.Float(
            'dropout_1',
            min_value=0.0,
            max_value=0.9,
            default=0.65,
            step=0.05,
        )))
    model.add(
        Dense(units=hp.Int('units_4',
                             min_value=70,
                             max_value=120,
```

```
                                step=10,
                                default=80),
                    activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))

        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.0005)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

```
/tmp/ipykernel_973303/2620525644.py:5: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='3_LSTM',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/3_LSTM/tuner0.json
```

[63]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 11
dense_activation (Choice)
{'default': 'relu', 'conditions': [], 'values': ['selu', 'mish', 'elu', 'gelu',
'relu'], 'ordered': False}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_1 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
units_2 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_2 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
units_3 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer_3 (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_1 (Float)
{'default': 0.65, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_4 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0005, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
```

[64]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[66]:
```
tuner.search(Xtrain,
             Ytrain,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 19m 29s]
val_f1_score: 0.6328944563865662

Best val_f1_score So Far: 0.6784997582435608
Total elapsed time: 22h 03m 27s
INFO:tensorflow:Oracle triggered exit
```

[67]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/3_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0714 summary
Hyperparameters:
dense_activation: mish
units_1: 125
regularizer_1: 0.00041721832896797245
units_2: 150
regularizer_2: 0.00014354078230406593
units_3: 150
regularizer_3: 0.002948111895566179
dropout_1: 0.4
units_4: 110
dropout_2: 0.4
learning_rate: 0.0001715739875569636
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0713
Score: 0.6784997582435608

Trial 0598 summary
Hyperparameters:
dense_activation: selu
units_1: 125
regularizer_1: 0.0017686030901453863
units_2: 150
regularizer_2: 0.0013257717103432026
units_3: 175
regularizer_3: 0.00912470672476799
dropout_1: 0.25
units_4: 120
dropout_2: 0.65
learning_rate: 0.00043631081921577624
tuner/epochs: 300
```

```
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0596
Score: 0.6762926578521729

Trial 0715 summary
Hyperparameters:
dense_activation: gelu
units_1: 75
regularizer_1: 0.0009694863912919338
units_2: 75
regularizer_2: 0.0005154994394291512
units_3: 200
regularizer_3: 0.0014166611978687546
dropout_1: 0.30000000000000004
units_4: 90
dropout_2: 0.45
learning_rate: 0.0002931259064707384
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0704
Score: 0.6710077822208405

Trial 0720 summary
Hyperparameters:
dense_activation: gelu
units_1: 200
regularizer_1: 0.0003968708072022741
units_2: 175
regularizer_2: 0.0001600303932910222
units_3: 200
regularizer_3: 0.0002957564285137658
dropout_1: 0.0
units_4: 110
dropout_2: 0.55
learning_rate: 0.00016750881794514998
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6688259840011597

Trial 0716 summary
Hyperparameters:
dense_activation: gelu
```

```
units_1: 75
regularizer_1: 0.00012170633740470043
units_2: 150
regularizer_2: 0.0056759756812172725
units_3: 200
regularizer_3: 0.00027301414931251203
dropout_1: 0.5
units_4: 80
dropout_2: 0.2
learning_rate: 0.00030095252014948165
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0706
Score: 0.668326735496521

Trial 0426 summary
Hyperparameters:
dense_activation: selu
units_1: 175
regularizer_1: 0.0005570209504908154
units_2: 200
regularizer_2: 0.0065117874801730825
units_3: 100
regularizer_3: 0.0004160740903870983
dropout_1: 0.0
units_4: 110
dropout_2: 0.65
learning_rate: 0.00011631756169915276
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.6656661331653595

Trial 0700 summary
Hyperparameters:
dense_activation: mish
units_1: 75
regularizer_1: 0.0003859141034054157
units_2: 175
regularizer_2: 0.003974209356331356
units_3: 175
regularizer_3: 0.0005076349956733739
dropout_1: 0.35000000000000003
units_4: 90
```

```
dropout_2: 0.1
learning_rate: 0.0003515867073645459
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.6630437672138214

Trial 0702 summary
Hyperparameters:
dense_activation: mish
units_1: 75
regularizer_1: 0.00021724924420591846
units_2: 50
regularizer_2: 0.00010571888417990372
units_3: 200
regularizer_3: 0.008081412828616083
dropout_1: 0.6000000000000001
units_4: 70
dropout_2: 0.2
learning_rate: 0.00020700506618024812
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0696
Score: 0.6530894041061401

Trial 0670 summary
Hyperparameters:
dense_activation: selu
units_1: 175
regularizer_1: 0.0007794198053538327
units_2: 175
regularizer_2: 0.00011186478838654108
units_3: 175
regularizer_3: 0.00113598525299953
dropout_1: 0.45
units_4: 90
dropout_2: 0.45
learning_rate: 0.0002178223003598895
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.6460326313972473
```

```
Trial 0722 summary
Hyperparameters:
dense_activation: selu
units_1: 175
regularizer_1: 0.0032222302570378875
units_2: 175
regularizer_2: 0.0009054646342198436
units_3: 125
regularizer_3: 0.0010779986330274175
dropout_1: 0.35000000000000003
units_4: 100
dropout_2: 0.25
learning_rate: 0.00011654631348796121
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6450113952159882
```

[121]:
```
best_model = tuner.get_best_models(num_models=3)[0]
```

```
2023-09-07 15:54:24.327227: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-07 15:54:24.420271: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1739 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1

WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
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object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.20
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.21
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.22
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.23
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.24
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.25
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
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```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```

```
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```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.24
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.25
```

[122]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
 3/11 [=======>…] - ETA: 0s - loss: 1.4701 - f1_score:
0.4815

2023-09-07 15:54:31.994385: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [==============================] - 2s 27ms/step - loss: 1.9141 - f1_score:
0.7073
```

[123]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 2s 29ms/step - loss: 0.2002 - f1_score:
0.9977
```

[70]:
```
best_model.summary()
```

```
Model: "sequential"

_________________________________________________________________
 Layer (type)                Output Shape              Param #
```

```
=================================================================
 lstm (LSTM)                 (None, 130, 125)          262500

 lstm_1 (LSTM)               (None, 130, 150)          165600

 lstm_2 (LSTM)               (None, 150)               180600

 dropout (Dropout)           (None, 150)               0

 dense (Dense)               (None, 110)               16610

 dropout_1 (Dropout)         (None, 110)               0

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 630,860
Trainable params: 630,860
Non-trainable params: 0
_________________________________________________________________
```

[71]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[71]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
LSTM
input: (None, 130, 399)
output: (None, 130, 125)
LSTM
input: (None, 130, 125)
output: (None, 130, 150)
LSTM
input: (None, 130, 150)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 110)
Dropout
input: (None, 110)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[72]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 2s 25ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.500     0.400     0.444        10
        BELT      0.750     0.750     0.750         4
        BITE      1.000     0.750     0.857         8
   BREAKFAST      0.571     0.667     0.615         6
      CANCER      0.778     0.875     0.824         8
   CHRISTMAS      0.750     1.000     0.857         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.231     0.500     0.316         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.714     0.625     0.667         8
     DEVELOP      1.000     0.500     0.667         6
      DINNER      0.889     1.000     0.941         8
         DOG      0.600     0.500     0.545         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.250     0.500     0.333         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.333     0.500     0.400         8
        FINE      0.600     0.750     0.667         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.833     0.625     0.714         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.600     0.500     0.545         6
 HURDLE/TRIP      0.500     0.250     0.333         4
     JEWELRY      0.800     1.000     0.889         4
      KNIGHT      1.000     0.250     0.400         4
        LOCK      0.556     0.625     0.588         8
       LUNCH      0.714     0.625     0.667         8
       MAPLE      0.800     1.000     0.889         4
        MEAT      0.500     0.667     0.571         6
    MECHANIC      1.000     1.000     1.000         4
```

```
  MICROSCOPE      0.750     0.375     0.500         8
       MOVIE      0.615     1.000     0.762         8
        NOON      1.000     1.000     1.000         8
       PARTY      0.857     0.750     0.800         8
     PATIENT      0.667     0.667     0.667         6
       RAZOR      0.400     0.500     0.444         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.889     1.000     0.941         8
       SHAVE      1.000     0.400     0.571        10
        SINK      0.333     0.333     0.333         6
     SQUEEZE      0.500     0.250     0.333         4
        THEY      0.600     0.750     0.667         4
       TWINS      0.833     0.625     0.714         8
     WHATFOR      0.857     0.600     0.706        10

    accuracy                           0.719       324
   macro avg      0.746     0.713     0.707       324
weighted avg      0.759     0.719     0.718       324
```

[73]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[74]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='3 LSTM/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[75]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 4.8033 - f1_score:
0.0122

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 44s 1s/step - loss: 4.8033 - f1_score:
0.0122 - val_loss: 4.7499 - val_f1_score: 9.1803e-04
Epoch 2/500
28/28 [==============================] - ETA: 0s - loss: 4.7150 - f1_score:
0.0121

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 777ms/step - loss: 4.7150 -
f1_score: 0.0121 - val_loss: 4.6661 - val_f1_score: 0.0031
Epoch 3/500
28/28 [==============================] - 4s 153ms/step - loss: 4.6260 -
f1_score: 0.0188 - val_loss: 4.5829 - val_f1_score: 0.0028
Epoch 4/500
28/28 [==============================] - 4s 156ms/step - loss: 4.5383 -
f1_score: 0.0233 - val_loss: 4.4965 - val_f1_score: 0.0012
Epoch 5/500
28/28 [==============================] - ETA: 0s - loss: 4.4339 - f1_score:
0.0210

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 20s 728ms/step - loss: 4.4339 -
f1_score: 0.0210 - val_loss: 4.3412 - val_f1_score: 0.0063
Epoch 6/500
28/28 [==============================] - ETA: 0s - loss: 4.3325 - f1_score:
0.0278

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 820ms/step - loss: 4.3325 -
f1_score: 0.0278 - val_loss: 4.2351 - val_f1_score: 0.0129
Epoch 7/500
28/28 [==============================] - ETA: 0s - loss: 4.2229 - f1_score:
0.0339

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 19s 707ms/step - loss: 4.2229 -
f1_score: 0.0339 - val_loss: 4.1269 - val_f1_score: 0.0175
Epoch 8/500
28/28 [==============================] - ETA: 0s - loss: 4.1171 - f1_score:
0.0380

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 19s 710ms/step - loss: 4.1171 -
f1_score: 0.0380 - val_loss: 3.9679 - val_f1_score: 0.0390
Epoch 9/500
28/28 [==============================] - 4s 153ms/step - loss: 4.0017 -
f1_score: 0.0539 - val_loss: 3.8893 - val_f1_score: 0.0336
Epoch 10/500
28/28 [==============================] - 4s 154ms/step - loss: 3.8989 -
f1_score: 0.0631 - val_loss: 3.7204 - val_f1_score: 0.0324
Epoch 11/500
28/28 [==============================] - ETA: 0s - loss: 3.7821 - f1_score:
0.0709

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 803ms/step - loss: 3.7821 -
f1_score: 0.0709 - val_loss: 3.6665 - val_f1_score: 0.0445
Epoch 12/500
28/28 [==============================] - ETA: 0s - loss: 3.7093 - f1_score:
0.0730

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 796ms/step - loss: 3.7093 -
f1_score: 0.0730 - val_loss: 3.5537 - val_f1_score: 0.0520
Epoch 13/500
28/28 [==============================] - ETA: 0s - loss: 3.5803 - f1_score:
0.0897

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 768ms/step - loss: 3.5803 -
f1_score: 0.0897 - val_loss: 3.4474 - val_f1_score: 0.0582
Epoch 14/500
28/28 [==============================] - 4s 154ms/step - loss: 3.5217 -
f1_score: 0.0979 - val_loss: 3.3894 - val_f1_score: 0.0525
Epoch 15/500
28/28 [==============================] - ETA: 0s - loss: 3.4199 - f1_score:
0.1063

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets
```

```
28/28 [==============================] - 21s 759ms/step - loss: 3.4199 -
f1_score: 0.1063 - val_loss: 3.2893 - val_f1_score: 0.0948
Epoch 16/500
28/28 [==============================] - 4s 154ms/step - loss: 3.3599 -
f1_score: 0.1132 - val_loss: 3.2570 - val_f1_score: 0.0627
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 3.2681 - f1_score:
0.1342

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 860ms/step - loss: 3.2681 -
f1_score: 0.1342 - val_loss: 3.1968 - val_f1_score: 0.1062
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 3.2175 - f1_score:
0.1420

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 808ms/step - loss: 3.2175 -
f1_score: 0.1420 - val_loss: 3.1104 - val_f1_score: 0.1459
Epoch 19/500
28/28 [==============================] - 4s 156ms/step - loss: 3.1161 -
f1_score: 0.1615 - val_loss: 3.0359 - val_f1_score: 0.1136
Epoch 20/500
28/28 [==============================] - ETA: 0s - loss: 3.0783 - f1_score:
0.1684

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets
```

```
28/28 [==============================] - 38s 1s/step - loss: 3.0783 - f1_score:
0.1684 - val_loss: 2.9059 - val_f1_score: 0.1470
Epoch 21/500
28/28 [==============================] - ETA: 0s - loss: 3.0039 - f1_score:
0.1853

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 785ms/step - loss: 3.0039 -
f1_score: 0.1853 - val_loss: 2.9328 - val_f1_score: 0.1662
Epoch 22/500
28/28 [==============================] - 4s 159ms/step - loss: 2.9196 -
f1_score: 0.1911 - val_loss: 2.8570 - val_f1_score: 0.1632
Epoch 23/500
28/28 [==============================] - ETA: 0s - loss: 2.8764 - f1_score:
0.2072

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 20s 745ms/step - loss: 2.8764 -
f1_score: 0.2072 - val_loss: 2.9903 - val_f1_score: 0.1824
Epoch 24/500
28/28 [==============================] - ETA: 0s - loss: 2.8371 - f1_score:
0.2266

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 803ms/step - loss: 2.8371 -
f1_score: 0.2266 - val_loss: 2.7095 - val_f1_score: 0.2374
Epoch 25/500
```

```
28/28 [==============================] - 4s 155ms/step - loss: 2.7681 -
f1_score: 0.2481 - val_loss: 2.6803 - val_f1_score: 0.2329
Epoch 26/500
28/28 [==============================] - 4s 154ms/step - loss: 2.6983 -
f1_score: 0.2503 - val_loss: 2.6968 - val_f1_score: 0.2128
Epoch 27/500
28/28 [==============================] - 4s 155ms/step - loss: 2.6554 -
f1_score: 0.2696 - val_loss: 2.6242 - val_f1_score: 0.2123
Epoch 28/500
28/28 [==============================] - 4s 156ms/step - loss: 2.5619 -
f1_score: 0.2923 - val_loss: 2.5967 - val_f1_score: 0.2368
Epoch 29/500
28/28 [==============================] - ETA: 0s - loss: 2.5140 - f1_score:
0.2907

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 807ms/step - loss: 2.5140 -
f1_score: 0.2907 - val_loss: 2.5072 - val_f1_score: 0.2953
Epoch 30/500
28/28 [==============================] - 4s 156ms/step - loss: 2.4997 -
f1_score: 0.3142 - val_loss: 2.5517 - val_f1_score: 0.2487
Epoch 31/500
28/28 [==============================] - 4s 156ms/step - loss: 2.4380 -
f1_score: 0.3174 - val_loss: 2.3862 - val_f1_score: 0.2953
Epoch 32/500
28/28 [==============================] - 4s 157ms/step - loss: 2.3730 -
f1_score: 0.3297 - val_loss: 2.5882 - val_f1_score: 0.2319
Epoch 33/500
28/28 [==============================] - ETA: 0s - loss: 2.3449 - f1_score:
0.3433

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 810ms/step - loss: 2.3449 -
f1_score: 0.3433 - val_loss: 2.3521 - val_f1_score: 0.3077
```

```
Epoch 34/500
28/28 [==============================] - ETA: 0s - loss: 2.2664 - f1_score:
0.3672

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 776ms/step - loss: 2.2664 -
f1_score: 0.3672 - val_loss: 2.3122 - val_f1_score: 0.3355
Epoch 35/500
28/28 [==============================] - 4s 155ms/step - loss: 2.2649 -
f1_score: 0.3788 - val_loss: 2.3478 - val_f1_score: 0.3166
Epoch 36/500
28/28 [==============================] - ETA: 0s - loss: 2.2421 - f1_score:
0.3780

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 795ms/step - loss: 2.2421 -
f1_score: 0.3780 - val_loss: 2.2420 - val_f1_score: 0.3673
Epoch 37/500
28/28 [==============================] - ETA: 0s - loss: 2.1385 - f1_score:
0.4015

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 763ms/step - loss: 2.1385 -
f1_score: 0.4015 - val_loss: 2.2216 - val_f1_score: 0.3814
Epoch 38/500
28/28 [==============================] - 4s 155ms/step - loss: 2.1106 -
f1_score: 0.4225 - val_loss: 2.3722 - val_f1_score: 0.3089
```

```
Epoch 39/500
28/28 [==============================] - 4s 155ms/step - loss: 2.0798 -
f1_score: 0.4160 - val_loss: 2.3751 - val_f1_score: 0.3521
Epoch 40/500
28/28 [==============================] - 4s 156ms/step - loss: 2.0303 -
f1_score: 0.4385 - val_loss: 2.2451 - val_f1_score: 0.3421
Epoch 41/500
28/28 [==============================] - ETA: 0s - loss: 1.9825 - f1_score:
0.4436

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 800ms/step - loss: 1.9825 -
f1_score: 0.4436 - val_loss: 2.1283 - val_f1_score: 0.4136
Epoch 42/500
28/28 [==============================] - 4s 155ms/step - loss: 1.9429 -
f1_score: 0.4680 - val_loss: 2.1473 - val_f1_score: 0.3902
Epoch 43/500
28/28 [==============================] - 4s 159ms/step - loss: 1.8810 -
f1_score: 0.4773 - val_loss: 2.1852 - val_f1_score: 0.3789
Epoch 44/500
28/28 [==============================] - ETA: 0s - loss: 1.8625 - f1_score:
0.4923

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 820ms/step - loss: 1.8625 -
f1_score: 0.4923 - val_loss: 1.9987 - val_f1_score: 0.4640
Epoch 45/500
28/28 [==============================] - 4s 157ms/step - loss: 1.7994 -
f1_score: 0.5042 - val_loss: 2.0006 - val_f1_score: 0.4127
Epoch 46/500
28/28 [==============================] - 4s 158ms/step - loss: 1.7549 -
f1_score: 0.5234 - val_loss: 2.1759 - val_f1_score: 0.3980
Epoch 47/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.6959 - f1_score:
0.5426

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 835ms/step - loss: 1.6959 -
f1_score: 0.5426 - val_loss: 1.9454 - val_f1_score: 0.4845
Epoch 48/500
28/28 [==============================] - 4s 154ms/step - loss: 1.7276 -
f1_score: 0.5339 - val_loss: 1.9980 - val_f1_score: 0.4462
Epoch 49/500
28/28 [==============================] - 4s 156ms/step - loss: 1.6595 -
f1_score: 0.5473 - val_loss: 2.0059 - val_f1_score: 0.4636
Epoch 50/500
28/28 [==============================] - 4s 157ms/step - loss: 1.6107 -
f1_score: 0.5833 - val_loss: 1.9564 - val_f1_score: 0.4506
Epoch 51/500
28/28 [==============================] - 4s 158ms/step - loss: 1.5172 -
f1_score: 0.6028 - val_loss: 1.9269 - val_f1_score: 0.4753
Epoch 52/500
28/28 [==============================] - 4s 158ms/step - loss: 1.5110 -
f1_score: 0.6032 - val_loss: 1.9369 - val_f1_score: 0.4643
Epoch 53/500
28/28 [==============================] - 4s 160ms/step - loss: 1.4766 -
f1_score: 0.6056 - val_loss: 1.9628 - val_f1_score: 0.4697
Epoch 54/500
28/28 [==============================] - 4s 160ms/step - loss: 1.5963 -
f1_score: 0.5590 - val_loss: 1.9686 - val_f1_score: 0.4589
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 1.4428 - f1_score:
0.6197

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 806ms/step - loss: 1.4428 -
f1_score: 0.6197 - val_loss: 1.9889 - val_f1_score: 0.4997
```

```
Epoch 56/500
28/28 [==============================] - ETA: 0s - loss: 1.4786 - f1_score:
0.6225

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 24s 882ms/step - loss: 1.4786 -
f1_score: 0.6225 - val_loss: 1.8722 - val_f1_score: 0.5022
Epoch 57/500
28/28 [==============================] - ETA: 0s - loss: 1.4014 - f1_score:
0.6451

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 770ms/step - loss: 1.4014 -
f1_score: 0.6451 - val_loss: 1.9478 - val_f1_score: 0.5054
Epoch 58/500
28/28 [==============================] - ETA: 0s - loss: 1.4354 - f1_score:
0.6226

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 804ms/step - loss: 1.4354 -
f1_score: 0.6226 - val_loss: 1.8395 - val_f1_score: 0.5187
Epoch 59/500
28/28 [==============================] - ETA: 0s - loss: 1.4241 - f1_score:
0.6252

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
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lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 782ms/step - loss: 1.4241 -
f1_score: 0.6252 - val_loss: 1.9032 - val_f1_score: 0.5241
Epoch 60/500
28/28 [==============================] - 4s 155ms/step - loss: 1.4403 -
f1_score: 0.6302 - val_loss: 1.9941 - val_f1_score: 0.4805
Epoch 61/500
28/28 [==============================] - 4s 156ms/step - loss: 1.3899 -
f1_score: 0.6347 - val_loss: 1.9086 - val_f1_score: 0.4853
Epoch 62/500
28/28 [==============================] - ETA: 0s - loss: 1.3303 - f1_score:
0.6507

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 821ms/step - loss: 1.3303 -
f1_score: 0.6507 - val_loss: 1.7973 - val_f1_score: 0.5430
Epoch 63/500
28/28 [==============================] - ETA: 0s - loss: 1.2922 - f1_score:
0.6578

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 21s 765ms/step - loss: 1.2922 -
f1_score: 0.6578 - val_loss: 1.7876 - val_f1_score: 0.5442
Epoch 64/500
28/28 [==============================] - ETA: 0s - loss: 1.2659 - f1_score:
0.6763

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
```

```
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 19s 699ms/step - loss: 1.2659 -
f1_score: 0.6763 - val_loss: 1.7875 - val_f1_score: 0.5472
Epoch 65/500
28/28 [==============================] - 4s 155ms/step - loss: 1.1634 -
f1_score: 0.7131 - val_loss: 1.8011 - val_f1_score: 0.5301
Epoch 66/500
28/28 [==============================] - 4s 155ms/step - loss: 1.1886 -
f1_score: 0.7020 - val_loss: 1.8109 - val_f1_score: 0.5399
Epoch 67/500
28/28 [==============================] - ETA: 0s - loss: 1.2019 - f1_score:
0.7031

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 848ms/step - loss: 1.2019 -
f1_score: 0.7031 - val_loss: 1.8321 - val_f1_score: 0.5612
Epoch 68/500
28/28 [==============================] - 4s 154ms/step - loss: 1.1744 -
f1_score: 0.7193 - val_loss: 1.6972 - val_f1_score: 0.5547
Epoch 69/500
28/28 [==============================] - 4s 155ms/step - loss: 1.1705 -
f1_score: 0.7082 - val_loss: 1.8418 - val_f1_score: 0.5443
Epoch 70/500
28/28 [==============================] - 4s 157ms/step - loss: 1.1446 -
f1_score: 0.7135 - val_loss: 1.7954 - val_f1_score: 0.5481
Epoch 71/500
28/28 [==============================] - ETA: 0s - loss: 1.0858 - f1_score:
0.7342

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets
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INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 815ms/step - loss: 1.0858 -
f1_score: 0.7342 - val_loss: 1.7923 - val_f1_score: 0.5725
Epoch 72/500
28/28 [==============================] - 4s 155ms/step - loss: 1.1017 -
f1_score: 0.7317 - val_loss: 1.7907 - val_f1_score: 0.5684
Epoch 73/500
28/28 [==============================] - 4s 157ms/step - loss: 1.0555 -
f1_score: 0.7398 - val_loss: 1.8129 - val_f1_score: 0.5634
Epoch 74/500
28/28 [==============================] - 4s 158ms/step - loss: 0.9611 -
f1_score: 0.7767 - val_loss: 1.9067 - val_f1_score: 0.5307
Epoch 75/500
28/28 [==============================] - 4s 159ms/step - loss: 1.0273 -
f1_score: 0.7514 - val_loss: 1.7822 - val_f1_score: 0.5546
Epoch 76/500
28/28 [==============================] - ETA: 0s - loss: 1.0000 - f1_score:
0.7670

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 856ms/step - loss: 1.0000 -
f1_score: 0.7670 - val_loss: 1.8105 - val_f1_score: 0.6007
Epoch 77/500
28/28 [==============================] - 4s 157ms/step - loss: 0.9969 -
f1_score: 0.7648 - val_loss: 1.7794 - val_f1_score: 0.5742
Epoch 78/500
28/28 [==============================] - ETA: 0s - loss: 1.0375 - f1_score:
0.7473

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 22s 824ms/step - loss: 1.0375 -
f1_score: 0.7473 - val_loss: 1.7438 - val_f1_score: 0.6060
Epoch 79/500
```

```
28/28 [==============================] - 4s 155ms/step - loss: 0.9325 -
f1_score: 0.7890 - val_loss: 1.8969 - val_f1_score: 0.5616
Epoch 80/500
28/28 [==============================] - 4s 156ms/step - loss: 0.9624 -
f1_score: 0.7713 - val_loss: 1.8667 - val_f1_score: 0.5657
Epoch 81/500
28/28 [==============================] - 4s 157ms/step - loss: 0.9237 -
f1_score: 0.7871 - val_loss: 1.8094 - val_f1_score: 0.5786
Epoch 82/500
28/28 [==============================] - 4s 158ms/step - loss: 0.9195 -
f1_score: 0.7990 - val_loss: 1.9357 - val_f1_score: 0.5346
Epoch 83/500
28/28 [==============================] - ETA: 0s - loss: 0.8785 - f1_score:
0.8114

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 837ms/step - loss: 0.8785 -
f1_score: 0.8114 - val_loss: 1.7455 - val_f1_score: 0.6157
Epoch 84/500
28/28 [==============================] - 4s 155ms/step - loss: 0.9088 -
f1_score: 0.7904 - val_loss: 1.9218 - val_f1_score: 0.5736
Epoch 85/500
28/28 [==============================] - 4s 158ms/step - loss: 0.9510 -
f1_score: 0.7843 - val_loss: 2.0076 - val_f1_score: 0.5565
Epoch 86/500
28/28 [==============================] - 4s 159ms/step - loss: 0.9911 -
f1_score: 0.7699 - val_loss: 1.9928 - val_f1_score: 0.5412
Epoch 87/500
28/28 [==============================] - ETA: 0s - loss: 0.8932 - f1_score:
0.8089

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 832ms/step - loss: 0.8932 -
f1_score: 0.8089 - val_loss: 1.8076 - val_f1_score: 0.6311
```

```
Epoch 88/500
28/28 [==============================] - 4s 156ms/step - loss: 0.8490 -
f1_score: 0.8091 - val_loss: 1.7807 - val_f1_score: 0.6250
Epoch 89/500
28/28 [==============================] - 4s 157ms/step - loss: 0.8317 -
f1_score: 0.8182 - val_loss: 1.7720 - val_f1_score: 0.6308
Epoch 90/500
28/28 [==============================] - 4s 158ms/step - loss: 0.9335 -
f1_score: 0.7932 - val_loss: 1.9824 - val_f1_score: 0.5490
Epoch 91/500
28/28 [==============================] - ETA: 0s - loss: 0.8960 - f1_score:
0.7924

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 23s 843ms/step - loss: 0.8960 -
f1_score: 0.7924 - val_loss: 1.7980 - val_f1_score: 0.6459
Epoch 92/500
28/28 [==============================] - 4s 161ms/step - loss: 0.8233 -
f1_score: 0.8300 - val_loss: 1.6961 - val_f1_score: 0.6350
Epoch 93/500
28/28 [==============================] - 4s 160ms/step - loss: 0.7586 -
f1_score: 0.8402 - val_loss: 1.7669 - val_f1_score: 0.6392
Epoch 94/500
28/28 [==============================] - 4s 158ms/step - loss: 0.7027 -
f1_score: 0.8618 - val_loss: 1.7835 - val_f1_score: 0.6412
Epoch 95/500
28/28 [==============================] - 4s 160ms/step - loss: 0.7035 -
f1_score: 0.8659 - val_loss: 1.8868 - val_f1_score: 0.6268
Epoch 96/500
28/28 [==============================] - ETA: 0s - loss: 0.6870 - f1_score:
0.8679

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets
```

```
28/28 [==============================] - 23s 855ms/step - loss: 0.6870 -
f1_score: 0.8679 - val_loss: 1.8623 - val_f1_score: 0.6468
Epoch 97/500
28/28 [==============================] - 4s 155ms/step - loss: 0.7167 -
f1_score: 0.8578 - val_loss: 1.8345 - val_f1_score: 0.6199
Epoch 98/500
28/28 [==============================] - 4s 156ms/step - loss: 0.8511 -
f1_score: 0.8215 - val_loss: 1.8848 - val_f1_score: 0.6235
Epoch 99/500
28/28 [==============================] - 4s 158ms/step - loss: 0.7146 -
f1_score: 0.8539 - val_loss: 1.8909 - val_f1_score: 0.6360
Epoch 100/500
28/28 [==============================] - 4s 159ms/step - loss: 0.6938 -
f1_score: 0.8659 - val_loss: 1.9411 - val_f1_score: 0.5874
Epoch 101/500
28/28 [==============================] - 4s 160ms/step - loss: 0.7229 -
f1_score: 0.8591 - val_loss: 2.1420 - val_f1_score: 0.5350
Epoch 102/500
28/28 [==============================] - 4s 160ms/step - loss: 0.8118 -
f1_score: 0.8274 - val_loss: 2.0071 - val_f1_score: 0.5878
Epoch 103/500
28/28 [==============================] - 5s 161ms/step - loss: 0.6969 -
f1_score: 0.8650 - val_loss: 1.8264 - val_f1_score: 0.6242
Epoch 104/500
28/28 [==============================] - 5s 163ms/step - loss: 0.6896 -
f1_score: 0.8688 - val_loss: 1.8283 - val_f1_score: 0.6073
Epoch 105/500
28/28 [==============================] - ETA: 0s - loss: 0.7217 - f1_score:
0.8609

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 26s 975ms/step - loss: 0.7217 -
f1_score: 0.8609 - val_loss: 1.7532 - val_f1_score: 0.6604
Epoch 106/500
28/28 [==============================] - 4s 155ms/step - loss: 0.6720 -
f1_score: 0.8735 - val_loss: 1.8218 - val_f1_score: 0.6362
Epoch 107/500
28/28 [==============================] - 4s 158ms/step - loss: 0.7181 -
f1_score: 0.8688 - val_loss: 1.9216 - val_f1_score: 0.5899
Epoch 108/500
28/28 [==============================] - 4s 159ms/step - loss: 0.7416 -
```

```
f1_score: 0.8419 - val_loss: 2.4546 - val_f1_score: 0.5252
Epoch 109/500
28/28 [==============================] - 4s 160ms/step - loss: 1.2229 -
f1_score: 0.7406 - val_loss: 3.2135 - val_f1_score: 0.3260
Epoch 110/500
28/28 [==============================] - 4s 161ms/step - loss: 1.8929 -
f1_score: 0.5440 - val_loss: 1.9386 - val_f1_score: 0.5554
Epoch 111/500
28/28 [==============================] - 5s 162ms/step - loss: 0.9791 -
f1_score: 0.7728 - val_loss: 1.8440 - val_f1_score: 0.5974
Epoch 112/500
28/28 [==============================] - 5s 162ms/step - loss: 0.7509 -
f1_score: 0.8543 - val_loss: 1.7844 - val_f1_score: 0.6177
Epoch 113/500
28/28 [==============================] - 5s 165ms/step - loss: 0.6865 -
f1_score: 0.8668 - val_loss: 1.8360 - val_f1_score: 0.6242
Epoch 114/500
28/28 [==============================] - 5s 163ms/step - loss: 0.6003 -
f1_score: 0.8958 - val_loss: 1.8506 - val_f1_score: 0.6223
Epoch 115/500
28/28 [==============================] - 5s 164ms/step - loss: 0.6028 -
f1_score: 0.9005 - val_loss: 1.8199 - val_f1_score: 0.6232
Epoch 116/500
28/28 [==============================] - 5s 163ms/step - loss: 0.5889 -
f1_score: 0.9043 - val_loss: 2.0616 - val_f1_score: 0.5894
Epoch 117/500
28/28 [==============================] - 5s 164ms/step - loss: 0.6672 -
f1_score: 0.8765 - val_loss: 1.7311 - val_f1_score: 0.6551
Epoch 118/500
28/28 [==============================] - 5s 175ms/step - loss: 0.5676 -
f1_score: 0.9043 - val_loss: 1.9015 - val_f1_score: 0.6234
Epoch 119/500
28/28 [==============================] - 5s 171ms/step - loss: 0.5413 -
f1_score: 0.9141 - val_loss: 1.9700 - val_f1_score: 0.5715
Epoch 120/500
28/28 [==============================] - 5s 167ms/step - loss: 0.5208 -
f1_score: 0.9192 - val_loss: 1.8268 - val_f1_score: 0.6271
Epoch 121/500
28/28 [==============================] - 5s 170ms/step - loss: 0.5411 -
f1_score: 0.9094 - val_loss: 2.0992 - val_f1_score: 0.6070
Epoch 122/500
28/28 [==============================] - 5s 168ms/step - loss: 0.6302 -
f1_score: 0.8933 - val_loss: 1.9189 - val_f1_score: 0.6149
Epoch 123/500
28/28 [==============================] - 5s 169ms/step - loss: 0.5832 -
f1_score: 0.9073 - val_loss: 1.8859 - val_f1_score: 0.6514
Epoch 124/500
28/28 [==============================] - 5s 163ms/step - loss: 0.5882 -
```

```
f1_score: 0.8962 - val_loss: 1.8944 - val_f1_score: 0.6254
Epoch 125/500
28/28 [==============================] - 5s 163ms/step - loss: 0.5565 -
f1_score: 0.9168 - val_loss: 1.9106 - val_f1_score: 0.6303
Epoch 126/500
28/28 [==============================] - 5s 167ms/step - loss: 0.5174 -
f1_score: 0.9298 - val_loss: 1.8356 - val_f1_score: 0.6458
Epoch 127/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4747 -
f1_score: 0.9395 - val_loss: 1.9692 - val_f1_score: 0.6431
Epoch 128/500
28/28 [==============================] - 5s 170ms/step - loss: 0.4485 -
f1_score: 0.9479 - val_loss: 1.8701 - val_f1_score: 0.6433
Epoch 129/500
28/28 [==============================] - 5s 169ms/step - loss: 0.4449 -
f1_score: 0.9512 - val_loss: 2.1939 - val_f1_score: 0.5837
Epoch 130/500
28/28 [==============================] - 5s 164ms/step - loss: 0.4865 -
f1_score: 0.9324 - val_loss: 2.0633 - val_f1_score: 0.5991
Epoch 131/500
28/28 [==============================] - 5s 164ms/step - loss: 0.5069 -
f1_score: 0.9280 - val_loss: 2.1140 - val_f1_score: 0.5990
Epoch 132/500
28/28 [==============================] - 5s 164ms/step - loss: 0.5811 -
f1_score: 0.9019 - val_loss: 2.2075 - val_f1_score: 0.5678
Epoch 133/500
28/28 [==============================] - 5s 164ms/step - loss: 0.7012 -
f1_score: 0.8699 - val_loss: 2.0923 - val_f1_score: 0.5987
Epoch 134/500
28/28 [==============================] - 5s 165ms/step - loss: 0.5678 -
f1_score: 0.9057 - val_loss: 1.9002 - val_f1_score: 0.6550
Epoch 135/500
28/28 [==============================] - 5s 167ms/step - loss: 0.5496 -
f1_score: 0.9101 - val_loss: 2.2351 - val_f1_score: 0.5655
Epoch 136/500
28/28 [==============================] - 5s 166ms/step - loss: 0.7512 -
f1_score: 0.8553 - val_loss: 2.1056 - val_f1_score: 0.6083
Epoch 137/500
28/28 [==============================] - 5s 167ms/step - loss: 0.6806 -
f1_score: 0.8741 - val_loss: 1.8662 - val_f1_score: 0.6505
Epoch 138/500
28/28 [==============================] - 5s 164ms/step - loss: 0.7123 -
f1_score: 0.8668 - val_loss: 2.2921 - val_f1_score: 0.5852
Epoch 139/500
28/28 [==============================] - 5s 168ms/step - loss: 0.6757 -
f1_score: 0.8689 - val_loss: 1.9489 - val_f1_score: 0.6102
Epoch 140/500
28/28 [==============================] - 5s 168ms/step - loss: 0.5690 -
```

```
f1_score: 0.9106 - val_loss: 2.1300 - val_f1_score: 0.5710
Epoch 141/500
28/28 [==============================] - 5s 165ms/step - loss: 0.7928 -
f1_score: 0.8484 - val_loss: 1.9795 - val_f1_score: 0.6172
Epoch 142/500
28/28 [==============================] - 5s 165ms/step - loss: 0.5790 -
f1_score: 0.9054 - val_loss: 1.8344 - val_f1_score: 0.6442
Epoch 143/500
28/28 [==============================] - 5s 164ms/step - loss: 0.4886 -
f1_score: 0.9322 - val_loss: 1.8705 - val_f1_score: 0.6240
Epoch 144/500
28/28 [==============================] - ETA: 0s - loss: 0.4389 - f1_score:
0.9437

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 27s 991ms/step - loss: 0.4389 -
f1_score: 0.9437 - val_loss: 1.8110 - val_f1_score: 0.6755
Epoch 145/500
28/28 [==============================] - 4s 156ms/step - loss: 0.5214 -
f1_score: 0.9201 - val_loss: 2.0389 - val_f1_score: 0.6063
Epoch 146/500
28/28 [==============================] - 4s 158ms/step - loss: 0.5280 -
f1_score: 0.9205 - val_loss: 1.8372 - val_f1_score: 0.6552
Epoch 147/500
28/28 [==============================] - 5s 162ms/step - loss: 0.4336 -
f1_score: 0.9435 - val_loss: 2.0451 - val_f1_score: 0.6221
Epoch 148/500
28/28 [==============================] - 5s 163ms/step - loss: 0.4179 -
f1_score: 0.9557 - val_loss: 2.0004 - val_f1_score: 0.6374
Epoch 149/500
28/28 [==============================] - 5s 162ms/step - loss: 0.4014 -
f1_score: 0.9558 - val_loss: 1.8842 - val_f1_score: 0.6542
Epoch 150/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4381 -
f1_score: 0.9480 - val_loss: 1.9224 - val_f1_score: 0.6421
Epoch 151/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4568 -
f1_score: 0.9348 - val_loss: 2.0591 - val_f1_score: 0.6569
Epoch 152/500
28/28 [==============================] - 5s 173ms/step - loss: 0.3756 -
f1_score: 0.9673 - val_loss: 2.0540 - val_f1_score: 0.6398
```

```
Epoch 153/500
28/28 [==============================] - ETA: 0s - loss: 0.3515 - f1_score:
0.9740

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 28s 1s/step - loss: 0.3515 - f1_score:
0.9740 - val_loss: 1.9294 - val_f1_score: 0.6836
Epoch 154/500
28/28 [==============================] - 4s 159ms/step - loss: 0.3883 -
f1_score: 0.9606 - val_loss: 1.9356 - val_f1_score: 0.6795
Epoch 155/500
28/28 [==============================] - 4s 161ms/step - loss: 0.4015 -
f1_score: 0.9539 - val_loss: 2.0759 - val_f1_score: 0.6570
Epoch 156/500
28/28 [==============================] - 5s 162ms/step - loss: 0.3560 -
f1_score: 0.9716 - val_loss: 2.0461 - val_f1_score: 0.6658
Epoch 157/500
28/28 [==============================] - 4s 161ms/step - loss: 0.3491 -
f1_score: 0.9736 - val_loss: 1.9475 - val_f1_score: 0.6620
Epoch 158/500
28/28 [==============================] - 5s 162ms/step - loss: 0.3355 -
f1_score: 0.9787 - val_loss: 1.9985 - val_f1_score: 0.6602
Epoch 159/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3608 -
f1_score: 0.9669 - val_loss: 1.9909 - val_f1_score: 0.6476
Epoch 160/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3592 -
f1_score: 0.9684 - val_loss: 2.0831 - val_f1_score: 0.6406
Epoch 161/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3952 -
f1_score: 0.9579 - val_loss: 2.0730 - val_f1_score: 0.6087
Epoch 162/500
28/28 [==============================] - 5s 174ms/step - loss: 0.4787 -
f1_score: 0.9255 - val_loss: 2.4194 - val_f1_score: 0.5896
Epoch 163/500
28/28 [==============================] - 5s 173ms/step - loss: 0.8063 -
f1_score: 0.8574 - val_loss: 2.3063 - val_f1_score: 0.5831
Epoch 164/500
28/28 [==============================] - 5s 167ms/step - loss: 0.6588 -
f1_score: 0.8796 - val_loss: 2.0332 - val_f1_score: 0.6242
Epoch 165/500
```

```
28/28 [==============================] - 5s 163ms/step - loss: 0.5981 -
f1_score: 0.8992 - val_loss: 2.0123 - val_f1_score: 0.6141
Epoch 166/500
28/28 [==============================] - 5s 164ms/step - loss: 0.4469 -
f1_score: 0.9373 - val_loss: 2.1111 - val_f1_score: 0.6220
Epoch 167/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3995 -
f1_score: 0.9519 - val_loss: 1.9529 - val_f1_score: 0.6548
Epoch 168/500
28/28 [==============================] - 5s 164ms/step - loss: 0.3652 -
f1_score: 0.9681 - val_loss: 2.1013 - val_f1_score: 0.6401
Epoch 169/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4100 -
f1_score: 0.9524 - val_loss: 2.1597 - val_f1_score: 0.6294
Epoch 170/500
28/28 [==============================] - 5s 173ms/step - loss: 0.4573 -
f1_score: 0.9380 - val_loss: 2.0174 - val_f1_score: 0.6622
Epoch 171/500
28/28 [==============================] - 5s 166ms/step - loss: 0.6291 -
f1_score: 0.8915 - val_loss: 2.3940 - val_f1_score: 0.5517
Epoch 172/500
28/28 [==============================] - 5s 165ms/step - loss: 0.6680 -
f1_score: 0.8806 - val_loss: 2.2610 - val_f1_score: 0.5526
Epoch 173/500
28/28 [==============================] - 5s 164ms/step - loss: 0.6280 -
f1_score: 0.8848 - val_loss: 1.9872 - val_f1_score: 0.6291
Epoch 174/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4194 -
f1_score: 0.9442 - val_loss: 1.9608 - val_f1_score: 0.6422
Epoch 175/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3506 -
f1_score: 0.9714 - val_loss: 1.9900 - val_f1_score: 0.6517
Epoch 176/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3254 -
f1_score: 0.9772 - val_loss: 1.9312 - val_f1_score: 0.6818
Epoch 177/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3288 -
f1_score: 0.9802 - val_loss: 1.9499 - val_f1_score: 0.6665
Epoch 178/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3092 -
f1_score: 0.9854 - val_loss: 1.9788 - val_f1_score: 0.6486
Epoch 179/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3248 -
f1_score: 0.9766 - val_loss: 1.9891 - val_f1_score: 0.6597
Epoch 180/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3493 -
f1_score: 0.9664 - val_loss: 2.2706 - val_f1_score: 0.6141
Epoch 181/500
```

```
28/28 [==============================] - 5s 164ms/step - loss: 0.4492 -
f1_score: 0.9456 - val_loss: 2.1291 - val_f1_score: 0.6404
Epoch 182/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4688 -
f1_score: 0.9270 - val_loss: 2.0875 - val_f1_score: 0.6165
Epoch 183/500
28/28 [==============================] - 5s 166ms/step - loss: 0.6434 -
f1_score: 0.8876 - val_loss: 1.8884 - val_f1_score: 0.6533
Epoch 184/500
28/28 [==============================] - 5s 167ms/step - loss: 0.6600 -
f1_score: 0.8906 - val_loss: 2.5511 - val_f1_score: 0.5615
Epoch 185/500
28/28 [==============================] - 5s 164ms/step - loss: 0.5445 -
f1_score: 0.9131 - val_loss: 2.2080 - val_f1_score: 0.6097
Epoch 186/500
28/28 [==============================] - 5s 164ms/step - loss: 0.5051 -
f1_score: 0.9190 - val_loss: 2.1221 - val_f1_score: 0.6441
Epoch 187/500
28/28 [==============================] - 5s 170ms/step - loss: 0.4420 -
f1_score: 0.9385 - val_loss: 2.1254 - val_f1_score: 0.6337
Epoch 188/500
28/28 [==============================] - 5s 172ms/step - loss: 0.3716 -
f1_score: 0.9650 - val_loss: 1.9398 - val_f1_score: 0.6588
Epoch 189/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3901 -
f1_score: 0.9509 - val_loss: 2.0263 - val_f1_score: 0.6478
Epoch 190/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3919 -
f1_score: 0.9557 - val_loss: 2.3989 - val_f1_score: 0.5941
Epoch 191/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4067 -
f1_score: 0.9538 - val_loss: 2.2840 - val_f1_score: 0.6146
Epoch 192/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3965 -
f1_score: 0.9533 - val_loss: 2.0681 - val_f1_score: 0.6619
Epoch 193/500
28/28 [==============================] - 5s 167ms/step - loss: 0.8721 -
f1_score: 0.8666 - val_loss: 2.7960 - val_f1_score: 0.4894
Epoch 194/500
28/28 [==============================] - 5s 167ms/step - loss: 1.2600 -
f1_score: 0.7259 - val_loss: 2.2026 - val_f1_score: 0.5644
Epoch 195/500
28/28 [==============================] - 5s 166ms/step - loss: 0.6090 -
f1_score: 0.8836 - val_loss: 2.0263 - val_f1_score: 0.6289
Epoch 196/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4754 -
f1_score: 0.9291 - val_loss: 1.9589 - val_f1_score: 0.6311
Epoch 197/500
```

```
28/28 [==============================] - 5s 167ms/step - loss: 0.3608 -
f1_score: 0.9701 - val_loss: 2.0010 - val_f1_score: 0.6298
Epoch 198/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3371 -
f1_score: 0.9705 - val_loss: 1.9411 - val_f1_score: 0.6325
Epoch 199/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3064 -
f1_score: 0.9841 - val_loss: 2.0099 - val_f1_score: 0.6356
Epoch 200/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3291 -
f1_score: 0.9734 - val_loss: 2.2645 - val_f1_score: 0.6471
Epoch 201/500
28/28 [==============================] - 5s 164ms/step - loss: 0.3157 -
f1_score: 0.9799 - val_loss: 2.0241 - val_f1_score: 0.6490
Epoch 202/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3280 -
f1_score: 0.9748 - val_loss: 2.0335 - val_f1_score: 0.6662
Epoch 203/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3020 -
f1_score: 0.9843 - val_loss: 2.1482 - val_f1_score: 0.6235
Epoch 204/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2985 -
f1_score: 0.9847 - val_loss: 2.4267 - val_f1_score: 0.5920
Epoch 205/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4143 -
f1_score: 0.9523 - val_loss: 2.4446 - val_f1_score: 0.5906
Epoch 206/500
28/28 [==============================] - 5s 171ms/step - loss: 0.4955 -
f1_score: 0.9265 - val_loss: 2.1543 - val_f1_score: 0.6198
Epoch 207/500
28/28 [==============================] - 5s 169ms/step - loss: 0.4356 -
f1_score: 0.9360 - val_loss: 2.0636 - val_f1_score: 0.6339
Epoch 208/500
28/28 [==============================] - 5s 169ms/step - loss: 0.3485 -
f1_score: 0.9667 - val_loss: 2.2026 - val_f1_score: 0.6174
Epoch 209/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3082 -
f1_score: 0.9782 - val_loss: 2.2501 - val_f1_score: 0.6399
Epoch 210/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3035 -
f1_score: 0.9786 - val_loss: 2.2054 - val_f1_score: 0.6163
Epoch 211/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3029 -
f1_score: 0.9782 - val_loss: 2.2815 - val_f1_score: 0.6298
Epoch 212/500
28/28 [==============================] - 5s 167ms/step - loss: 0.4604 -
f1_score: 0.9334 - val_loss: 2.2034 - val_f1_score: 0.6238
Epoch 213/500
```

```
28/28 [==============================] - 5s 166ms/step - loss: 0.4245 -
f1_score: 0.9438 - val_loss: 2.1132 - val_f1_score: 0.6592
Epoch 214/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3942 -
f1_score: 0.9554 - val_loss: 2.0858 - val_f1_score: 0.6256
Epoch 215/500
28/28 [==============================] - 5s 172ms/step - loss: 0.3216 -
f1_score: 0.9718 - val_loss: 2.2541 - val_f1_score: 0.6376
Epoch 216/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2917 -
f1_score: 0.9838 - val_loss: 2.2092 - val_f1_score: 0.6421
Epoch 217/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2799 -
f1_score: 0.9868 - val_loss: 2.3149 - val_f1_score: 0.6291
Epoch 218/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2701 -
f1_score: 0.9896 - val_loss: 2.2097 - val_f1_score: 0.6441
Epoch 219/500
28/28 [==============================] - 5s 174ms/step - loss: 0.2704 -
f1_score: 0.9906 - val_loss: 2.3339 - val_f1_score: 0.6297
Epoch 220/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2531 -
f1_score: 0.9952 - val_loss: 2.3334 - val_f1_score: 0.6268
Epoch 221/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2523 -
f1_score: 0.9941 - val_loss: 2.3929 - val_f1_score: 0.6388
Epoch 222/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2497 -
f1_score: 0.9947 - val_loss: 2.3394 - val_f1_score: 0.6272
Epoch 223/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2488 -
f1_score: 0.9964 - val_loss: 2.3277 - val_f1_score: 0.6369
Epoch 224/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2460 -
f1_score: 0.9961 - val_loss: 2.2800 - val_f1_score: 0.6454
Epoch 225/500
28/28 [==============================] - 5s 171ms/step - loss: 0.2485 -
f1_score: 0.9952 - val_loss: 2.3710 - val_f1_score: 0.6440
Epoch 226/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2460 -
f1_score: 0.9953 - val_loss: 2.3544 - val_f1_score: 0.6501
Epoch 227/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2440 -
f1_score: 0.9946 - val_loss: 2.3700 - val_f1_score: 0.6540
Epoch 228/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2368 -
f1_score: 0.9980 - val_loss: 2.3634 - val_f1_score: 0.6661
Epoch 229/500
```

```
28/28 [==============================] - 5s 164ms/step - loss: 0.2402 -
f1_score: 0.9957 - val_loss: 2.3581 - val_f1_score: 0.6384
Epoch 230/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2361 -
f1_score: 0.9958 - val_loss: 2.3809 - val_f1_score: 0.6482
Epoch 231/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2517 -
f1_score: 0.9918 - val_loss: 2.4112 - val_f1_score: 0.6421
Epoch 232/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3428 -
f1_score: 0.9667 - val_loss: 2.4725 - val_f1_score: 0.6315
Epoch 233/500
28/28 [==============================] - 5s 166ms/step - loss: 0.4247 -
f1_score: 0.9406 - val_loss: 2.6856 - val_f1_score: 0.5787
Epoch 234/500
28/28 [==============================] - 5s 166ms/step - loss: 0.5665 -
f1_score: 0.9058 - val_loss: 2.5712 - val_f1_score: 0.5632
Epoch 235/500
28/28 [==============================] - 5s 168ms/step - loss: 0.6362 -
f1_score: 0.8857 - val_loss: 2.7033 - val_f1_score: 0.5736
Epoch 236/500
28/28 [==============================] - 5s 172ms/step - loss: 0.6623 -
f1_score: 0.8800 - val_loss: 2.3799 - val_f1_score: 0.5502
Epoch 237/500
28/28 [==============================] - 5s 176ms/step - loss: 0.5632 -
f1_score: 0.9004 - val_loss: 2.2995 - val_f1_score: 0.5842
Epoch 238/500
28/28 [==============================] - 5s 180ms/step - loss: 0.3709 -
f1_score: 0.9527 - val_loss: 2.3372 - val_f1_score: 0.5973
Epoch 239/500
28/28 [==============================] - 5s 173ms/step - loss: 0.3846 -
f1_score: 0.9535 - val_loss: 2.2208 - val_f1_score: 0.6190
Epoch 240/500
28/28 [==============================] - 5s 169ms/step - loss: 0.3532 -
f1_score: 0.9611 - val_loss: 2.2885 - val_f1_score: 0.6381
Epoch 241/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3421 -
f1_score: 0.9666 - val_loss: 2.2786 - val_f1_score: 0.6215
Epoch 242/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3250 -
f1_score: 0.9655 - val_loss: 2.0723 - val_f1_score: 0.6698
Epoch 243/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2774 -
f1_score: 0.9872 - val_loss: 2.1666 - val_f1_score: 0.6655
Epoch 244/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2511 -
f1_score: 0.9902 - val_loss: 2.1997 - val_f1_score: 0.6523
Epoch 245/500
```

```
28/28 [==============================] - 5s 169ms/step - loss: 0.2469 -
f1_score: 0.9953 - val_loss: 2.0832 - val_f1_score: 0.6547
Epoch 246/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2385 -
f1_score: 0.9953 - val_loss: 2.1263 - val_f1_score: 0.6684
Epoch 247/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2381 -
f1_score: 0.9943 - val_loss: 2.1839 - val_f1_score: 0.6335
Epoch 248/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2318 -
f1_score: 0.9961 - val_loss: 2.1607 - val_f1_score: 0.6589
Epoch 249/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2318 -
f1_score: 0.9967 - val_loss: 2.1751 - val_f1_score: 0.6586
Epoch 250/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2325 -
f1_score: 0.9959 - val_loss: 2.0832 - val_f1_score: 0.6641
Epoch 251/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2282 -
f1_score: 0.9973 - val_loss: 2.2409 - val_f1_score: 0.6523
Epoch 252/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2257 -
f1_score: 0.9988 - val_loss: 2.1901 - val_f1_score: 0.6640
Epoch 253/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2261 -
f1_score: 0.9973 - val_loss: 2.2377 - val_f1_score: 0.6571
Epoch 254/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2260 -
f1_score: 0.9960 - val_loss: 2.2442 - val_f1_score: 0.6753
Epoch 255/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2232 -
f1_score: 0.9958 - val_loss: 2.2142 - val_f1_score: 0.6486
Epoch 256/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2231 -
f1_score: 0.9973 - val_loss: 2.2314 - val_f1_score: 0.6631
Epoch 257/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2203 -
f1_score: 0.9968 - val_loss: 2.2939 - val_f1_score: 0.6390
Epoch 258/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2266 -
f1_score: 0.9946 - val_loss: 2.2410 - val_f1_score: 0.6487
Epoch 259/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2286 -
f1_score: 0.9961 - val_loss: 2.2072 - val_f1_score: 0.6704
Epoch 260/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2180 -
f1_score: 0.9975 - val_loss: 2.2665 - val_f1_score: 0.6542
Epoch 261/500
```

```
28/28 [==============================] - 5s 168ms/step - loss: 0.2223 -
f1_score: 0.9972 - val_loss: 2.2938 - val_f1_score: 0.6560
Epoch 262/500
28/28 [==============================] - 5s 167ms/step - loss: 0.5078 -
f1_score: 0.9341 - val_loss: 2.8410 - val_f1_score: 0.5412
Epoch 263/500
28/28 [==============================] - 5s 166ms/step - loss: 0.8827 -
f1_score: 0.8381 - val_loss: 2.3388 - val_f1_score: 0.5814
Epoch 264/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4787 -
f1_score: 0.9206 - val_loss: 2.4895 - val_f1_score: 0.5917
Epoch 265/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3739 -
f1_score: 0.9486 - val_loss: 2.3532 - val_f1_score: 0.5975
Epoch 266/500
28/28 [==============================] - 5s 170ms/step - loss: 0.4148 -
f1_score: 0.9407 - val_loss: 2.2463 - val_f1_score: 0.6272
Epoch 267/500
28/28 [==============================] - 5s 172ms/step - loss: 0.3495 -
f1_score: 0.9591 - val_loss: 2.5573 - val_f1_score: 0.5727
Epoch 268/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4278 -
f1_score: 0.9322 - val_loss: 2.1277 - val_f1_score: 0.6430
Epoch 269/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4323 -
f1_score: 0.9361 - val_loss: 2.3075 - val_f1_score: 0.6192
Epoch 270/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3315 -
f1_score: 0.9653 - val_loss: 2.5641 - val_f1_score: 0.5981
Epoch 271/500
28/28 [==============================] - 5s 171ms/step - loss: 0.3072 -
f1_score: 0.9714 - val_loss: 2.3677 - val_f1_score: 0.6107
Epoch 272/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2835 -
f1_score: 0.9766 - val_loss: 2.2463 - val_f1_score: 0.6379
Epoch 273/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3493 -
f1_score: 0.9656 - val_loss: 2.2188 - val_f1_score: 0.6427
Epoch 274/500
28/28 [==============================] - 5s 165ms/step - loss: 0.8850 -
f1_score: 0.8484 - val_loss: 2.4692 - val_f1_score: 0.5887
Epoch 275/500
28/28 [==============================] - 5s 166ms/step - loss: 0.6265 -
f1_score: 0.8765 - val_loss: 2.2506 - val_f1_score: 0.5945
Epoch 276/500
28/28 [==============================] - 5s 164ms/step - loss: 0.4674 -
f1_score: 0.9261 - val_loss: 2.2061 - val_f1_score: 0.6556
Epoch 277/500
```

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28/28 [==============================] - 5s 166ms/step - loss: 0.3915 -
f1_score: 0.9476 - val_loss: 2.2354 - val_f1_score: 0.6395
Epoch 278/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3243 -
f1_score: 0.9669 - val_loss: 2.1474 - val_f1_score: 0.6579
Epoch 279/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3072 -
f1_score: 0.9738 - val_loss: 2.0983 - val_f1_score: 0.6613
Epoch 280/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2656 -
f1_score: 0.9879 - val_loss: 2.2887 - val_f1_score: 0.6411
Epoch 281/500
28/28 [==============================] - 5s 169ms/step - loss: 0.3012 -
f1_score: 0.9713 - val_loss: 2.2876 - val_f1_score: 0.6450
Epoch 282/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2425 -
f1_score: 0.9924 - val_loss: 2.2118 - val_f1_score: 0.6587
Epoch 283/500
28/28 [==============================] - 5s 173ms/step - loss: 0.2332 -
f1_score: 0.9958 - val_loss: 2.2957 - val_f1_score: 0.6616
Epoch 284/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2263 -
f1_score: 0.9954 - val_loss: 2.2800 - val_f1_score: 0.6685
Epoch 285/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2223 -
f1_score: 0.9976 - val_loss: 2.2409 - val_f1_score: 0.6831
Epoch 286/500
28/28 [==============================] - 5s 174ms/step - loss: 0.2184 -
f1_score: 0.9965 - val_loss: 2.2661 - val_f1_score: 0.6647
Epoch 287/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2192 -
f1_score: 0.9968 - val_loss: 2.3200 - val_f1_score: 0.6712
Epoch 288/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2120 -
f1_score: 1.0000 - val_loss: 2.2606 - val_f1_score: 0.6775
Epoch 289/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2128 -
f1_score: 0.9987 - val_loss: 2.2892 - val_f1_score: 0.6718
Epoch 290/500
28/28 [==============================] - ETA: 0s - loss: 0.2123 - f1_score:
0.9979

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets
```

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INFO:tensorflow:Assets written to: 3 LSTM/assets
28/28 [==============================] - 24s 872ms/step - loss: 0.2123 -
f1_score: 0.9979 - val_loss: 2.2671 - val_f1_score: 0.6911
Epoch 291/500
28/28 [==============================] - 4s 158ms/step - loss: 0.2138 -
f1_score: 0.9960 - val_loss: 2.3029 - val_f1_score: 0.6823
Epoch 292/500
28/28 [==============================] - 4s 160ms/step - loss: 0.2109 -
f1_score: 0.9981 - val_loss: 2.2960 - val_f1_score: 0.6644
Epoch 293/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2090 -
f1_score: 0.9982 - val_loss: 2.2979 - val_f1_score: 0.6741
Epoch 294/500
28/28 [==============================] - 5s 163ms/step - loss: 0.2083 -
f1_score: 0.9980 - val_loss: 2.2651 - val_f1_score: 0.6765
Epoch 295/500
28/28 [==============================] - 5s 162ms/step - loss: 0.2049 -
f1_score: 0.9988 - val_loss: 2.3129 - val_f1_score: 0.6768
Epoch 296/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2876 -
f1_score: 0.9770 - val_loss: 2.9377 - val_f1_score: 0.5989
Epoch 297/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3456 -
f1_score: 0.9623 - val_loss: 2.7297 - val_f1_score: 0.5825
Epoch 298/500
28/28 [==============================] - 5s 165ms/step - loss: 0.5509 -
f1_score: 0.9161 - val_loss: 2.6392 - val_f1_score: 0.5789
Epoch 299/500
28/28 [==============================] - 5s 166ms/step - loss: 0.6747 -
f1_score: 0.8805 - val_loss: 2.4195 - val_f1_score: 0.6380
Epoch 300/500
28/28 [==============================] - 5s 164ms/step - loss: 0.4312 -
f1_score: 0.9303 - val_loss: 2.1228 - val_f1_score: 0.6463
Epoch 301/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4397 -
f1_score: 0.9366 - val_loss: 2.1403 - val_f1_score: 0.6561
Epoch 302/500
28/28 [==============================] - 5s 164ms/step - loss: 0.3987 -
f1_score: 0.9453 - val_loss: 2.4212 - val_f1_score: 0.5867
Epoch 303/500
28/28 [==============================] - 5s 165ms/step - loss: 0.7202 -
f1_score: 0.8683 - val_loss: 2.3558 - val_f1_score: 0.5651
Epoch 304/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3663 -
f1_score: 0.9518 - val_loss: 2.0511 - val_f1_score: 0.6237
Epoch 305/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3828 -
```

```
f1_score: 0.9486 - val_loss: 2.3015 - val_f1_score: 0.6365
Epoch 306/500
28/28 [==============================] - 5s 164ms/step - loss: 0.3519 -
f1_score: 0.9564 - val_loss: 2.2502 - val_f1_score: 0.6342
Epoch 307/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4660 -
f1_score: 0.9356 - val_loss: 2.2531 - val_f1_score: 0.6175
Epoch 308/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2883 -
f1_score: 0.9710 - val_loss: 2.1631 - val_f1_score: 0.6325
Epoch 309/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2421 -
f1_score: 0.9893 - val_loss: 2.2105 - val_f1_score: 0.6428
Epoch 310/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2223 -
f1_score: 0.9969 - val_loss: 2.1922 - val_f1_score: 0.6530
Epoch 311/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2156 -
f1_score: 0.9976 - val_loss: 2.2434 - val_f1_score: 0.6449
Epoch 312/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2165 -
f1_score: 0.9964 - val_loss: 2.2416 - val_f1_score: 0.6557
Epoch 313/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2115 -
f1_score: 0.9971 - val_loss: 2.1949 - val_f1_score: 0.6676
Epoch 314/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2087 -
f1_score: 0.9980 - val_loss: 2.1957 - val_f1_score: 0.6698
Epoch 315/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2082 -
f1_score: 0.9976 - val_loss: 2.2513 - val_f1_score: 0.6516
Epoch 316/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2043 -
f1_score: 0.9988 - val_loss: 2.2739 - val_f1_score: 0.6526
Epoch 317/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2044 -
f1_score: 0.9987 - val_loss: 2.2319 - val_f1_score: 0.6689
Epoch 318/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2033 -
f1_score: 0.9993 - val_loss: 2.2691 - val_f1_score: 0.6802
Epoch 319/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2009 -
f1_score: 0.9989 - val_loss: 2.2970 - val_f1_score: 0.6688
Epoch 320/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2013 -
f1_score: 0.9985 - val_loss: 2.2593 - val_f1_score: 0.6610
Epoch 321/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2037 -
```

```
f1_score: 0.9964 - val_loss: 2.2672 - val_f1_score: 0.6860
Epoch 322/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2094 -
f1_score: 0.9955 - val_loss: 2.3633 - val_f1_score: 0.6155
Epoch 323/500
28/28 [==============================] - 5s 173ms/step - loss: 0.2504 -
f1_score: 0.9823 - val_loss: 2.3486 - val_f1_score: 0.6307
Epoch 324/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2791 -
f1_score: 0.9768 - val_loss: 2.4793 - val_f1_score: 0.6351
Epoch 325/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3095 -
f1_score: 0.9731 - val_loss: 2.5012 - val_f1_score: 0.6085
Epoch 326/500
28/28 [==============================] - 5s 166ms/step - loss: 0.4291 -
f1_score: 0.9389 - val_loss: 2.3893 - val_f1_score: 0.6342
Epoch 327/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3589 -
f1_score: 0.9491 - val_loss: 2.4088 - val_f1_score: 0.6157
Epoch 328/500
28/28 [==============================] - 5s 166ms/step - loss: 0.4877 -
f1_score: 0.9211 - val_loss: 2.3564 - val_f1_score: 0.6197
Epoch 329/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3367 -
f1_score: 0.9602 - val_loss: 2.2485 - val_f1_score: 0.6205
Epoch 330/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2865 -
f1_score: 0.9780 - val_loss: 2.1515 - val_f1_score: 0.6523
Epoch 331/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2451 -
f1_score: 0.9882 - val_loss: 2.1666 - val_f1_score: 0.6795
Epoch 332/500
28/28 [==============================] - ETA: 0s - loss: 0.2357 - f1_score:
0.9867

WARNING:absl:Found untraced functions such as lstm_cell_3_layer_call_fn,
lstm_cell_3_layer_call_and_return_conditional_losses, lstm_cell_4_layer_call_fn,
lstm_cell_4_layer_call_and_return_conditional_losses, lstm_cell_5_layer_call_fn
while saving (showing 5 of 6). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 3 LSTM/assets

INFO:tensorflow:Assets written to: 3 LSTM/assets

28/28 [==============================] - 25s 920ms/step - loss: 0.2357 -
f1_score: 0.9867 - val_loss: 2.1101 - val_f1_score: 0.6933
Epoch 333/500
28/28 [==============================] - 4s 157ms/step - loss: 0.2317 -
f1_score: 0.9913 - val_loss: 2.4897 - val_f1_score: 0.6354
```

```
Epoch 334/500
28/28 [==============================] - 4s 160ms/step - loss: 0.3035 -
f1_score: 0.9698 - val_loss: 2.2064 - val_f1_score: 0.6748
Epoch 335/500
28/28 [==============================] - 5s 162ms/step - loss: 0.6428 -
f1_score: 0.8899 - val_loss: 2.5046 - val_f1_score: 0.6116
Epoch 336/500
28/28 [==============================] - 5s 162ms/step - loss: 0.4817 -
f1_score: 0.9191 - val_loss: 2.4185 - val_f1_score: 0.6166
Epoch 337/500
28/28 [==============================] - 5s 162ms/step - loss: 0.3938 -
f1_score: 0.9474 - val_loss: 2.1450 - val_f1_score: 0.6192
Epoch 338/500
28/28 [==============================] - 5s 163ms/step - loss: 0.3076 -
f1_score: 0.9655 - val_loss: 2.2900 - val_f1_score: 0.6487
Epoch 339/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2593 -
f1_score: 0.9806 - val_loss: 2.2586 - val_f1_score: 0.6258
Epoch 340/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2462 -
f1_score: 0.9849 - val_loss: 2.3653 - val_f1_score: 0.6379
Epoch 341/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2282 -
f1_score: 0.9888 - val_loss: 2.3357 - val_f1_score: 0.6510
Epoch 342/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2090 -
f1_score: 0.9953 - val_loss: 2.3377 - val_f1_score: 0.6427
Epoch 343/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2069 -
f1_score: 0.9973 - val_loss: 2.2888 - val_f1_score: 0.6739
Epoch 344/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2071 -
f1_score: 0.9956 - val_loss: 2.4465 - val_f1_score: 0.6337
Epoch 345/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2141 -
f1_score: 0.9953 - val_loss: 2.5075 - val_f1_score: 0.6326
Epoch 346/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1979 -
f1_score: 0.9988 - val_loss: 2.4533 - val_f1_score: 0.6331
Epoch 347/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1948 -
f1_score: 0.9988 - val_loss: 2.3692 - val_f1_score: 0.6671
Epoch 348/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1926 -
f1_score: 0.9989 - val_loss: 2.4181 - val_f1_score: 0.6642
Epoch 349/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1924 -
f1_score: 0.9993 - val_loss: 2.4299 - val_f1_score: 0.6702
```

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Epoch 350/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1911 -
f1_score: 0.9996 - val_loss: 2.4915 - val_f1_score: 0.6557
Epoch 351/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1908 -
f1_score: 0.9992 - val_loss: 2.4072 - val_f1_score: 0.6682
Epoch 352/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1895 -
f1_score: 0.9988 - val_loss: 2.4648 - val_f1_score: 0.6672
Epoch 353/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1889 -
f1_score: 0.9984 - val_loss: 2.4773 - val_f1_score: 0.6714
Epoch 354/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1889 -
f1_score: 0.9988 - val_loss: 2.4854 - val_f1_score: 0.6648
Epoch 355/500
28/28 [==============================] - 5s 173ms/step - loss: 0.1870 -
f1_score: 0.9992 - val_loss: 2.4962 - val_f1_score: 0.6627
Epoch 356/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1858 -
f1_score: 1.0000 - val_loss: 2.4748 - val_f1_score: 0.6734
Epoch 357/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1880 -
f1_score: 0.9983 - val_loss: 2.5086 - val_f1_score: 0.6695
Epoch 358/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1840 -
f1_score: 1.0000 - val_loss: 2.5107 - val_f1_score: 0.6758
Epoch 359/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1841 -
f1_score: 0.9996 - val_loss: 2.5005 - val_f1_score: 0.6712
Epoch 360/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1822 -
f1_score: 1.0000 - val_loss: 2.4773 - val_f1_score: 0.6779
Epoch 361/500
28/28 [==============================] - 5s 172ms/step - loss: 0.1837 -
f1_score: 0.9988 - val_loss: 2.4196 - val_f1_score: 0.6891
Epoch 362/500
28/28 [==============================] - 5s 174ms/step - loss: 0.1823 -
f1_score: 0.9997 - val_loss: 2.4484 - val_f1_score: 0.6857
Epoch 363/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1829 -
f1_score: 0.9987 - val_loss: 2.5430 - val_f1_score: 0.6702
Epoch 364/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1806 -
f1_score: 0.9996 - val_loss: 2.4817 - val_f1_score: 0.6692
Epoch 365/500
28/28 [==============================] - 5s 173ms/step - loss: 0.1811 -
f1_score: 0.9984 - val_loss: 2.5845 - val_f1_score: 0.6680
```

```
Epoch 366/500
28/28 [==============================] - 5s 178ms/step - loss: 0.1790 -
f1_score: 1.0000 - val_loss: 2.5243 - val_f1_score: 0.6795
Epoch 367/500
28/28 [==============================] - 5s 180ms/step - loss: 0.1797 -
f1_score: 0.9996 - val_loss: 2.5802 - val_f1_score: 0.6637
Epoch 368/500
28/28 [==============================] - 5s 175ms/step - loss: 0.1779 -
f1_score: 0.9996 - val_loss: 2.5444 - val_f1_score: 0.6714
Epoch 369/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1775 -
f1_score: 0.9996 - val_loss: 2.6001 - val_f1_score: 0.6621
Epoch 370/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1766 -
f1_score: 0.9996 - val_loss: 2.5316 - val_f1_score: 0.6865
Epoch 371/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1762 -
f1_score: 0.9995 - val_loss: 2.5881 - val_f1_score: 0.6742
Epoch 372/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1748 -
f1_score: 0.9992 - val_loss: 2.6722 - val_f1_score: 0.6620
Epoch 373/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1732 -
f1_score: 1.0000 - val_loss: 2.6367 - val_f1_score: 0.6617
Epoch 374/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1754 -
f1_score: 0.9991 - val_loss: 2.6074 - val_f1_score: 0.6727
Epoch 375/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1733 -
f1_score: 1.0000 - val_loss: 2.6047 - val_f1_score: 0.6648
Epoch 376/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1724 -
f1_score: 1.0000 - val_loss: 2.5623 - val_f1_score: 0.6778
Epoch 377/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1722 -
f1_score: 0.9997 - val_loss: 2.6211 - val_f1_score: 0.6668
Epoch 378/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1717 -
f1_score: 0.9993 - val_loss: 2.5616 - val_f1_score: 0.6772
Epoch 379/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1703 -
f1_score: 1.0000 - val_loss: 2.5823 - val_f1_score: 0.6637
Epoch 380/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1704 -
f1_score: 1.0000 - val_loss: 2.5541 - val_f1_score: 0.6685
Epoch 381/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1705 -
f1_score: 0.9992 - val_loss: 2.5379 - val_f1_score: 0.6788
```

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Epoch 382/500
28/28 [==============================] - 5s 164ms/step - loss: 0.1686 -
f1_score: 0.9996 - val_loss: 2.5682 - val_f1_score: 0.6929
Epoch 383/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1696 -
f1_score: 0.9992 - val_loss: 2.5810 - val_f1_score: 0.6684
Epoch 384/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1687 -
f1_score: 0.9991 - val_loss: 2.5872 - val_f1_score: 0.6609
Epoch 385/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1678 -
f1_score: 0.9993 - val_loss: 2.5811 - val_f1_score: 0.6721
Epoch 386/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1673 -
f1_score: 1.0000 - val_loss: 2.5836 - val_f1_score: 0.6814
Epoch 387/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1660 -
f1_score: 0.9988 - val_loss: 2.5865 - val_f1_score: 0.6844
Epoch 388/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1660 -
f1_score: 0.9996 - val_loss: 2.6860 - val_f1_score: 0.6628
Epoch 389/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1841 -
f1_score: 0.9948 - val_loss: 2.8202 - val_f1_score: 0.6288
Epoch 390/500
28/28 [==============================] - 5s 168ms/step - loss: 1.7384 -
f1_score: 0.7172 - val_loss: 3.2411 - val_f1_score: 0.3981
Epoch 391/500
28/28 [==============================] - 5s 166ms/step - loss: 1.0585 -
f1_score: 0.7569 - val_loss: 1.9890 - val_f1_score: 0.5659
Epoch 392/500
28/28 [==============================] - 5s 165ms/step - loss: 0.4444 -
f1_score: 0.9177 - val_loss: 2.0263 - val_f1_score: 0.6221
Epoch 393/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3242 -
f1_score: 0.9606 - val_loss: 2.1945 - val_f1_score: 0.6189
Epoch 394/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3451 -
f1_score: 0.9558 - val_loss: 1.9390 - val_f1_score: 0.6557
Epoch 395/500
28/28 [==============================] - 5s 166ms/step - loss: 0.3395 -
f1_score: 0.9553 - val_loss: 2.2296 - val_f1_score: 0.6256
Epoch 396/500
28/28 [==============================] - 5s 171ms/step - loss: 0.2916 -
f1_score: 0.9639 - val_loss: 2.0742 - val_f1_score: 0.6549
Epoch 397/500
28/28 [==============================] - 5s 176ms/step - loss: 0.2607 -
f1_score: 0.9749 - val_loss: 2.0229 - val_f1_score: 0.6469
```

```
Epoch 398/500
28/28 [==============================] - 5s 176ms/step - loss: 0.3842 -
f1_score: 0.9412 - val_loss: 2.1016 - val_f1_score: 0.6190
Epoch 399/500
28/28 [==============================] - 5s 171ms/step - loss: 0.3533 -
f1_score: 0.9517 - val_loss: 2.0491 - val_f1_score: 0.6101
Epoch 400/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2877 -
f1_score: 0.9659 - val_loss: 2.1143 - val_f1_score: 0.6453
Epoch 401/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2296 -
f1_score: 0.9855 - val_loss: 2.2243 - val_f1_score: 0.6309
Epoch 402/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2534 -
f1_score: 0.9756 - val_loss: 2.2708 - val_f1_score: 0.5915
Epoch 403/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2773 -
f1_score: 0.9678 - val_loss: 2.3141 - val_f1_score: 0.5925
Epoch 404/500
28/28 [==============================] - 5s 175ms/step - loss: 0.3324 -
f1_score: 0.9580 - val_loss: 2.0520 - val_f1_score: 0.6476
Epoch 405/500
28/28 [==============================] - 5s 169ms/step - loss: 0.2837 -
f1_score: 0.9680 - val_loss: 2.0182 - val_f1_score: 0.6355
Epoch 406/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2588 -
f1_score: 0.9745 - val_loss: 2.2126 - val_f1_score: 0.6000
Epoch 407/500
28/28 [==============================] - 5s 165ms/step - loss: 0.6658 -
f1_score: 0.8811 - val_loss: 2.3963 - val_f1_score: 0.5689
Epoch 408/500
28/28 [==============================] - 5s 170ms/step - loss: 0.4956 -
f1_score: 0.9018 - val_loss: 2.0307 - val_f1_score: 0.6308
Epoch 409/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4385 -
f1_score: 0.9236 - val_loss: 2.4049 - val_f1_score: 0.6306
Epoch 410/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3122 -
f1_score: 0.9606 - val_loss: 2.2563 - val_f1_score: 0.6378
Epoch 411/500
28/28 [==============================] - 5s 167ms/step - loss: 0.2266 -
f1_score: 0.9857 - val_loss: 2.2721 - val_f1_score: 0.6209
Epoch 412/500
28/28 [==============================] - 5s 171ms/step - loss: 0.2283 -
f1_score: 0.9837 - val_loss: 2.1395 - val_f1_score: 0.6634
Epoch 413/500
28/28 [==============================] - 5s 170ms/step - loss: 0.2003 -
f1_score: 0.9942 - val_loss: 2.2236 - val_f1_score: 0.6407
```

```
Epoch 414/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3003 -
f1_score: 0.9659 - val_loss: 2.2403 - val_f1_score: 0.6317
Epoch 415/500
28/28 [==============================] - 5s 165ms/step - loss: 0.3115 -
f1_score: 0.9551 - val_loss: 2.4129 - val_f1_score: 0.6164
Epoch 416/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2700 -
f1_score: 0.9741 - val_loss: 2.2773 - val_f1_score: 0.6295
Epoch 417/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2400 -
f1_score: 0.9796 - val_loss: 2.3694 - val_f1_score: 0.6268
Epoch 418/500
28/28 [==============================] - 5s 181ms/step - loss: 0.2715 -
f1_score: 0.9731 - val_loss: 2.1269 - val_f1_score: 0.6384
Epoch 419/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2215 -
f1_score: 0.9881 - val_loss: 2.0697 - val_f1_score: 0.6692
Epoch 420/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1875 -
f1_score: 0.9954 - val_loss: 2.1816 - val_f1_score: 0.6631
Epoch 421/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1881 -
f1_score: 0.9960 - val_loss: 2.2151 - val_f1_score: 0.6708
Epoch 422/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1856 -
f1_score: 0.9963 - val_loss: 2.1804 - val_f1_score: 0.6689
Epoch 423/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1798 -
f1_score: 0.9969 - val_loss: 2.2142 - val_f1_score: 0.6567
Epoch 424/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1749 -
f1_score: 0.9984 - val_loss: 2.3198 - val_f1_score: 0.6715
Epoch 425/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1726 -
f1_score: 1.0000 - val_loss: 2.2714 - val_f1_score: 0.6674
Epoch 426/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1718 -
f1_score: 0.9996 - val_loss: 2.3064 - val_f1_score: 0.6686
Epoch 427/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1703 -
f1_score: 0.9996 - val_loss: 2.3055 - val_f1_score: 0.6639
Epoch 428/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1693 -
f1_score: 0.9992 - val_loss: 2.3232 - val_f1_score: 0.6661
Epoch 429/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1693 -
f1_score: 0.9992 - val_loss: 2.3588 - val_f1_score: 0.6564
```

```
Epoch 430/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1692 -
f1_score: 0.9984 - val_loss: 2.3830 - val_f1_score: 0.6679
Epoch 431/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1680 -
f1_score: 0.9992 - val_loss: 2.3372 - val_f1_score: 0.6567
Epoch 432/500
28/28 [==============================] - 5s 181ms/step - loss: 0.1685 -
f1_score: 0.9989 - val_loss: 2.3994 - val_f1_score: 0.6631
Epoch 433/500
28/28 [==============================] - 5s 172ms/step - loss: 0.1650 -
f1_score: 1.0000 - val_loss: 2.3861 - val_f1_score: 0.6618
Epoch 434/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1647 -
f1_score: 0.9997 - val_loss: 2.4283 - val_f1_score: 0.6657
Epoch 435/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1656 -
f1_score: 0.9996 - val_loss: 2.3962 - val_f1_score: 0.6602
Epoch 436/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1631 -
f1_score: 1.0000 - val_loss: 2.3915 - val_f1_score: 0.6653
Epoch 437/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1643 -
f1_score: 0.9992 - val_loss: 2.3854 - val_f1_score: 0.6763
Epoch 438/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1633 -
f1_score: 1.0000 - val_loss: 2.4137 - val_f1_score: 0.6719
Epoch 439/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1626 -
f1_score: 0.9996 - val_loss: 2.4544 - val_f1_score: 0.6569
Epoch 440/500
28/28 [==============================] - 5s 178ms/step - loss: 0.1610 -
f1_score: 1.0000 - val_loss: 2.4638 - val_f1_score: 0.6685
Epoch 441/500
28/28 [==============================] - 5s 172ms/step - loss: 0.1601 -
f1_score: 0.9996 - val_loss: 2.4269 - val_f1_score: 0.6757
Epoch 442/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1619 -
f1_score: 0.9992 - val_loss: 2.4432 - val_f1_score: 0.6727
Epoch 443/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1598 -
f1_score: 0.9996 - val_loss: 2.4821 - val_f1_score: 0.6693
Epoch 444/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1616 -
f1_score: 0.9983 - val_loss: 2.4683 - val_f1_score: 0.6581
Epoch 445/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1578 -
f1_score: 1.0000 - val_loss: 2.5106 - val_f1_score: 0.6560
```

```
Epoch 446/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1577 -
f1_score: 0.9996 - val_loss: 2.5343 - val_f1_score: 0.6638
Epoch 447/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1568 -
f1_score: 1.0000 - val_loss: 2.5400 - val_f1_score: 0.6662
Epoch 448/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1580 -
f1_score: 0.9996 - val_loss: 2.5580 - val_f1_score: 0.6592
Epoch 449/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1565 -
f1_score: 1.0000 - val_loss: 2.5949 - val_f1_score: 0.6650
Epoch 450/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2195 -
f1_score: 0.9853 - val_loss: 2.6891 - val_f1_score: 0.6156
Epoch 451/500
28/28 [==============================] - 5s 166ms/step - loss: 0.8912 -
f1_score: 0.8262 - val_loss: 2.4290 - val_f1_score: 0.5443
Epoch 452/500
28/28 [==============================] - 5s 168ms/step - loss: 0.5722 -
f1_score: 0.8914 - val_loss: 2.3455 - val_f1_score: 0.5934
Epoch 453/500
28/28 [==============================] - 5s 168ms/step - loss: 0.5315 -
f1_score: 0.9026 - val_loss: 2.2841 - val_f1_score: 0.5898
Epoch 454/500
28/28 [==============================] - 5s 166ms/step - loss: 0.2916 -
f1_score: 0.9601 - val_loss: 1.9336 - val_f1_score: 0.6921
Epoch 455/500
28/28 [==============================] - 5s 167ms/step - loss: 0.3739 -
f1_score: 0.9400 - val_loss: 2.0031 - val_f1_score: 0.6448
Epoch 456/500
28/28 [==============================] - 5s 170ms/step - loss: 0.3769 -
f1_score: 0.9406 - val_loss: 2.3457 - val_f1_score: 0.6211
Epoch 457/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3085 -
f1_score: 0.9576 - val_loss: 2.2660 - val_f1_score: 0.6135
Epoch 458/500
28/28 [==============================] - 5s 169ms/step - loss: 0.3673 -
f1_score: 0.9494 - val_loss: 2.3144 - val_f1_score: 0.6457
Epoch 459/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2832 -
f1_score: 0.9644 - val_loss: 2.0819 - val_f1_score: 0.6413
Epoch 460/500
28/28 [==============================] - 5s 178ms/step - loss: 0.9165 -
f1_score: 0.8617 - val_loss: 2.6863 - val_f1_score: 0.5084
Epoch 461/500
28/28 [==============================] - 5s 176ms/step - loss: 1.2330 -
f1_score: 0.7231 - val_loss: 1.8752 - val_f1_score: 0.5817
```

```
Epoch 462/500
28/28 [==============================] - 5s 175ms/step - loss: 0.5190 -
f1_score: 0.8884 - val_loss: 2.2812 - val_f1_score: 0.5600
Epoch 463/500
28/28 [==============================] - 5s 183ms/step - loss: 0.3522 -
f1_score: 0.9428 - val_loss: 1.9304 - val_f1_score: 0.6210
Epoch 464/500
28/28 [==============================] - 5s 174ms/step - loss: 0.2738 -
f1_score: 0.9678 - val_loss: 2.0101 - val_f1_score: 0.6299
Epoch 465/500
28/28 [==============================] - 5s 172ms/step - loss: 0.2356 -
f1_score: 0.9792 - val_loss: 1.9489 - val_f1_score: 0.6571
Epoch 466/500
28/28 [==============================] - 5s 173ms/step - loss: 0.2175 -
f1_score: 0.9849 - val_loss: 2.0162 - val_f1_score: 0.6555
Epoch 467/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1972 -
f1_score: 0.9908 - val_loss: 2.0119 - val_f1_score: 0.6438
Epoch 468/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1857 -
f1_score: 0.9955 - val_loss: 2.0203 - val_f1_score: 0.6745
Epoch 469/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1830 -
f1_score: 0.9969 - val_loss: 1.9533 - val_f1_score: 0.6654
Epoch 470/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1777 -
f1_score: 0.9973 - val_loss: 2.0302 - val_f1_score: 0.6646
Epoch 471/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1748 -
f1_score: 0.9982 - val_loss: 2.0303 - val_f1_score: 0.6712
Epoch 472/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1724 -
f1_score: 0.9979 - val_loss: 2.0572 - val_f1_score: 0.6679
Epoch 473/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1719 -
f1_score: 0.9986 - val_loss: 2.0382 - val_f1_score: 0.6781
Epoch 474/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1728 -
f1_score: 0.9975 - val_loss: 2.2043 - val_f1_score: 0.6717
Epoch 475/500
28/28 [==============================] - 5s 164ms/step - loss: 0.1740 -
f1_score: 0.9965 - val_loss: 2.0809 - val_f1_score: 0.6700
Epoch 476/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1671 -
f1_score: 0.9985 - val_loss: 2.1315 - val_f1_score: 0.6741
Epoch 477/500
28/28 [==============================] - 5s 167ms/step - loss: 0.1671 -
f1_score: 0.9992 - val_loss: 2.1611 - val_f1_score: 0.6689
```

```
Epoch 478/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1660 -
f1_score: 0.9986 - val_loss: 2.2527 - val_f1_score: 0.6673
Epoch 479/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1626 -
f1_score: 0.9993 - val_loss: 2.1737 - val_f1_score: 0.6802
Epoch 480/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1622 -
f1_score: 1.0000 - val_loss: 2.1956 - val_f1_score: 0.6783
Epoch 481/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1593 -
f1_score: 0.9997 - val_loss: 2.1726 - val_f1_score: 0.6882
Epoch 482/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1595 -
f1_score: 0.9997 - val_loss: 2.2023 - val_f1_score: 0.6835
Epoch 483/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1599 -
f1_score: 0.9992 - val_loss: 2.1277 - val_f1_score: 0.6879
Epoch 484/500
28/28 [==============================] - 5s 165ms/step - loss: 0.1587 -
f1_score: 0.9996 - val_loss: 2.1960 - val_f1_score: 0.6868
Epoch 485/500
28/28 [==============================] - 5s 174ms/step - loss: 0.1592 -
f1_score: 0.9988 - val_loss: 2.2049 - val_f1_score: 0.6722
Epoch 486/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1557 -
f1_score: 0.9992 - val_loss: 2.2232 - val_f1_score: 0.6792
Epoch 487/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1563 -
f1_score: 0.9996 - val_loss: 2.1982 - val_f1_score: 0.6808
Epoch 488/500
28/28 [==============================] - 5s 170ms/step - loss: 0.1572 -
f1_score: 0.9997 - val_loss: 2.2531 - val_f1_score: 0.6724
Epoch 489/500
28/28 [==============================] - 5s 166ms/step - loss: 0.1548 -
f1_score: 0.9993 - val_loss: 2.2298 - val_f1_score: 0.6855
Epoch 490/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1539 -
f1_score: 0.9997 - val_loss: 2.2555 - val_f1_score: 0.6802
Epoch 491/500
28/28 [==============================] - 5s 171ms/step - loss: 0.1549 -
f1_score: 0.9993 - val_loss: 2.2355 - val_f1_score: 0.6734
Epoch 492/500
28/28 [==============================] - 5s 169ms/step - loss: 0.1537 -
f1_score: 0.9996 - val_loss: 2.2757 - val_f1_score: 0.6864
Epoch 493/500
28/28 [==============================] - 5s 168ms/step - loss: 0.1533 -
f1_score: 0.9987 - val_loss: 2.2239 - val_f1_score: 0.6808
```

```
Epoch 494/500
28/28 [==============================] - 5s 168ms/step - loss: 0.4447 -
f1_score: 0.9411 - val_loss: 2.5011 - val_f1_score: 0.6262
Epoch 495/500
28/28 [==============================] - 5s 167ms/step - loss: 0.5004 -
f1_score: 0.9120 - val_loss: 2.4416 - val_f1_score: 0.6200
Epoch 496/500
28/28 [==============================] - 5s 169ms/step - loss: 0.5440 -
f1_score: 0.9044 - val_loss: 2.3062 - val_f1_score: 0.5807
Epoch 497/500
28/28 [==============================] - 5s 168ms/step - loss: 0.3476 -
f1_score: 0.9484 - val_loss: 2.0541 - val_f1_score: 0.6373
Epoch 498/500
28/28 [==============================] - 5s 171ms/step - loss: 0.2595 -
f1_score: 0.9720 - val_loss: 2.3085 - val_f1_score: 0.6140
Epoch 499/500
28/28 [==============================] - 5s 165ms/step - loss: 0.2650 -
f1_score: 0.9700 - val_loss: 2.2450 - val_f1_score: 0.6389
Epoch 500/500
28/28 [==============================] - 5s 164ms/step - loss: 0.2106 -
f1_score: 0.9847 - val_loss: 2.1919 - val_f1_score: 0.6218
```

[76]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 2s 26ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.667     0.667     0.667         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.800     0.400     0.533        10
        BELT      1.000     1.000     1.000         4
        BITE      0.714     0.625     0.667         8
   BREAKFAST      0.556     0.833     0.667         6
      CANCER      0.833     0.625     0.714         8
   CHRISTMAS      1.000     0.833     0.909         6
    CONFUSED      0.714     0.833     0.769         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      0.714     0.833     0.769         6
      DEMAND      0.889     1.000     0.941         8
     DEVELOP      0.400     0.333     0.364         6
      DINNER      0.750     0.375     0.500         8
         DOG      0.429     0.500     0.462         6
```

```
    DOWNSIZE      0.889     1.000     0.941         8
        DRAG      0.500     0.500     0.500         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.833     0.833     0.833         6
    ELEVATOR      0.444     0.500     0.471         8
        FINE      0.250     0.500     0.333         4
       FLOAT      1.000     0.250     0.400         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.800     1.000     0.889         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.333     0.333     0.333         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.667     0.500     0.571         4
      KNIGHT      0.000     0.000     0.000         4
        LOCK      1.000     0.750     0.857         8
       LUNCH      0.667     0.500     0.571         8
       MAPLE      0.167     0.250     0.200         4
        MEAT      0.500     0.333     0.400         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.389     0.875     0.538         8
        NOON      0.667     1.000     0.800         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.556     0.833     0.667         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.333     0.300     0.316        10
        SINK      0.333     0.333     0.333         6
     SQUEEZE      0.182     0.500     0.267         4
        THEY      0.500     0.750     0.600         4
       TWINS      0.500     0.500     0.500         8
     WHATFOR      1.000     0.500     0.667        10

    accuracy                          0.654       324
   macro avg      0.652     0.632     0.622       324
weighted avg      0.684     0.654     0.648       324
```

[77]:
```python
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '3 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[119]:
```
hist_df = pd.read_csv('3 LSTM/history.csv', index_col=0)
hist_df.tail()
```

[119]:

	loss	f1_score	val_loss	val_f1_score
495	0.543994	0.904393	2.306155	0.580705
496	0.347574	0.948425	2.054087	0.637343
497	0.259453	0.972048	2.308527	0.613971
498	0.265040	0.969994	2.245025	0.638905
499	0.210580	0.984705	2.191885	0.621819

[120]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[121]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[122]:
```
reconstructed_model = tf.keras.models.load_model("3 LSTM")
```

```
2023-09-11 20:06:02.938894: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-11 20:06:04.539580: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 539 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[125]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
```

```
 Layer (type)                Output Shape              Param #
=================================================================
 lstm_3 (LSTM)               (None, 130, 125)          262500

 lstm_4 (LSTM)               (None, 130, 150)          165600

 lstm_5 (LSTM)               (None, 150)               180600

 dropout_2 (Dropout)         (None, 150)               0

 dense_2 (Dense)             (None, 110)               16610

 dropout_3 (Dropout)         (None, 110)               0

 dense_3 (Dense)             (None, 50)                5550

=================================================================
Total params: 630,860
Trainable params: 630,860
Non-trainable params: 0
_________________________________________________________________
```

[126]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[126]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
LSTM
input: (None, 130, 399)
output: (None, 130, 125)
LSTM
input: (None, 130, 125)
output: (None, 130, 150)
LSTM
input: (None, 130, 150)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 110)
Dropout
input: (None, 110)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[123]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[123]:

LSTM
Dropout
Dense

[127]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 2s 27ms/step - loss: 2.1101 - f1_score:
0.6933
```

[127]:
```
[2.1100780963897705, 0.6932531595230103]
```

[128]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 2s 29ms/step - loss: 0.1957 - f1_score:
0.9954
```

[128]:
```
[0.19567184150218964, 0.9954199194908142]
```

[84]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 2s 25ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.750     0.600     0.667        10
        BELT      1.000     0.500     0.667         4
        BITE      1.000     0.750     0.857         8
   BREAKFAST      0.800     0.667     0.727         6
      CANCER      1.000     1.000     1.000         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      1.000     1.000     1.000         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      0.667     0.667     0.667         6
      DEMAND      1.000     0.875     0.933         8
     DEVELOP      1.000     0.333     0.500         6
      DINNER      0.800     0.500     0.615         8
         DOG      0.500     0.667     0.571         6
    DOWNSIZE      0.800     1.000     0.889         8
        DRAG      0.200     0.250     0.222         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      0.417     0.625     0.500         8
        FINE      0.222     0.500     0.308         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.875     0.875     0.875         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.400     0.333     0.364         6
 HURDLE/TRIP      0.167     0.250     0.200         4
     JEWELRY      1.000     0.750     0.857         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.667     0.750     0.706         8
       MAPLE      0.500     0.500     0.500         4
        MEAT      0.750     1.000     0.857         6
    MECHANIC      0.667     1.000     0.800         4
  MICROSCOPE      0.833     0.625     0.714         8
       MOVIE      0.467     0.875     0.609         8
        NOON      0.800     1.000     0.889         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.667     0.667     0.667         6
       RAZOR      0.286     0.500     0.364         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.800     0.400     0.533        10
        SINK      0.333     0.333     0.333         6
     SQUEEZE      0.333     0.250     0.286         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.286     0.250     0.267         8
     WHATFOR      0.571     0.400     0.471        10

    accuracy                          0.710       324
   macro avg      0.731     0.695     0.693       324
weighted avg      0.748     0.710     0.711       324
```

3.4 Hyperparameter Tuning 1 1D CNN Layer

[119]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, SpatialDropout1D, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):
```

```
    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='gelu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20],
                       default=2,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
                values=[2, 3, 4, 5, 6, 7, 8, 9, 10],
                default=2,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.75,
                step=0.05,
            )))
        model.add(Flatten())
        model.add(
            Dense(units=hp.Int('units_2',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=90),
                  activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
```

```
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.5,
                step=0.05,
            )))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.0032857440370174544)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

```
/tmp/ipykernel_1434469/3344394336.py:5: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
HYPERBAND_MAX_EPOCHS = 300
#MAX_TRIALS = 20
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='1_1D_CNN',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN/tuner0.json
```

[121]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 8
dense_activation (Choice)
{'default': 'gelu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
```

```
'relu'], 'ordered': False}
num_filters_1 (Choice)
{'default': 150, 'conditions': [], 'values': [100, 125, 150, 200], 'ordered':
True}
kernel_1 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20],
'ordered': True}
pool_1 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5, 6, 7, 8, 9, 10],
'ordered': True}
dropout_1 (Float)
{'default': 0.75, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 90, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
{'default': 0.5, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0032857440370174544, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[122]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[123]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 03m 03s]
val_f1_score: 0.01736710499972105

Best val_f1_score So Far: 0.5334144830703735
Total elapsed time: 01h 50m 14s
INFO:tensorflow:Oracle triggered exit
```

[124]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN
Showing 10 best trials
Objective(name="val_f1_score", direction="max")
```

```
Trial 0670 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 150
kernel_1: 2
pool_1: 10
dropout_1: 0.55
units_2: 110
dropout_2: 0.55
learning_rate: 0.00043075793575989864
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.5334144830703735

Trial 0598 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 100
kernel_1: 2
pool_1: 9
dropout_1: 0.0
units_2: 80
dropout_2: 0.8500000000000001
learning_rate: 0.001687289391829868
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0593
Score: 0.49332109093666077

Trial 0599 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 150
kernel_1: 15
pool_1: 10
dropout_1: 0.15000000000000002
units_2: 80
dropout_2: 0.2
learning_rate: 0.00021098836250509396
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
```

```
tuner/trial_id: 0595
Score: 0.4787854105234146

Trial 0593 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 100
kernel_1: 2
pool_1: 9
dropout_1: 0.0
units_2: 80
dropout_2: 0.8500000000000001
learning_rate: 0.001687289391829868
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0592
Score: 0.4640840142965317

Trial 0595 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 150
kernel_1: 15
pool_1: 10
dropout_1: 0.15000000000000002
units_2: 80
dropout_2: 0.2
learning_rate: 0.00021098836250509396
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0588
Score: 0.447617769241333

Trial 0718 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 200
kernel_1: 3
pool_1: 5
dropout_1: 0.55
units_2: 100
dropout_2: 0.6000000000000001
learning_rate: 0.0006659567514505796
filters_1: 75
```

```
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.4341233819723129

Trial 0426 summary
Hyperparameters:
dense_activation: selu
num_filters_1: 150
kernel_1: 2
pool_1: 10
dropout_1: 0.55
units_2: 120
dropout_2: 0.7000000000000001
learning_rate: 0.001102804105585901
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.43396107852458954

Trial 0723 summary
Hyperparameters:
dense_activation: selu
num_filters_1: 125
kernel_1: 4
pool_1: 10
dropout_1: 0.1
units_2: 90
dropout_2: 0.55
learning_rate: 0.00023669525078715348
filters_1: 200
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.4283321797847748

Trial 0664 summary
Hyperparameters:
dense_activation: elu
num_filters_1: 150
kernel_1: 2
pool_1: 10
dropout_1: 0.55
units_2: 110
```

```
dropout_2: 0.55
learning_rate: 0.00043075793575989864
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0650
Score: 0.4220774471759796

Trial 0671 summary
Hyperparameters:
dense_activation: selu
num_filters_1: 150
kernel_1: 4
pool_1: 7
dropout_1: 0.2
units_2: 90
dropout_2: 0.8
learning_rate: 0.0005976783923870351
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0666
Score: 0.4174632132053375
```

[125]:
```
best_model = tuner.get_best_models(num_models=1)[0]
```

[126]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 129, 150)          119850

 max_pooling1d (MaxPooling1D  (None, 12, 150)          0
 )

 dropout (Dropout)           (None, 12, 150)           0

 flatten (Flatten)           (None, 1800)              0

 dense (Dense)               (None, 110)               198110

 dropout_1 (Dropout)         (None, 110)               0

 dense_1 (Dense)             (None, 50)                5550
```

```
=================================================================
Total params: 323,510
Trainable params: 323,510
Non-trainable params: 0
_________________________________________________________________
```

[127]:
```python
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[127]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 129, 150)
MaxPooling1D
input:
(None, 129, 150)
output:
(None, 12, 150)
Dropout
input:
(None, 12, 150)
output:
(None, 12, 150)
Flatten
input:
(None, 12, 150)
output:
(None, 1800)
Dense
input:
(None, 1800)
output:
(None, 110)
Dropout
input:
(None, 110)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[128]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 35ms/step - loss: 2.1379 - f1_score:
0.5353
```

[133]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 9ms/step - loss: 0.0905 - f1_score:
0.9931
```

[129]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 8ms/step
              precision    recall  f1-score   support

         AXE      0.857     0.750     0.800         8
    BACKPACK      0.462     1.000     0.632         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.455     0.500     0.476        10
        BELT      1.000     1.000     1.000         4
        BITE      0.000     0.000     0.000         8
   BREAKFAST      1.000     0.333     0.500         6
      CANCER      0.667     0.750     0.706         8
   CHRISTMAS      0.400     0.333     0.364         6
    CONFUSED      0.800     0.667     0.727         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.000     0.000     0.000         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      0.200     0.250     0.222         8
     DEVELOP      0.600     0.500     0.545         6
      DINNER      0.000     0.000     0.000         8
         DOG      1.000     0.333     0.500         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.333     0.750     0.462         4
         EAT      1.000     0.833     0.909         6
        EDIT      0.500     0.667     0.571         6
    ELEVATOR      0.000     0.000     0.000         8
        FINE      0.286     0.500     0.364         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.800     0.667     0.727         6
       GUESS      0.800     0.500     0.615         8
   HALLOWEEN      1.000     1.000     1.000         8
```

```
    HOSPITAL      0.200     0.167     0.182         6
 HURDLE/TRIP      1.000     0.250     0.400         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.400     0.500     0.444         4
        LOCK      1.000     0.375     0.545         8
       LUNCH      0.143     0.125     0.133         8
       MAPLE      0.667     1.000     0.800         4
        MEAT      0.417     0.833     0.556         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.462     0.750     0.571         8
        NOON      0.583     0.875     0.700         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.100     0.333     0.154         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.600     1.000     0.750         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.600     0.600     0.600        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.500     1.000     0.667         4
       TWINS      0.429     0.750     0.545         8
     WHATFOR      0.400     0.200     0.267        10

    accuracy                          0.549       324
   macro avg      0.587     0.560     0.535       324
weighted avg      0.579     0.549     0.529       324
```

```
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[130]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[131]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1DCNN/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[132]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 4.1782 - f1_score:
0.0219

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 10s 274ms/step - loss: 4.1782 -
f1_score: 0.0219 - val_loss: 3.9117 - val_f1_score: 0.0271
Epoch 2/500
28/28 [==============================] - 1s 38ms/step - loss: 3.9862 - f1_score:
0.0322 - val_loss: 3.8709 - val_f1_score: 0.0103
Epoch 3/500
27/28 [===========================>..] - ETA: 0s - loss: 3.9161 - f1_score:
0.0363

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 158ms/step - loss: 3.9153 -
f1_score: 0.0366 - val_loss: 3.8101 - val_f1_score: 0.0312
Epoch 4/500
27/28 [===========================>..] - ETA: 0s - loss: 3.8238 - f1_score:
0.0518
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 167ms/step - loss: 3.8258 -
f1_score: 0.0509 - val_loss: 3.7322 - val_f1_score: 0.0355
Epoch 5/500
27/28 [===========================>..] - ETA: 0s - loss: 3.7262 - f1_score:
0.0593

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 168ms/step - loss: 3.7282 -
f1_score: 0.0601 - val_loss: 3.6588 - val_f1_score: 0.0561
Epoch 6/500
27/28 [===========================>..] - ETA: 0s - loss: 3.6179 - f1_score:
0.0731

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 140ms/step - loss: 3.6156 -
f1_score: 0.0732 - val_loss: 3.5797 - val_f1_score: 0.0855
Epoch 7/500
27/28 [===========================>..] - ETA: 0s - loss: 3.5300 - f1_score:
0.0866

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 139ms/step - loss: 3.5239 -
f1_score: 0.0879 - val_loss: 3.4878 - val_f1_score: 0.0982
Epoch 8/500
27/28 [===========================>..] - ETA: 0s - loss: 3.4141 - f1_score:
0.1070
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 147ms/step - loss: 3.4193 -
f1_score: 0.1058 - val_loss: 3.3818 - val_f1_score: 0.0993
Epoch 9/500
27/28 [===========================>..] - ETA: 0s - loss: 3.3392 - f1_score:
0.1121

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 142ms/step - loss: 3.3353 -
f1_score: 0.1125 - val_loss: 3.3242 - val_f1_score: 0.1010
Epoch 10/500
27/28 [===========================>..] - ETA: 0s - loss: 3.2319 - f1_score:
0.1323

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 136ms/step - loss: 3.2274 -
f1_score: 0.1342 - val_loss: 3.2142 - val_f1_score: 0.1514
Epoch 11/500
28/28 [==============================] - 1s 39ms/step - loss: 3.1982 - f1_score:
0.1319 - val_loss: 3.1384 - val_f1_score: 0.1456
Epoch 12/500
27/28 [===========================>..] - ETA: 0s - loss: 3.0936 - f1_score:
0.1552

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 141ms/step - loss: 3.0887 -
f1_score: 0.1567 - val_loss: 3.1138 - val_f1_score: 0.1525
```

```
Epoch 13/500
27/28 [==========================>..] - ETA: 0s - loss: 3.0335 - f1_score:
0.1582

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 140ms/step - loss: 3.0339 -
f1_score: 0.1583 - val_loss: 3.0535 - val_f1_score: 0.1649
Epoch 14/500
28/28 [==============================] - 1s 40ms/step - loss: 2.9749 - f1_score:
0.1840 - val_loss: 3.0626 - val_f1_score: 0.1647
Epoch 15/500
27/28 [==========================>..] - ETA: 0s - loss: 2.9055 - f1_score:
0.1906

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 148ms/step - loss: 2.9131 -
f1_score: 0.1891 - val_loss: 2.9533 - val_f1_score: 0.2041
Epoch 16/500
28/28 [==============================] - 1s 39ms/step - loss: 2.8403 - f1_score:
0.2068 - val_loss: 2.9182 - val_f1_score: 0.1816
Epoch 17/500
27/28 [==========================>..] - ETA: 0s - loss: 2.8353 - f1_score:
0.2090

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 166ms/step - loss: 2.8374 -
f1_score: 0.2078 - val_loss: 2.8859 - val_f1_score: 0.2067
Epoch 18/500
28/28 [==============================] - 1s 41ms/step - loss: 2.7422 - f1_score:
0.2372 - val_loss: 2.8608 - val_f1_score: 0.1744
Epoch 19/500
27/28 [==========================>..] - ETA: 0s - loss: 2.7422 - f1_score:
0.2083
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 155ms/step - loss: 2.7340 -
f1_score: 0.2104 - val_loss: 2.8076 - val_f1_score: 0.2226
Epoch 20/500
28/28 [==============================] - 1s 38ms/step - loss: 2.6935 - f1_score:
0.2383 - val_loss: 2.7784 - val_f1_score: 0.2215
Epoch 21/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6502 - f1_score:
0.2438

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 164ms/step - loss: 2.6477 -
f1_score: 0.2440 - val_loss: 2.7910 - val_f1_score: 0.2443
Epoch 22/500
28/28 [==============================] - 1s 39ms/step - loss: 2.6085 - f1_score:
0.2541 - val_loss: 2.7699 - val_f1_score: 0.2296
Epoch 23/500
28/28 [==============================] - 1s 39ms/step - loss: 2.5604 - f1_score:
0.2747 - val_loss: 2.7196 - val_f1_score: 0.2420
Epoch 24/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5434 - f1_score:
0.2710

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 177ms/step - loss: 2.5419 -
f1_score: 0.2705 - val_loss: 2.7216 - val_f1_score: 0.2694
Epoch 25/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4813 - f1_score:
0.2854

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 171ms/step - loss: 2.4850 -
f1_score: 0.2857 - val_loss: 2.7140 - val_f1_score: 0.2718
Epoch 26/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4480 - f1_score:
0.3013

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 155ms/step - loss: 2.4453 -
f1_score: 0.3011 - val_loss: 2.6845 - val_f1_score: 0.2883
Epoch 27/500
28/28 [==============================] - 1s 40ms/step - loss: 2.4410 - f1_score:
0.2867 - val_loss: 2.6887 - val_f1_score: 0.2609
Epoch 28/500
28/28 [==============================] - 1s 39ms/step - loss: 2.4207 - f1_score:
0.2957 - val_loss: 2.6552 - val_f1_score: 0.2343
Epoch 29/500
28/28 [==============================] - 1s 42ms/step - loss: 2.3870 - f1_score:
0.2982 - val_loss: 2.6445 - val_f1_score: 0.2817
Epoch 30/500
27/28 [===========================>..] - ETA: 0s - loss: 2.3382 - f1_score:
0.3267

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 145ms/step - loss: 2.3390 -
f1_score: 0.3258 - val_loss: 2.6150 - val_f1_score: 0.3014
Epoch 31/500
27/28 [===========================>..] - ETA: 0s - loss: 2.3048 - f1_score:
0.3346

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets
```

```
28/28 [==============================] - 4s 142ms/step - loss: 2.3063 -
f1_score: 0.3346 - val_loss: 2.6020 - val_f1_score: 0.3127
Epoch 32/500
28/28 [==============================] - 1s 41ms/step - loss: 2.2747 - f1_score:
0.3353 - val_loss: 2.6115 - val_f1_score: 0.3023
Epoch 33/500
28/28 [==============================] - 1s 41ms/step - loss: 2.2553 - f1_score:
0.3488 - val_loss: 2.6204 - val_f1_score: 0.2667
Epoch 34/500
28/28 [==============================] - 1s 40ms/step - loss: 2.2401 - f1_score:
0.3372 - val_loss: 2.5669 - val_f1_score: 0.2797
Epoch 35/500
28/28 [==============================] - 1s 40ms/step - loss: 2.2148 - f1_score:
0.3461 - val_loss: 2.5499 - val_f1_score: 0.3055
Epoch 36/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2151 - f1_score:
0.3516

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 160ms/step - loss: 2.2168 -
f1_score: 0.3503 - val_loss: 2.5124 - val_f1_score: 0.3485
Epoch 37/500
28/28 [==============================] - 1s 39ms/step - loss: 2.1405 - f1_score:
0.3625 - val_loss: 2.5923 - val_f1_score: 0.3150
Epoch 38/500
28/28 [==============================] - 1s 39ms/step - loss: 2.1384 - f1_score:
0.3617 - val_loss: 2.5049 - val_f1_score: 0.3378
Epoch 39/500
28/28 [==============================] - 1s 39ms/step - loss: 2.0904 - f1_score:
0.3797 - val_loss: 2.5485 - val_f1_score: 0.3256
Epoch 40/500
28/28 [==============================] - 1s 40ms/step - loss: 2.1010 - f1_score:
0.3725 - val_loss: 2.4894 - val_f1_score: 0.3147
Epoch 41/500
28/28 [==============================] - 1s 40ms/step - loss: 2.0671 - f1_score:
0.3912 - val_loss: 2.5132 - val_f1_score: 0.3182
Epoch 42/500
27/28 [===========================>..] - ETA: 0s - loss: 2.0632 - f1_score:
0.3900

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 185ms/step - loss: 2.0594 -
f1_score: 0.3930 - val_loss: 2.4909 - val_f1_score: 0.3507
Epoch 43/500
28/28 [==============================] - 1s 40ms/step - loss: 2.0624 - f1_score:
0.3921 - val_loss: 2.5102 - val_f1_score: 0.3325
Epoch 44/500
28/28 [==============================] - 1s 38ms/step - loss: 2.0037 - f1_score:
0.4190 - val_loss: 2.4545 - val_f1_score: 0.3169
Epoch 45/500
28/28 [==============================] - 1s 38ms/step - loss: 1.9986 - f1_score:
0.4112 - val_loss: 2.4759 - val_f1_score: 0.3335
Epoch 46/500
28/28 [==============================] - 1s 39ms/step - loss: 1.9590 - f1_score:
0.4076 - val_loss: 2.4200 - val_f1_score: 0.3156
Epoch 47/500
28/28 [==============================] - 1s 39ms/step - loss: 1.9338 - f1_score:
0.4272 - val_loss: 2.4407 - val_f1_score: 0.3495
Epoch 48/500
28/28 [==============================] - 1s 39ms/step - loss: 1.9268 - f1_score:
0.4338 - val_loss: 2.4171 - val_f1_score: 0.3416
Epoch 49/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9120 - f1_score:
0.4179

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 157ms/step - loss: 1.9099 -
f1_score: 0.4217 - val_loss: 2.4008 - val_f1_score: 0.3671
Epoch 50/500
28/28 [==============================] - 1s 40ms/step - loss: 1.9079 - f1_score:
0.4285 - val_loss: 2.4326 - val_f1_score: 0.3520
Epoch 51/500
28/28 [==============================] - 1s 39ms/step - loss: 1.8582 - f1_score:
0.4349 - val_loss: 2.4649 - val_f1_score: 0.3107
Epoch 52/500
28/28 [==============================] - 1s 38ms/step - loss: 1.8630 - f1_score:
0.4367 - val_loss: 2.4377 - val_f1_score: 0.3533
Epoch 53/500
28/28 [==============================] - 1s 38ms/step - loss: 1.8508 - f1_score:
0.4402 - val_loss: 2.3979 - val_f1_score: 0.3649
Epoch 54/500
```

```
28/28 [==============================] - 1s 38ms/step - loss: 1.8105 - f1_score:
0.4581 - val_loss: 2.3543 - val_f1_score: 0.3455
Epoch 55/500
28/28 [==============================] - 1s 39ms/step - loss: 1.7580 - f1_score:
0.4595 - val_loss: 2.3423 - val_f1_score: 0.3274
Epoch 56/500
28/28 [==============================] - 1s 40ms/step - loss: 1.8225 - f1_score:
0.4399 - val_loss: 2.4072 - val_f1_score: 0.3662
Epoch 57/500
28/28 [==============================] - 1s 39ms/step - loss: 1.7195 - f1_score:
0.4769 - val_loss: 2.4274 - val_f1_score: 0.3549
Epoch 58/500
28/28 [==============================] - 1s 40ms/step - loss: 1.7355 - f1_score:
0.4721 - val_loss: 2.3714 - val_f1_score: 0.3298
Epoch 59/500
28/28 [==============================] - 1s 40ms/step - loss: 1.7333 - f1_score:
0.4650 - val_loss: 2.3780 - val_f1_score: 0.3648
Epoch 60/500
28/28 [==============================] - 1s 39ms/step - loss: 1.6981 - f1_score:
0.4941 - val_loss: 2.3530 - val_f1_score: 0.3589
Epoch 61/500
27/28 [===========================>..] - ETA: 0s - loss: 1.7354 - f1_score:
0.4725

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 154ms/step - loss: 1.7297 -
f1_score: 0.4734 - val_loss: 2.3374 - val_f1_score: 0.3805
Epoch 62/500
28/28 [==============================] - 1s 39ms/step - loss: 1.7307 - f1_score:
0.4744 - val_loss: 2.3368 - val_f1_score: 0.3546
Epoch 63/500
28/28 [==============================] - 1s 39ms/step - loss: 1.6346 - f1_score:
0.5083 - val_loss: 2.3700 - val_f1_score: 0.3702
Epoch 64/500
28/28 [==============================] - 1s 38ms/step - loss: 1.6413 - f1_score:
0.5019 - val_loss: 2.3654 - val_f1_score: 0.3790
Epoch 65/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6452 - f1_score:
0.5141

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 165ms/step - loss: 1.6486 -
f1_score: 0.5126 - val_loss: 2.2912 - val_f1_score: 0.3806
Epoch 66/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6139 - f1_score:
0.4972

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 157ms/step - loss: 1.6190 -
f1_score: 0.4955 - val_loss: 2.3192 - val_f1_score: 0.3902
Epoch 67/500
28/28 [==============================] - 1s 38ms/step - loss: 1.5940 - f1_score:
0.5091 - val_loss: 2.3074 - val_f1_score: 0.3743
Epoch 68/500
28/28 [==============================] - 1s 40ms/step - loss: 1.5714 - f1_score:
0.5308 - val_loss: 2.2765 - val_f1_score: 0.3769
Epoch 69/500
28/28 [==============================] - 1s 39ms/step - loss: 1.5776 - f1_score:
0.5352 - val_loss: 2.3100 - val_f1_score: 0.3469
Epoch 70/500
28/28 [==============================] - 1s 39ms/step - loss: 1.5892 - f1_score:
0.5157 - val_loss: 2.2845 - val_f1_score: 0.3586
Epoch 71/500
28/28 [==============================] - 1s 40ms/step - loss: 1.5390 - f1_score:
0.5316 - val_loss: 2.2787 - val_f1_score: 0.3720
Epoch 72/500
28/28 [==============================] - 1s 40ms/step - loss: 1.5048 - f1_score:
0.5442 - val_loss: 2.3427 - val_f1_score: 0.3764
Epoch 73/500
28/28 [==============================] - 1s 40ms/step - loss: 1.5264 - f1_score:
0.5453 - val_loss: 2.2775 - val_f1_score: 0.3776
Epoch 74/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5176 - f1_score:
0.5362

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets
```

```
28/28 [==============================] - 4s 147ms/step - loss: 1.5125 -
f1_score: 0.5371 - val_loss: 2.2344 - val_f1_score: 0.4013
Epoch 75/500
28/28 [==============================] - 1s 39ms/step - loss: 1.4918 - f1_score:
0.5489 - val_loss: 2.2846 - val_f1_score: 0.3978
Epoch 76/500
28/28 [==============================] - 1s 40ms/step - loss: 1.5103 - f1_score:
0.5374 - val_loss: 2.2786 - val_f1_score: 0.3486
Epoch 77/500
27/28 [===========================>..] - ETA: 0s - loss: 1.4924 - f1_score:
0.5401

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 4s 151ms/step - loss: 1.4967 -
f1_score: 0.5407 - val_loss: 2.2459 - val_f1_score: 0.4083
Epoch 78/500
28/28 [==============================] - 1s 40ms/step - loss: 1.4728 - f1_score:
0.5513 - val_loss: 2.2739 - val_f1_score: 0.4028
Epoch 79/500
28/28 [==============================] - 1s 42ms/step - loss: 1.4749 - f1_score:
0.5538 - val_loss: 2.3226 - val_f1_score: 0.3350
Epoch 80/500
28/28 [==============================] - 1s 41ms/step - loss: 1.4437 - f1_score:
0.5622 - val_loss: 2.2204 - val_f1_score: 0.3950
Epoch 81/500
28/28 [==============================] - 1s 40ms/step - loss: 1.4323 - f1_score:
0.5660 - val_loss: 2.2319 - val_f1_score: 0.3996
Epoch 82/500
28/28 [==============================] - 1s 40ms/step - loss: 1.4083 - f1_score:
0.5666 - val_loss: 2.2521 - val_f1_score: 0.3929
Epoch 83/500
28/28 [==============================] - 1s 41ms/step - loss: 1.4042 - f1_score:
0.5754 - val_loss: 2.2162 - val_f1_score: 0.3877
Epoch 84/500
28/28 [==============================] - 1s 39ms/step - loss: 1.3989 - f1_score:
0.5799 - val_loss: 2.2540 - val_f1_score: 0.4008
Epoch 85/500
28/28 [==============================] - 1s 40ms/step - loss: 1.3820 - f1_score:
0.5750 - val_loss: 2.2290 - val_f1_score: 0.3858
Epoch 86/500
28/28 [==============================] - 1s 42ms/step - loss: 1.3395 - f1_score:
0.5798 - val_loss: 2.2537 - val_f1_score: 0.4033
Epoch 87/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 1.3440 - f1_score:
0.5784 - val_loss: 2.2362 - val_f1_score: 0.3824
Epoch 88/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3560 - f1_score:
0.5772

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 169ms/step - loss: 1.3561 -
f1_score: 0.5758 - val_loss: 2.2816 - val_f1_score: 0.4087
Epoch 89/500
28/28 [==============================] - 1s 39ms/step - loss: 1.3712 - f1_score:
0.5794 - val_loss: 2.2054 - val_f1_score: 0.3547
Epoch 90/500
28/28 [==============================] - 1s 39ms/step - loss: 1.3237 - f1_score:
0.5962 - val_loss: 2.3066 - val_f1_score: 0.3825
Epoch 91/500
28/28 [==============================] - 1s 38ms/step - loss: 1.3543 - f1_score:
0.5871 - val_loss: 2.2758 - val_f1_score: 0.3778
Epoch 92/500
28/28 [==============================] - 1s 41ms/step - loss: 1.3491 - f1_score:
0.5800 - val_loss: 2.2400 - val_f1_score: 0.4046
Epoch 93/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2976 - f1_score:
0.5929 - val_loss: 2.2058 - val_f1_score: 0.3717
Epoch 94/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2790 - f1_score:
0.6009 - val_loss: 2.1831 - val_f1_score: 0.3993
Epoch 95/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2557 - f1_score:
0.6086 - val_loss: 2.2281 - val_f1_score: 0.3702
Epoch 96/500
28/28 [==============================] - 1s 39ms/step - loss: 1.3072 - f1_score:
0.6003 - val_loss: 2.1527 - val_f1_score: 0.4061
Epoch 97/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2513 - f1_score:
0.6077 - val_loss: 2.2407 - val_f1_score: 0.3739
Epoch 98/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2379 - f1_score:
0.6097 - val_loss: 2.1967 - val_f1_score: 0.3939
Epoch 99/500
28/28 [==============================] - 1s 43ms/step - loss: 1.2760 - f1_score:
0.6010 - val_loss: 2.2103 - val_f1_score: 0.4044
Epoch 100/500
```

```
28/28 [==============================] - 1s 39ms/step - loss: 1.2000 - f1_score:
0.6365 - val_loss: 2.1525 - val_f1_score: 0.3919
Epoch 101/500
28/28 [==============================] - 1s 41ms/step - loss: 1.2009 - f1_score:
0.6191 - val_loss: 2.2399 - val_f1_score: 0.3994
Epoch 102/500
28/28 [==============================] - 1s 39ms/step - loss: 1.2552 - f1_score:
0.6116 - val_loss: 2.2114 - val_f1_score: 0.3963
Epoch 103/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2068 - f1_score:
0.6198

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 185ms/step - loss: 1.2118 -
f1_score: 0.6195 - val_loss: 2.1689 - val_f1_score: 0.4268
Epoch 104/500
28/28 [==============================] - 1s 43ms/step - loss: 1.2146 - f1_score:
0.6226 - val_loss: 2.2433 - val_f1_score: 0.4040
Epoch 105/500
28/28 [==============================] - 1s 44ms/step - loss: 1.1936 - f1_score:
0.6285 - val_loss: 2.2411 - val_f1_score: 0.4012
Epoch 106/500
28/28 [==============================] - 1s 39ms/step - loss: 1.1908 - f1_score:
0.6276 - val_loss: 2.1810 - val_f1_score: 0.3893
Epoch 107/500
28/28 [==============================] - 1s 40ms/step - loss: 1.2211 - f1_score:
0.6220 - val_loss: 2.1406 - val_f1_score: 0.3851
Epoch 108/500
28/28 [==============================] - 1s 42ms/step - loss: 1.1691 - f1_score:
0.6403 - val_loss: 2.1501 - val_f1_score: 0.4032
Epoch 109/500
28/28 [==============================] - 1s 40ms/step - loss: 1.1660 - f1_score:
0.6272 - val_loss: 2.1641 - val_f1_score: 0.3957
Epoch 110/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1410 - f1_score:
0.6386

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets
```

```
28/28 [==============================] - 4s 164ms/step - loss: 1.1358 -
f1_score: 0.6402 - val_loss: 2.1805 - val_f1_score: 0.4338
Epoch 111/500
28/28 [==============================] - 1s 42ms/step - loss: 1.1834 - f1_score:
0.6271 - val_loss: 2.1202 - val_f1_score: 0.4246
Epoch 112/500
28/28 [==============================] - 1s 47ms/step - loss: 1.1173 - f1_score:
0.6456 - val_loss: 2.1249 - val_f1_score: 0.4228
Epoch 113/500
27/28 [===========================>..] - ETA: 0s - loss: 1.0996 - f1_score:
0.6590

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 179ms/step - loss: 1.0960 -
f1_score: 0.6580 - val_loss: 2.1423 - val_f1_score: 0.4375
Epoch 114/500
28/28 [==============================] - 1s 44ms/step - loss: 1.1109 - f1_score:
0.6531 - val_loss: 2.1896 - val_f1_score: 0.3912
Epoch 115/500
28/28 [==============================] - 1s 44ms/step - loss: 1.1169 - f1_score:
0.6459 - val_loss: 2.1257 - val_f1_score: 0.3988
Epoch 116/500
28/28 [==============================] - 1s 49ms/step - loss: 1.1177 - f1_score:
0.6469 - val_loss: 2.2203 - val_f1_score: 0.3872
Epoch 117/500
28/28 [==============================] - 1s 47ms/step - loss: 1.0777 - f1_score:
0.6600 - val_loss: 2.1139 - val_f1_score: 0.4258
Epoch 118/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0820 - f1_score:
0.6620 - val_loss: 2.1724 - val_f1_score: 0.4311
Epoch 119/500
28/28 [==============================] - 1s 49ms/step - loss: 1.1056 - f1_score:
0.6512 - val_loss: 2.1168 - val_f1_score: 0.3986
Epoch 120/500
28/28 [==============================] - 1s 47ms/step - loss: 1.0901 - f1_score:
0.6664 - val_loss: 2.1559 - val_f1_score: 0.4288
Epoch 121/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0633 - f1_score:
0.6626 - val_loss: 2.1467 - val_f1_score: 0.4309
Epoch 122/500
28/28 [==============================] - 1s 48ms/step - loss: 1.0502 - f1_score:
0.6732 - val_loss: 2.1567 - val_f1_score: 0.3983
Epoch 123/500
```

```
28/28 [==============================] - 1s 48ms/step - loss: 1.0487 - f1_score:
0.6734 - val_loss: 2.1177 - val_f1_score: 0.4197
Epoch 124/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0456 - f1_score:
0.6627 - val_loss: 2.1718 - val_f1_score: 0.3668
Epoch 125/500
28/28 [==============================] - ETA: 0s - loss: 1.0492 - f1_score:
0.6643

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 6s 222ms/step - loss: 1.0492 -
f1_score: 0.6643 - val_loss: 2.1135 - val_f1_score: 0.4498
Epoch 126/500
27/28 [===========================>..] - ETA: 0s - loss: 1.0506 - f1_score:
0.6723

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 192ms/step - loss: 1.0527 -
f1_score: 0.6716 - val_loss: 2.1459 - val_f1_score: 0.4585
Epoch 127/500
28/28 [==============================] - 1s 42ms/step - loss: 1.0250 - f1_score:
0.6751 - val_loss: 2.1269 - val_f1_score: 0.4434
Epoch 128/500
28/28 [==============================] - 1s 42ms/step - loss: 1.0098 - f1_score:
0.6895 - val_loss: 2.1739 - val_f1_score: 0.4024
Epoch 129/500
28/28 [==============================] - 1s 44ms/step - loss: 1.0211 - f1_score:
0.6788 - val_loss: 2.1540 - val_f1_score: 0.4197
Epoch 130/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9825 - f1_score:
0.6902 - val_loss: 2.0932 - val_f1_score: 0.4539
Epoch 131/500
28/28 [==============================] - 1s 46ms/step - loss: 0.9966 - f1_score:
0.6882 - val_loss: 2.1740 - val_f1_score: 0.4351
Epoch 132/500
28/28 [==============================] - 1s 47ms/step - loss: 0.9572 - f1_score:
0.6969 - val_loss: 2.1295 - val_f1_score: 0.4543
Epoch 133/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 0.9963 - f1_score:
0.6919 - val_loss: 2.1342 - val_f1_score: 0.4457
Epoch 134/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9651 - f1_score:
0.6903 - val_loss: 2.1510 - val_f1_score: 0.4330
Epoch 135/500
28/28 [==============================] - 1s 43ms/step - loss: 1.0047 - f1_score:
0.6750 - val_loss: 2.2081 - val_f1_score: 0.4019
Epoch 136/500
28/28 [==============================] - 1s 43ms/step - loss: 0.9699 - f1_score:
0.6993 - val_loss: 2.0952 - val_f1_score: 0.4388
Epoch 137/500
28/28 [==============================] - 1s 43ms/step - loss: 0.9722 - f1_score:
0.6960 - val_loss: 2.0608 - val_f1_score: 0.4421
Epoch 138/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9625 - f1_score:
0.6983 - val_loss: 2.1546 - val_f1_score: 0.4270
Epoch 139/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9992 - f1_score:
0.6864 - val_loss: 2.1625 - val_f1_score: 0.4187
Epoch 140/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9350 - f1_score:
0.7040 - val_loss: 2.1426 - val_f1_score: 0.4470
Epoch 141/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9700 - f1_score:
0.6852 - val_loss: 2.0701 - val_f1_score: 0.4517
Epoch 142/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9524 - f1_score:
0.6923 - val_loss: 2.1705 - val_f1_score: 0.4295
Epoch 143/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9266 - f1_score:
0.7126 - val_loss: 2.1456 - val_f1_score: 0.4265
Epoch 144/500
28/28 [==============================] - 1s 44ms/step - loss: 0.9098 - f1_score:
0.6968 - val_loss: 2.1517 - val_f1_score: 0.4212
Epoch 145/500
28/28 [==============================] - 1s 43ms/step - loss: 0.9227 - f1_score:
0.7045 - val_loss: 2.1843 - val_f1_score: 0.3936
Epoch 146/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9299 - f1_score:
0.7099 - val_loss: 2.1715 - val_f1_score: 0.4215
Epoch 147/500
28/28 [==============================] - 1s 46ms/step - loss: 0.9102 - f1_score:
0.7007 - val_loss: 2.1864 - val_f1_score: 0.4168
Epoch 148/500
28/28 [==============================] - 1s 41ms/step - loss: 0.9524 - f1_score:
0.6951 - val_loss: 2.1328 - val_f1_score: 0.4375
Epoch 149/500
```

```
28/28 [==============================] - 1s 46ms/step - loss: 0.9237 - f1_score:
0.7059 - val_loss: 2.1108 - val_f1_score: 0.4578
Epoch 150/500
27/28 [===========================>..] - ETA: 0s - loss: 0.9315 - f1_score:
0.7084

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 7s 241ms/step - loss: 0.9347 -
f1_score: 0.7065 - val_loss: 2.1122 - val_f1_score: 0.4800
Epoch 151/500
28/28 [==============================] - 1s 42ms/step - loss: 0.9158 - f1_score:
0.7018 - val_loss: 2.0570 - val_f1_score: 0.4559
Epoch 152/500
28/28 [==============================] - 1s 41ms/step - loss: 0.8624 - f1_score:
0.7234 - val_loss: 2.1097 - val_f1_score: 0.4707
Epoch 153/500
28/28 [==============================] - 1s 43ms/step - loss: 0.8907 - f1_score:
0.7150 - val_loss: 2.1275 - val_f1_score: 0.4265
Epoch 154/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8570 - f1_score:
0.7298 - val_loss: 2.2188 - val_f1_score: 0.4506
Epoch 155/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8886 - f1_score:
0.7193 - val_loss: 2.1022 - val_f1_score: 0.4674
Epoch 156/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8793 - f1_score:
0.7156 - val_loss: 2.1219 - val_f1_score: 0.4590
Epoch 157/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8596 - f1_score:
0.7144 - val_loss: 2.1164 - val_f1_score: 0.4364
Epoch 158/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8657 - f1_score:
0.7132 - val_loss: 2.1391 - val_f1_score: 0.4282
Epoch 159/500
28/28 [==============================] - 1s 46ms/step - loss: 0.8574 - f1_score:
0.7301 - val_loss: 2.1990 - val_f1_score: 0.4632
Epoch 160/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8372 - f1_score:
0.7282 - val_loss: 2.0597 - val_f1_score: 0.4743
Epoch 161/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8817 - f1_score:
0.7278 - val_loss: 2.0831 - val_f1_score: 0.4544
Epoch 162/500
```

```
28/28 [==============================] - 1s 46ms/step - loss: 0.8586 - f1_score:
0.7300 - val_loss: 2.1021 - val_f1_score: 0.4711
Epoch 163/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8309 - f1_score:
0.7386 - val_loss: 2.0984 - val_f1_score: 0.4633
Epoch 164/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8485 - f1_score:
0.7303 - val_loss: 2.0760 - val_f1_score: 0.4711
Epoch 165/500
28/28 [==============================] - 1s 48ms/step - loss: 0.8348 - f1_score:
0.7317 - val_loss: 2.0904 - val_f1_score: 0.4720
Epoch 166/500
27/28 [============================>..] - ETA: 0s - loss: 0.8281 - f1_score:
0.7298

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 6s 207ms/step - loss: 0.8353 -
f1_score: 0.7285 - val_loss: 2.1758 - val_f1_score: 0.4913
Epoch 167/500
28/28 [==============================] - 1s 50ms/step - loss: 0.8357 - f1_score:
0.7348 - val_loss: 2.1210 - val_f1_score: 0.4674
Epoch 168/500
28/28 [==============================] - 1s 48ms/step - loss: 0.7877 - f1_score:
0.7488 - val_loss: 2.1191 - val_f1_score: 0.4700
Epoch 169/500
28/28 [==============================] - 1s 43ms/step - loss: 0.7979 - f1_score:
0.7439 - val_loss: 2.1249 - val_f1_score: 0.4590
Epoch 170/500
28/28 [==============================] - 1s 40ms/step - loss: 0.8171 - f1_score:
0.7375 - val_loss: 2.1733 - val_f1_score: 0.4598
Epoch 171/500
28/28 [==============================] - 1s 40ms/step - loss: 0.8052 - f1_score:
0.7461 - val_loss: 2.1438 - val_f1_score: 0.4809
Epoch 172/500
28/28 [==============================] - 1s 39ms/step - loss: 0.7944 - f1_score:
0.7430 - val_loss: 2.1553 - val_f1_score: 0.4654
Epoch 173/500
28/28 [==============================] - 1s 40ms/step - loss: 0.7871 - f1_score:
0.7494 - val_loss: 2.2284 - val_f1_score: 0.4546
Epoch 174/500
28/28 [==============================] - 1s 40ms/step - loss: 0.7656 - f1_score:
0.7435 - val_loss: 2.1773 - val_f1_score: 0.4559
Epoch 175/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.7774 - f1_score:
0.7533 - val_loss: 2.0951 - val_f1_score: 0.4590
Epoch 176/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7832 - f1_score:
0.7533 - val_loss: 2.1441 - val_f1_score: 0.4585
Epoch 177/500
28/28 [==============================] - 1s 42ms/step - loss: 0.7959 - f1_score:
0.7536 - val_loss: 2.1078 - val_f1_score: 0.4555
Epoch 178/500
28/28 [==============================] - 1s 43ms/step - loss: 0.7821 - f1_score:
0.7560 - val_loss: 2.1066 - val_f1_score: 0.4570
Epoch 179/500
28/28 [==============================] - 1s 44ms/step - loss: 0.7630 - f1_score:
0.7522 - val_loss: 2.0921 - val_f1_score: 0.4653
Epoch 180/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7494 - f1_score:
0.7552 - val_loss: 2.1373 - val_f1_score: 0.4403
Epoch 181/500
28/28 [==============================] - 1s 46ms/step - loss: 0.8032 - f1_score:
0.7448 - val_loss: 2.1142 - val_f1_score: 0.4585
Epoch 182/500
28/28 [==============================] - 1s 45ms/step - loss: 0.7756 - f1_score:
0.7505 - val_loss: 2.1468 - val_f1_score: 0.4364
Epoch 183/500
28/28 [==============================] - 1s 45ms/step - loss: 0.7143 - f1_score:
0.7682 - val_loss: 2.2043 - val_f1_score: 0.4626
Epoch 184/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7576 - f1_score:
0.7627 - val_loss: 2.2602 - val_f1_score: 0.4563
Epoch 185/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7405 - f1_score:
0.7607 - val_loss: 2.1696 - val_f1_score: 0.4501
Epoch 186/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7427 - f1_score:
0.7619 - val_loss: 2.1955 - val_f1_score: 0.4669
Epoch 187/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7488 - f1_score:
0.7612 - val_loss: 2.1475 - val_f1_score: 0.4587
Epoch 188/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7322 - f1_score:
0.7655 - val_loss: 2.1036 - val_f1_score: 0.4725
Epoch 189/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7328 - f1_score:
0.7642 - val_loss: 2.1898 - val_f1_score: 0.4697
Epoch 190/500
28/28 [==============================] - 1s 49ms/step - loss: 0.7205 - f1_score:
0.7702 - val_loss: 2.1705 - val_f1_score: 0.4745
Epoch 191/500
```

```
28/28 [==============================] - 1s 47ms/step - loss: 0.7175 - f1_score:
0.7595 - val_loss: 2.1460 - val_f1_score: 0.4623
Epoch 192/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7191 - f1_score:
0.7668 - val_loss: 2.2539 - val_f1_score: 0.4531
Epoch 193/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7247 - f1_score:
0.7572 - val_loss: 2.1169 - val_f1_score: 0.4366
Epoch 194/500
28/28 [==============================] - 1s 45ms/step - loss: 0.7421 - f1_score:
0.7531 - val_loss: 2.1628 - val_f1_score: 0.4354
Epoch 195/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7398 - f1_score:
0.7539 - val_loss: 2.1255 - val_f1_score: 0.4729
Epoch 196/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6988 - f1_score:
0.7692 - val_loss: 2.2369 - val_f1_score: 0.4556
Epoch 197/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7159 - f1_score:
0.7676 - val_loss: 2.2455 - val_f1_score: 0.4422
Epoch 198/500
28/28 [==============================] - 1s 42ms/step - loss: 0.6853 - f1_score:
0.7788 - val_loss: 2.1923 - val_f1_score: 0.4759
Epoch 199/500
27/28 [===========================>..] - ETA: 0s - loss: 0.6919 - f1_score:
0.7858

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

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28/28 [==============================] - 4s 159ms/step - loss: 0.6906 -
f1_score: 0.7871 - val_loss: 2.1272 - val_f1_score: 0.4927
Epoch 200/500
28/28 [==============================] - 1s 42ms/step - loss: 0.6954 - f1_score:
0.7726 - val_loss: 2.1433 - val_f1_score: 0.4555
Epoch 201/500
28/28 [==============================] - 1s 39ms/step - loss: 0.6968 - f1_score:
0.7775 - val_loss: 2.1589 - val_f1_score: 0.4726
Epoch 202/500
28/28 [==============================] - 1s 39ms/step - loss: 0.6781 - f1_score:
0.7838 - val_loss: 2.1393 - val_f1_score: 0.4714
Epoch 203/500
28/28 [==============================] - 1s 42ms/step - loss: 0.7115 - f1_score:
0.7726 - val_loss: 2.2054 - val_f1_score: 0.4481
Epoch 204/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.6618 - f1_score:
0.7808 - val_loss: 2.1489 - val_f1_score: 0.4577
Epoch 205/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6963 - f1_score:
0.7745 - val_loss: 2.1687 - val_f1_score: 0.4566
Epoch 206/500
28/28 [==============================] - 1s 41ms/step - loss: 0.6935 - f1_score:
0.7750 - val_loss: 2.1914 - val_f1_score: 0.4526
Epoch 207/500
28/28 [==============================] - 1s 41ms/step - loss: 0.6884 - f1_score:
0.7701 - val_loss: 2.1084 - val_f1_score: 0.4882
Epoch 208/500
28/28 [==============================] - 1s 43ms/step - loss: 0.6467 - f1_score:
0.7906 - val_loss: 2.1269 - val_f1_score: 0.4830
Epoch 209/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6874 - f1_score:
0.7858 - val_loss: 2.2990 - val_f1_score: 0.4530
Epoch 210/500
28/28 [==============================] - 1s 44ms/step - loss: 0.6875 - f1_score:
0.7733 - val_loss: 2.0805 - val_f1_score: 0.4815
Epoch 211/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6384 - f1_score:
0.7879 - val_loss: 2.2151 - val_f1_score: 0.4828
Epoch 212/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6757 - f1_score:
0.7803 - val_loss: 2.1291 - val_f1_score: 0.4605
Epoch 213/500
28/28 [==============================] - 1s 44ms/step - loss: 0.6851 - f1_score:
0.7755 - val_loss: 2.0882 - val_f1_score: 0.4704
Epoch 214/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6535 - f1_score:
0.7883 - val_loss: 2.2776 - val_f1_score: 0.4532
Epoch 215/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6661 - f1_score:
0.7842 - val_loss: 2.1543 - val_f1_score: 0.4659
Epoch 216/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6444 - f1_score:
0.7906 - val_loss: 2.1790 - val_f1_score: 0.4574
Epoch 217/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6508 - f1_score:
0.7856 - val_loss: 2.1079 - val_f1_score: 0.4891
Epoch 218/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6506 - f1_score:
0.7808 - val_loss: 2.1347 - val_f1_score: 0.4839
Epoch 219/500
28/28 [==============================] - 1s 50ms/step - loss: 0.6361 - f1_score:
0.7941 - val_loss: 2.2155 - val_f1_score: 0.4769
Epoch 220/500
```

```
28/28 [==============================] - 1s 46ms/step - loss: 0.6219 - f1_score:
0.7997 - val_loss: 2.2541 - val_f1_score: 0.4737
Epoch 221/500
28/28 [==============================] - 1s 50ms/step - loss: 0.6652 - f1_score:
0.7722 - val_loss: 2.2240 - val_f1_score: 0.4735
Epoch 222/500
27/28 [===========================>..] - ETA: 0s - loss: 0.6272 - f1_score:
0.8002

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INFO:tensorflow:Assets written to: 1 1DCNN/assets

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28/28 [==============================] - 5s 199ms/step - loss: 0.6267 -
f1_score: 0.8014 - val_loss: 2.1693 - val_f1_score: 0.5213
Epoch 223/500
28/28 [==============================] - 1s 39ms/step - loss: 0.6616 - f1_score:
0.7878 - val_loss: 2.2148 - val_f1_score: 0.4863
Epoch 224/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6328 - f1_score:
0.7998 - val_loss: 2.1127 - val_f1_score: 0.5029
Epoch 225/500
28/28 [==============================] - 1s 41ms/step - loss: 0.6298 - f1_score:
0.7927 - val_loss: 2.2281 - val_f1_score: 0.4898
Epoch 226/500
28/28 [==============================] - 1s 42ms/step - loss: 0.6433 - f1_score:
0.7867 - val_loss: 2.1162 - val_f1_score: 0.4791
Epoch 227/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5895 - f1_score:
0.8168 - val_loss: 2.2043 - val_f1_score: 0.4436
Epoch 228/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6598 - f1_score:
0.7879 - val_loss: 2.1828 - val_f1_score: 0.4749
Epoch 229/500
28/28 [==============================] - 1s 41ms/step - loss: 0.6150 - f1_score:
0.7966 - val_loss: 2.0956 - val_f1_score: 0.4806
Epoch 230/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5928 - f1_score:
0.8036 - val_loss: 2.2097 - val_f1_score: 0.4650
Epoch 231/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6170 - f1_score:
0.8030 - val_loss: 2.1742 - val_f1_score: 0.4630
Epoch 232/500
28/28 [==============================] - 1s 41ms/step - loss: 0.6395 - f1_score:
0.7826 - val_loss: 2.1960 - val_f1_score: 0.4563
Epoch 233/500
```

```
28/28 [==============================] - 1s 43ms/step - loss: 0.6212 - f1_score:
0.7899 - val_loss: 2.1716 - val_f1_score: 0.4614
Epoch 234/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6070 - f1_score:
0.7955 - val_loss: 2.1526 - val_f1_score: 0.4643
Epoch 235/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6087 - f1_score:
0.7937 - val_loss: 2.1135 - val_f1_score: 0.4679
Epoch 236/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6345 - f1_score:
0.7988 - val_loss: 2.2477 - val_f1_score: 0.4465
Epoch 237/500
28/28 [==============================] - 1s 39ms/step - loss: 0.6151 - f1_score:
0.7994 - val_loss: 2.2529 - val_f1_score: 0.4786
Epoch 238/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6017 - f1_score:
0.8083 - val_loss: 2.2288 - val_f1_score: 0.4889
Epoch 239/500
28/28 [==============================] - 1s 42ms/step - loss: 0.6294 - f1_score:
0.7922 - val_loss: 2.1784 - val_f1_score: 0.4948
Epoch 240/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5900 - f1_score:
0.8093 - val_loss: 2.2154 - val_f1_score: 0.4429
Epoch 241/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5877 - f1_score:
0.8044 - val_loss: 2.1657 - val_f1_score: 0.4522
Epoch 242/500
28/28 [==============================] - 1s 44ms/step - loss: 0.6009 - f1_score:
0.8073 - val_loss: 2.2240 - val_f1_score: 0.4752
Epoch 243/500
28/28 [==============================] - 1s 40ms/step - loss: 0.6025 - f1_score:
0.8023 - val_loss: 2.1851 - val_f1_score: 0.4575
Epoch 244/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5708 - f1_score:
0.8161 - val_loss: 2.1564 - val_f1_score: 0.4543
Epoch 245/500
28/28 [==============================] - 1s 43ms/step - loss: 0.5510 - f1_score:
0.8103 - val_loss: 2.1970 - val_f1_score: 0.4613
Epoch 246/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6011 - f1_score:
0.8028 - val_loss: 2.1968 - val_f1_score: 0.4888
Epoch 247/500
28/28 [==============================] - 1s 43ms/step - loss: 0.5655 - f1_score:
0.8071 - val_loss: 2.2103 - val_f1_score: 0.5103
Epoch 248/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5898 - f1_score:
0.8100 - val_loss: 2.2809 - val_f1_score: 0.4504
Epoch 249/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.5690 - f1_score:
0.8174 - val_loss: 2.2446 - val_f1_score: 0.5094
Epoch 250/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5754 - f1_score:
0.8081 - val_loss: 2.2388 - val_f1_score: 0.4768
Epoch 251/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5579 - f1_score:
0.8206 - val_loss: 2.2755 - val_f1_score: 0.4729
Epoch 252/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5610 - f1_score:
0.8206 - val_loss: 2.2002 - val_f1_score: 0.4730
Epoch 253/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5552 - f1_score:
0.8201 - val_loss: 2.1843 - val_f1_score: 0.4809
Epoch 254/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5600 - f1_score:
0.8145 - val_loss: 2.1228 - val_f1_score: 0.5015
Epoch 255/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5647 - f1_score:
0.8149 - val_loss: 2.1965 - val_f1_score: 0.4817
Epoch 256/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5730 - f1_score:
0.8133 - val_loss: 2.1613 - val_f1_score: 0.4711
Epoch 257/500
28/28 [==============================] - 1s 44ms/step - loss: 0.5586 - f1_score:
0.8135 - val_loss: 2.2039 - val_f1_score: 0.4733
Epoch 258/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5573 - f1_score:
0.8224 - val_loss: 2.1755 - val_f1_score: 0.4743
Epoch 259/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5578 - f1_score:
0.8187 - val_loss: 2.2087 - val_f1_score: 0.4636
Epoch 260/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5435 - f1_score:
0.8330 - val_loss: 2.2344 - val_f1_score: 0.4711
Epoch 261/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5513 - f1_score:
0.8234 - val_loss: 2.1551 - val_f1_score: 0.4720
Epoch 262/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5661 - f1_score:
0.8115 - val_loss: 2.2367 - val_f1_score: 0.4640
Epoch 263/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5537 - f1_score:
0.8114 - val_loss: 2.2314 - val_f1_score: 0.4822
Epoch 264/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5394 - f1_score:
0.8135 - val_loss: 2.2185 - val_f1_score: 0.4755
Epoch 265/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.5623 - f1_score:
0.8114 - val_loss: 2.2357 - val_f1_score: 0.4680
Epoch 266/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5530 - f1_score:
0.8130 - val_loss: 2.2608 - val_f1_score: 0.4798
Epoch 267/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5853 - f1_score:
0.7991 - val_loss: 2.1604 - val_f1_score: 0.4684
Epoch 268/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5311 - f1_score:
0.8252 - val_loss: 2.2379 - val_f1_score: 0.4826
Epoch 269/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5614 - f1_score:
0.8149 - val_loss: 2.1313 - val_f1_score: 0.4798
Epoch 270/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5290 - f1_score:
0.8211 - val_loss: 2.2267 - val_f1_score: 0.4663
Epoch 271/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5350 - f1_score:
0.8316 - val_loss: 2.2042 - val_f1_score: 0.4682
Epoch 272/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5082 - f1_score:
0.8269 - val_loss: 2.2657 - val_f1_score: 0.4540
Epoch 273/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5535 - f1_score:
0.8113 - val_loss: 2.3463 - val_f1_score: 0.4553
Epoch 274/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5325 - f1_score:
0.8213 - val_loss: 2.2490 - val_f1_score: 0.4696
Epoch 275/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5556 - f1_score:
0.8179 - val_loss: 2.2298 - val_f1_score: 0.4466
Epoch 276/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5460 - f1_score:
0.8158 - val_loss: 2.2351 - val_f1_score: 0.4700
Epoch 277/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5640 - f1_score:
0.8194 - val_loss: 2.2101 - val_f1_score: 0.4763
Epoch 278/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5244 - f1_score:
0.8294 - val_loss: 2.2543 - val_f1_score: 0.4695
Epoch 279/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5317 - f1_score:
0.8208 - val_loss: 2.2648 - val_f1_score: 0.4777
Epoch 280/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5298 - f1_score:
0.8295 - val_loss: 2.1907 - val_f1_score: 0.4756
Epoch 281/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.5415 - f1_score:
0.8191 - val_loss: 2.2314 - val_f1_score: 0.4741
Epoch 282/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5095 - f1_score:
0.8357 - val_loss: 2.2203 - val_f1_score: 0.4556
Epoch 283/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5102 - f1_score:
0.8286 - val_loss: 2.2517 - val_f1_score: 0.4293
Epoch 284/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5083 - f1_score:
0.8365 - val_loss: 2.3046 - val_f1_score: 0.4552
Epoch 285/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5206 - f1_score:
0.8290 - val_loss: 2.2914 - val_f1_score: 0.4469
Epoch 286/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5033 - f1_score:
0.8363 - val_loss: 2.2201 - val_f1_score: 0.4542
Epoch 287/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5193 - f1_score:
0.8262 - val_loss: 2.2157 - val_f1_score: 0.4911
Epoch 288/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5269 - f1_score:
0.8305 - val_loss: 2.2273 - val_f1_score: 0.4644
Epoch 289/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5109 - f1_score:
0.8352 - val_loss: 2.2927 - val_f1_score: 0.4819
Epoch 290/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5197 - f1_score:
0.8264 - val_loss: 2.2635 - val_f1_score: 0.4606
Epoch 291/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5247 - f1_score:
0.8238 - val_loss: 2.2567 - val_f1_score: 0.4967
Epoch 292/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5051 - f1_score:
0.8312 - val_loss: 2.1596 - val_f1_score: 0.4948
Epoch 293/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4989 - f1_score:
0.8360 - val_loss: 2.2838 - val_f1_score: 0.4632
Epoch 294/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4820 - f1_score:
0.8427 - val_loss: 2.1812 - val_f1_score: 0.4938
Epoch 295/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5237 - f1_score:
0.8241 - val_loss: 2.2294 - val_f1_score: 0.4702
Epoch 296/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4665 - f1_score:
0.8349 - val_loss: 2.2793 - val_f1_score: 0.4737
Epoch 297/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.4886 - f1_score:
0.8384 - val_loss: 2.3201 - val_f1_score: 0.4857
Epoch 298/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4846 - f1_score:
0.8402 - val_loss: 2.2794 - val_f1_score: 0.4846
Epoch 299/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4707 - f1_score:
0.8459 - val_loss: 2.2800 - val_f1_score: 0.4785
Epoch 300/500
28/28 [==============================] - 1s 42ms/step - loss: 0.4864 - f1_score:
0.8493 - val_loss: 2.2349 - val_f1_score: 0.4855
Epoch 301/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4832 - f1_score:
0.8369 - val_loss: 2.3086 - val_f1_score: 0.4483
Epoch 302/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4837 - f1_score:
0.8341 - val_loss: 2.2739 - val_f1_score: 0.4684
Epoch 303/500
28/28 [==============================] - 1s 42ms/step - loss: 0.5009 - f1_score:
0.8312 - val_loss: 2.2413 - val_f1_score: 0.4884
Epoch 304/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4711 - f1_score:
0.8442 - val_loss: 2.4093 - val_f1_score: 0.4615
Epoch 305/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5017 - f1_score:
0.8344 - val_loss: 2.3883 - val_f1_score: 0.4627
Epoch 306/500
28/28 [==============================] - 1s 41ms/step - loss: 0.5263 - f1_score:
0.8230 - val_loss: 2.3482 - val_f1_score: 0.4495
Epoch 307/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5069 - f1_score:
0.8168 - val_loss: 2.2035 - val_f1_score: 0.5080
Epoch 308/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4927 - f1_score:
0.8431 - val_loss: 2.3249 - val_f1_score: 0.4842
Epoch 309/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4527 - f1_score:
0.8454 - val_loss: 2.2740 - val_f1_score: 0.4734
Epoch 310/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4749 - f1_score:
0.8491 - val_loss: 2.2660 - val_f1_score: 0.4934
Epoch 311/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4475 - f1_score:
0.8445 - val_loss: 2.2401 - val_f1_score: 0.4839
Epoch 312/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4830 - f1_score:
0.8424 - val_loss: 2.2968 - val_f1_score: 0.4800
Epoch 313/500
```

```
27/28 [==========================>..] - ETA: 0s - loss: 0.4776 - f1_score:
0.8320

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 5s 197ms/step - loss: 0.4780 -
f1_score: 0.8323 - val_loss: 2.3004 - val_f1_score: 0.5328
Epoch 314/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4620 - f1_score:
0.8375 - val_loss: 2.3037 - val_f1_score: 0.4940
Epoch 315/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4699 - f1_score:
0.8469 - val_loss: 2.2468 - val_f1_score: 0.4646
Epoch 316/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4786 - f1_score:
0.8413 - val_loss: 2.2371 - val_f1_score: 0.4812
Epoch 317/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4689 - f1_score:
0.8540 - val_loss: 2.3163 - val_f1_score: 0.4671
Epoch 318/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4539 - f1_score:
0.8552 - val_loss: 2.2709 - val_f1_score: 0.4860
Epoch 319/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4810 - f1_score:
0.8355 - val_loss: 2.2812 - val_f1_score: 0.4668
Epoch 320/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4534 - f1_score:
0.8548 - val_loss: 2.3442 - val_f1_score: 0.4452
Epoch 321/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4743 - f1_score:
0.8453 - val_loss: 2.3525 - val_f1_score: 0.4900
Epoch 322/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4582 - f1_score:
0.8429 - val_loss: 2.2403 - val_f1_score: 0.4894
Epoch 323/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4294 - f1_score:
0.8588 - val_loss: 2.3440 - val_f1_score: 0.5065
Epoch 324/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4769 - f1_score:
0.8418 - val_loss: 2.3227 - val_f1_score: 0.4815
Epoch 325/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4868 - f1_score:
0.8405 - val_loss: 2.3383 - val_f1_score: 0.4893
Epoch 326/500
```

```
28/28 [==============================] - 1s 48ms/step - loss: 0.4503 - f1_score:
0.8563 - val_loss: 2.2095 - val_f1_score: 0.5035
Epoch 327/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4630 - f1_score:
0.8479 - val_loss: 2.3024 - val_f1_score: 0.4566
Epoch 328/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4766 - f1_score:
0.8400 - val_loss: 2.3201 - val_f1_score: 0.4699
Epoch 329/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4429 - f1_score:
0.8500 - val_loss: 2.3180 - val_f1_score: 0.4955
Epoch 330/500
28/28 [==============================] - 2s 55ms/step - loss: 0.4658 - f1_score:
0.8442 - val_loss: 2.2088 - val_f1_score: 0.5029
Epoch 331/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4502 - f1_score:
0.8501 - val_loss: 2.2415 - val_f1_score: 0.4848
Epoch 332/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4263 - f1_score:
0.8556 - val_loss: 2.3451 - val_f1_score: 0.5118
Epoch 333/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4441 - f1_score:
0.8453 - val_loss: 2.2616 - val_f1_score: 0.4671
Epoch 334/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4259 - f1_score:
0.8639 - val_loss: 2.2374 - val_f1_score: 0.4895
Epoch 335/500
28/28 [==============================] - 1s 53ms/step - loss: 0.4635 - f1_score:
0.8460 - val_loss: 2.2604 - val_f1_score: 0.5141
Epoch 336/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4629 - f1_score:
0.8486 - val_loss: 2.2630 - val_f1_score: 0.5058
Epoch 337/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4198 - f1_score:
0.8580 - val_loss: 2.3450 - val_f1_score: 0.4861
Epoch 338/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4634 - f1_score:
0.8481 - val_loss: 2.2571 - val_f1_score: 0.5031
Epoch 339/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4305 - f1_score:
0.8595 - val_loss: 2.2077 - val_f1_score: 0.5095
Epoch 340/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4236 - f1_score:
0.8652 - val_loss: 2.3550 - val_f1_score: 0.4904
Epoch 341/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4830 - f1_score:
0.8390 - val_loss: 2.2379 - val_f1_score: 0.5078
Epoch 342/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.4245 - f1_score:
0.8578 - val_loss: 2.3070 - val_f1_score: 0.4853
Epoch 343/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4764 - f1_score:
0.8410 - val_loss: 2.3122 - val_f1_score: 0.4946
Epoch 344/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4315 - f1_score:
0.8637 - val_loss: 2.3218 - val_f1_score: 0.5075
Epoch 345/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4557 - f1_score:
0.8443 - val_loss: 2.2367 - val_f1_score: 0.5092
Epoch 346/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4368 - f1_score:
0.8462 - val_loss: 2.2819 - val_f1_score: 0.4889
Epoch 347/500
28/28 [==============================] - 1s 52ms/step - loss: 0.4275 - f1_score:
0.8606 - val_loss: 2.2247 - val_f1_score: 0.4932
Epoch 348/500
28/28 [==============================] - 2s 54ms/step - loss: 0.4388 - f1_score:
0.8439 - val_loss: 2.2698 - val_f1_score: 0.5074
Epoch 349/500
28/28 [==============================] - 2s 54ms/step - loss: 0.4282 - f1_score:
0.8546 - val_loss: 2.2245 - val_f1_score: 0.5039
Epoch 350/500
28/28 [==============================] - 1s 52ms/step - loss: 0.4159 - f1_score:
0.8558 - val_loss: 2.3082 - val_f1_score: 0.4980
Epoch 351/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4638 - f1_score:
0.8425 - val_loss: 2.2092 - val_f1_score: 0.4912
Epoch 352/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4259 - f1_score:
0.8569 - val_loss: 2.3556 - val_f1_score: 0.4667
Epoch 353/500
28/28 [==============================] - 1s 44ms/step - loss: 0.4500 - f1_score:
0.8555 - val_loss: 2.2792 - val_f1_score: 0.4945
Epoch 354/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4205 - f1_score:
0.8583 - val_loss: 2.2355 - val_f1_score: 0.5170
Epoch 355/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4375 - f1_score:
0.8571 - val_loss: 2.3551 - val_f1_score: 0.4935
Epoch 356/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4323 - f1_score:
0.8552 - val_loss: 2.3092 - val_f1_score: 0.4743
Epoch 357/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4496 - f1_score:
0.8412 - val_loss: 2.3708 - val_f1_score: 0.5108
Epoch 358/500
```

```
28/28 [==============================] - 1s 47ms/step - loss: 0.4363 - f1_score:
0.8575 - val_loss: 2.2915 - val_f1_score: 0.5008
Epoch 359/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4244 - f1_score:
0.8569 - val_loss: 2.3493 - val_f1_score: 0.5194
Epoch 360/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4451 - f1_score:
0.8530 - val_loss: 2.3527 - val_f1_score: 0.5031
Epoch 361/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4450 - f1_score:
0.8475 - val_loss: 2.3424 - val_f1_score: 0.4878
Epoch 362/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4390 - f1_score:
0.8557 - val_loss: 2.2535 - val_f1_score: 0.5239
Epoch 363/500
28/28 [==============================] - 1s 44ms/step - loss: 0.4264 - f1_score:
0.8565 - val_loss: 2.3650 - val_f1_score: 0.4940
Epoch 364/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4476 - f1_score:
0.8517 - val_loss: 2.3298 - val_f1_score: 0.4718
Epoch 365/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4483 - f1_score:
0.8514 - val_loss: 2.3309 - val_f1_score: 0.4995
Epoch 366/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4247 - f1_score:
0.8619 - val_loss: 2.3848 - val_f1_score: 0.5063
Epoch 367/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4563 - f1_score:
0.8502 - val_loss: 2.3588 - val_f1_score: 0.4975
Epoch 368/500
28/28 [==============================] - 1s 53ms/step - loss: 0.4046 - f1_score:
0.8618 - val_loss: 2.2897 - val_f1_score: 0.5118
Epoch 369/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3966 - f1_score:
0.8593 - val_loss: 2.2971 - val_f1_score: 0.4973
Epoch 370/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4077 - f1_score:
0.8620 - val_loss: 2.3870 - val_f1_score: 0.4982
Epoch 371/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4223 - f1_score:
0.8620 - val_loss: 2.3283 - val_f1_score: 0.5088
Epoch 372/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4211 - f1_score:
0.8604 - val_loss: 2.3438 - val_f1_score: 0.4870
Epoch 373/500
28/28 [==============================] - 1s 42ms/step - loss: 0.4147 - f1_score:
0.8573 - val_loss: 2.3763 - val_f1_score: 0.5025
Epoch 374/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.4111 - f1_score:
0.8735 - val_loss: 2.4724 - val_f1_score: 0.4827
Epoch 375/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4112 - f1_score:
0.8644 - val_loss: 2.3551 - val_f1_score: 0.4857
Epoch 376/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3975 - f1_score:
0.8709 - val_loss: 2.5859 - val_f1_score: 0.4679
Epoch 377/500
28/28 [==============================] - 1s 44ms/step - loss: 0.4129 - f1_score:
0.8569 - val_loss: 2.2449 - val_f1_score: 0.5210
Epoch 378/500
28/28 [==============================] - 1s 42ms/step - loss: 0.4026 - f1_score:
0.8642 - val_loss: 2.5094 - val_f1_score: 0.4722
Epoch 379/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4084 - f1_score:
0.8656 - val_loss: 2.3410 - val_f1_score: 0.5055
Epoch 380/500
28/28 [==============================] - 1s 42ms/step - loss: 0.4019 - f1_score:
0.8679 - val_loss: 2.3820 - val_f1_score: 0.5083
Epoch 381/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4122 - f1_score:
0.8567 - val_loss: 2.3779 - val_f1_score: 0.4868
Epoch 382/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4052 - f1_score:
0.8600 - val_loss: 2.3217 - val_f1_score: 0.4942
Epoch 383/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4093 - f1_score:
0.8656 - val_loss: 2.3126 - val_f1_score: 0.5227
Epoch 384/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3938 - f1_score:
0.8641 - val_loss: 2.3728 - val_f1_score: 0.4986
Epoch 385/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3751 - f1_score:
0.8719 - val_loss: 2.4324 - val_f1_score: 0.5106
Epoch 386/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3901 - f1_score:
0.8746 - val_loss: 2.4041 - val_f1_score: 0.4525
Epoch 387/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4321 - f1_score:
0.8607 - val_loss: 2.3931 - val_f1_score: 0.4884
Epoch 388/500
28/28 [==============================] - 1s 54ms/step - loss: 0.3924 - f1_score:
0.8730 - val_loss: 2.4060 - val_f1_score: 0.4879
Epoch 389/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3617 - f1_score:
0.8784 - val_loss: 2.4739 - val_f1_score: 0.4727
Epoch 390/500
```

```
28/28 [==============================] - 1s 48ms/step - loss: 0.3813 - f1_score:
0.8722 - val_loss: 2.3084 - val_f1_score: 0.5150
Epoch 391/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4294 - f1_score:
0.8514 - val_loss: 2.3237 - val_f1_score: 0.4926
Epoch 392/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4126 - f1_score:
0.8635 - val_loss: 2.5735 - val_f1_score: 0.4812
Epoch 393/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4337 - f1_score:
0.8490 - val_loss: 2.3868 - val_f1_score: 0.4906
Epoch 394/500
28/28 [==============================] - 2s 55ms/step - loss: 0.3903 - f1_score:
0.8715 - val_loss: 2.5496 - val_f1_score: 0.4743
Epoch 395/500
28/28 [==============================] - 1s 52ms/step - loss: 0.4494 - f1_score:
0.8512 - val_loss: 2.4935 - val_f1_score: 0.4567
Epoch 396/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4499 - f1_score:
0.8514 - val_loss: 2.4679 - val_f1_score: 0.4810
Epoch 397/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3976 - f1_score:
0.8682 - val_loss: 2.4235 - val_f1_score: 0.4880
Epoch 398/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4183 - f1_score:
0.8632 - val_loss: 2.4473 - val_f1_score: 0.4968
Epoch 399/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3630 - f1_score:
0.8800 - val_loss: 2.4158 - val_f1_score: 0.5005
Epoch 400/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3781 - f1_score:
0.8682 - val_loss: 2.4181 - val_f1_score: 0.4788
Epoch 401/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3762 - f1_score:
0.8712 - val_loss: 2.3668 - val_f1_score: 0.4882
Epoch 402/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3934 - f1_score:
0.8757 - val_loss: 2.3953 - val_f1_score: 0.5171
Epoch 403/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3904 - f1_score:
0.8701 - val_loss: 2.3032 - val_f1_score: 0.4962
Epoch 404/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3842 - f1_score:
0.8636 - val_loss: 2.3893 - val_f1_score: 0.4952
Epoch 405/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4022 - f1_score:
0.8684 - val_loss: 2.4364 - val_f1_score: 0.5104
Epoch 406/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.3702 - f1_score:
0.8770 - val_loss: 2.4196 - val_f1_score: 0.4824
Epoch 407/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3566 - f1_score:
0.8794 - val_loss: 2.5195 - val_f1_score: 0.5016
Epoch 408/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3609 - f1_score:
0.8792 - val_loss: 2.3857 - val_f1_score: 0.5045
Epoch 409/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3792 - f1_score:
0.8723 - val_loss: 2.3862 - val_f1_score: 0.5064
Epoch 410/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3931 - f1_score:
0.8729 - val_loss: 2.3844 - val_f1_score: 0.5146
Epoch 411/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4039 - f1_score:
0.8632 - val_loss: 2.4807 - val_f1_score: 0.4921
Epoch 412/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3792 - f1_score:
0.8725 - val_loss: 2.4364 - val_f1_score: 0.4943
Epoch 413/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3693 - f1_score:
0.8755 - val_loss: 2.3369 - val_f1_score: 0.5146
Epoch 414/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4100 - f1_score:
0.8619

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op while
saving (showing 1 of 1). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1DCNN/assets

INFO:tensorflow:Assets written to: 1 1DCNN/assets

28/28 [==============================] - 8s 282ms/step - loss: 0.4104 -
f1_score: 0.8628 - val_loss: 2.4444 - val_f1_score: 0.5510
Epoch 415/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4164 - f1_score:
0.8598 - val_loss: 2.3924 - val_f1_score: 0.4908
Epoch 416/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3814 - f1_score:
0.8765 - val_loss: 2.4917 - val_f1_score: 0.4889
Epoch 417/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3567 - f1_score:
0.8806 - val_loss: 2.4026 - val_f1_score: 0.4879
Epoch 418/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3780 - f1_score:
0.8776 - val_loss: 2.4667 - val_f1_score: 0.4925
Epoch 419/500
```

```
28/28 [==============================] - 1s 52ms/step - loss: 0.3454 - f1_score:
0.8860 - val_loss: 2.5016 - val_f1_score: 0.4772
Epoch 420/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4104 - f1_score:
0.8650 - val_loss: 2.5828 - val_f1_score: 0.4638
Epoch 421/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3955 - f1_score:
0.8576 - val_loss: 2.3999 - val_f1_score: 0.5103
Epoch 422/500
28/28 [==============================] - 1s 53ms/step - loss: 0.4042 - f1_score:
0.8695 - val_loss: 2.4226 - val_f1_score: 0.5067
Epoch 423/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3710 - f1_score:
0.8753 - val_loss: 2.4565 - val_f1_score: 0.4885
Epoch 424/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4069 - f1_score:
0.8636 - val_loss: 2.6023 - val_f1_score: 0.4821
Epoch 425/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3572 - f1_score:
0.8790 - val_loss: 2.4546 - val_f1_score: 0.4671
Epoch 426/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3715 - f1_score:
0.8709 - val_loss: 2.5739 - val_f1_score: 0.4841
Epoch 427/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3819 - f1_score:
0.8714 - val_loss: 2.5786 - val_f1_score: 0.4776
Epoch 428/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3691 - f1_score:
0.8738 - val_loss: 2.3428 - val_f1_score: 0.5036
Epoch 429/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3707 - f1_score:
0.8778 - val_loss: 2.4069 - val_f1_score: 0.4762
Epoch 430/500
28/28 [==============================] - 1s 44ms/step - loss: 0.3480 - f1_score:
0.8760 - val_loss: 2.3709 - val_f1_score: 0.4965
Epoch 431/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3657 - f1_score:
0.8763 - val_loss: 2.4435 - val_f1_score: 0.5024
Epoch 432/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3697 - f1_score:
0.8785 - val_loss: 2.4161 - val_f1_score: 0.5156
Epoch 433/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3872 - f1_score:
0.8676 - val_loss: 2.4795 - val_f1_score: 0.4951
Epoch 434/500
28/28 [==============================] - 1s 43ms/step - loss: 0.4055 - f1_score:
0.8692 - val_loss: 2.4137 - val_f1_score: 0.4984
Epoch 435/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.3919 - f1_score:
0.8730 - val_loss: 2.4731 - val_f1_score: 0.5074
Epoch 436/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3721 - f1_score:
0.8710 - val_loss: 2.4999 - val_f1_score: 0.5149
Epoch 437/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3536 - f1_score:
0.8706 - val_loss: 2.4728 - val_f1_score: 0.4940
Epoch 438/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3662 - f1_score:
0.8735 - val_loss: 2.4901 - val_f1_score: 0.4804
Epoch 439/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3472 - f1_score:
0.8761 - val_loss: 2.5437 - val_f1_score: 0.4989
Epoch 440/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3865 - f1_score:
0.8693 - val_loss: 2.4710 - val_f1_score: 0.4820
Epoch 441/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3886 - f1_score:
0.8774 - val_loss: 2.4413 - val_f1_score: 0.4833
Epoch 442/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3476 - f1_score:
0.8847 - val_loss: 2.4421 - val_f1_score: 0.4929
Epoch 443/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3004 - f1_score:
0.9023 - val_loss: 2.5204 - val_f1_score: 0.4645
Epoch 444/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4043 - f1_score:
0.8643 - val_loss: 2.3550 - val_f1_score: 0.5043
Epoch 445/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3804 - f1_score:
0.8695 - val_loss: 2.4511 - val_f1_score: 0.5144
Epoch 446/500
28/28 [==============================] - 2s 56ms/step - loss: 0.3730 - f1_score:
0.8746 - val_loss: 2.5110 - val_f1_score: 0.4947
Epoch 447/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3758 - f1_score:
0.8697 - val_loss: 2.3535 - val_f1_score: 0.5321
Epoch 448/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3385 - f1_score:
0.8857 - val_loss: 2.4357 - val_f1_score: 0.5006
Epoch 449/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3557 - f1_score:
0.8777 - val_loss: 2.5803 - val_f1_score: 0.4947
Epoch 450/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3547 - f1_score:
0.8808 - val_loss: 2.4986 - val_f1_score: 0.5100
Epoch 451/500
```

```
28/28 [==============================] - 1s 48ms/step - loss: 0.3529 - f1_score:
0.8840 - val_loss: 2.6158 - val_f1_score: 0.4845
Epoch 452/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3520 - f1_score:
0.8864 - val_loss: 2.5227 - val_f1_score: 0.5017
Epoch 453/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3580 - f1_score:
0.8764 - val_loss: 2.3990 - val_f1_score: 0.5037
Epoch 454/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3433 - f1_score:
0.8870 - val_loss: 2.5959 - val_f1_score: 0.4790
Epoch 455/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3464 - f1_score:
0.8866 - val_loss: 2.4201 - val_f1_score: 0.4967
Epoch 456/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3458 - f1_score:
0.8873 - val_loss: 2.5511 - val_f1_score: 0.4997
Epoch 457/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3495 - f1_score:
0.8854 - val_loss: 2.4237 - val_f1_score: 0.5000
Epoch 458/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3468 - f1_score:
0.8833 - val_loss: 2.4890 - val_f1_score: 0.4883
Epoch 459/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3622 - f1_score:
0.8825 - val_loss: 2.4698 - val_f1_score: 0.4818
Epoch 460/500
28/28 [==============================] - 2s 54ms/step - loss: 0.3601 - f1_score:
0.8769 - val_loss: 2.4198 - val_f1_score: 0.4807
Epoch 461/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3749 - f1_score:
0.8734 - val_loss: 2.4138 - val_f1_score: 0.4734
Epoch 462/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3555 - f1_score:
0.8783 - val_loss: 2.3885 - val_f1_score: 0.4994
Epoch 463/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3479 - f1_score:
0.8879 - val_loss: 2.6667 - val_f1_score: 0.4661
Epoch 464/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3994 - f1_score:
0.8695 - val_loss: 2.4332 - val_f1_score: 0.4736
Epoch 465/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3426 - f1_score:
0.8847 - val_loss: 2.4071 - val_f1_score: 0.5182
Epoch 466/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3604 - f1_score:
0.8835 - val_loss: 2.4970 - val_f1_score: 0.4566
Epoch 467/500
```

```
28/28 [==============================] - 1s 39ms/step - loss: 0.3421 - f1_score:
0.8829 - val_loss: 2.4274 - val_f1_score: 0.5099
Epoch 468/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3253 - f1_score:
0.8879 - val_loss: 2.4600 - val_f1_score: 0.5063
Epoch 469/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3360 - f1_score:
0.8894 - val_loss: 2.4837 - val_f1_score: 0.5079
Epoch 470/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3359 - f1_score:
0.8854 - val_loss: 2.5384 - val_f1_score: 0.4672
Epoch 471/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3413 - f1_score:
0.8851 - val_loss: 2.4326 - val_f1_score: 0.4844
Epoch 472/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3177 - f1_score:
0.8969 - val_loss: 2.7352 - val_f1_score: 0.4606
Epoch 473/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3475 - f1_score:
0.8870 - val_loss: 2.5122 - val_f1_score: 0.4903
Epoch 474/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3611 - f1_score:
0.8838 - val_loss: 2.4888 - val_f1_score: 0.5031
Epoch 475/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3364 - f1_score:
0.8817 - val_loss: 2.5364 - val_f1_score: 0.5030
Epoch 476/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3651 - f1_score:
0.8783 - val_loss: 2.4413 - val_f1_score: 0.5174
Epoch 477/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3608 - f1_score:
0.8704 - val_loss: 2.5263 - val_f1_score: 0.4943
Epoch 478/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3301 - f1_score:
0.8878 - val_loss: 2.5599 - val_f1_score: 0.4939
Epoch 479/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3242 - f1_score:
0.8920 - val_loss: 2.5788 - val_f1_score: 0.4580
Epoch 480/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3417 - f1_score:
0.8872 - val_loss: 2.4111 - val_f1_score: 0.5002
Epoch 481/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3530 - f1_score:
0.8765 - val_loss: 2.5468 - val_f1_score: 0.4762
Epoch 482/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3769 - f1_score:
0.8725 - val_loss: 2.4810 - val_f1_score: 0.5062
Epoch 483/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.3539 - f1_score:
0.8799 - val_loss: 2.4840 - val_f1_score: 0.4797
Epoch 484/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3304 - f1_score:
0.8965 - val_loss: 2.5057 - val_f1_score: 0.4798
Epoch 485/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3447 - f1_score:
0.8850 - val_loss: 2.4886 - val_f1_score: 0.4866
Epoch 486/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3656 - f1_score:
0.8838 - val_loss: 2.6203 - val_f1_score: 0.5015
Epoch 487/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3217 - f1_score:
0.8915 - val_loss: 2.5364 - val_f1_score: 0.5005
Epoch 488/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3505 - f1_score:
0.8805 - val_loss: 2.3553 - val_f1_score: 0.5116
Epoch 489/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3455 - f1_score:
0.8818 - val_loss: 2.5315 - val_f1_score: 0.4675
Epoch 490/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3123 - f1_score:
0.8941 - val_loss: 2.6524 - val_f1_score: 0.4652
Epoch 491/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3401 - f1_score:
0.8839 - val_loss: 2.5126 - val_f1_score: 0.4903
Epoch 492/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3510 - f1_score:
0.8809 - val_loss: 2.5577 - val_f1_score: 0.4973
Epoch 493/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3425 - f1_score:
0.8850 - val_loss: 2.4112 - val_f1_score: 0.5141
Epoch 494/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3420 - f1_score:
0.8895 - val_loss: 2.5725 - val_f1_score: 0.4993
Epoch 495/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3229 - f1_score:
0.8937 - val_loss: 2.5436 - val_f1_score: 0.4715
Epoch 496/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3668 - f1_score:
0.8789 - val_loss: 2.5757 - val_f1_score: 0.4942
Epoch 497/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3301 - f1_score:
0.8904 - val_loss: 2.5171 - val_f1_score: 0.4936
Epoch 498/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3452 - f1_score:
0.8895 - val_loss: 2.5158 - val_f1_score: 0.4935
Epoch 499/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.3149 - f1_score:
0.8895 - val_loss: 2.4357 - val_f1_score: 0.5230
Epoch 500/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3133 - f1_score:
0.8906 - val_loss: 2.5949 - val_f1_score: 0.4729
```

[134]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 6ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.500     0.667         8
    BACKPACK      0.556     0.833     0.667         6
  BASKETBALL      0.769     1.000     0.870        10
         BEE      0.500     0.700     0.583        10
        BELT      0.571     1.000     0.727         4
        BITE      0.000     0.000     0.000         8
   BREAKFAST      0.000     0.000     0.000         6
      CANCER      0.571     1.000     0.727         8
   CHRISTMAS      0.154     0.333     0.211         6
    CONFUSED      1.000     0.667     0.800         6
        DARK      0.800     1.000     0.889         4
        DEAF      0.000     0.000     0.000         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      0.000     0.000     0.000         8
     DEVELOP      0.375     0.500     0.429         6
      DINNER      0.000     0.000     0.000         8
         DOG      0.625     0.833     0.714         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.200     0.250     0.222         4
         EAT      1.000     0.833     0.909         6
        EDIT      0.286     0.333     0.308         6
    ELEVATOR      0.300     0.375     0.333         8
        FINE      0.333     0.500     0.400         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.400     0.667     0.500         6
       GUESS      0.250     0.125     0.167         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.111     0.167     0.133         6
 HURDLE/TRIP      0.667     0.500     0.571         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.250     0.250     0.250         4
        LOCK      0.500     0.250     0.333         8
       LUNCH      0.182     0.250     0.211         8
```

```
       MAPLE      0.429     0.750     0.545         4
        MEAT      0.500     0.667     0.571         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.125     0.222         8
       MOVIE      0.444     0.500     0.471         8
        NOON      0.438     0.875     0.583         8
       PARTY      0.714     0.625     0.667         8
     PATIENT      0.500     0.333     0.400         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.462     0.600     0.522        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.000     0.000     0.000         4
        THEY      1.000     0.750     0.857         4
       TWINS      0.200     0.250     0.222         8
     WHATFOR      0.556     0.500     0.526        10

    accuracy                          0.500       324
   macro avg      0.498     0.498     0.473       324
weighted avg      0.495     0.500     0.471       324


/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[135]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1DCNN/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[119]:
```
hist_df = pd.read_csv('1 1DCNN/history.csv', index_col=0)
hist_df.tail()
```

[119]:

	loss	f1_score	val_loss	val_f1_score
495	0.366761	0.878911	2.575713	0.494158
496	0.330135	0.890351	2.517061	0.493626
497	0.345212	0.889460	2.515764	0.493497
498	0.314874	0.889479	2.435677	0.522970
499	0.313338	0.890630	2.594901	0.472854

[120]:

```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[121]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[122]:
```
reconstructed_model = tf.keras.models.load_model("1 1DCNN")
```

```
2023-09-11 20:13:55.328682: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-11 20:13:55.572724: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 539 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[139]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
```

```
=================================================================
 conv1d_1 (Conv1D)           (None, 129, 150)          119850

 max_pooling1d_1 (MaxPooling  (None, 12, 150)          0
 1D)

 dropout_2 (Dropout)         (None, 12, 150)           0

 flatten_1 (Flatten)         (None, 1800)              0

 dense_2 (Dense)             (None, 110)               198110

 dropout_3 (Dropout)         (None, 110)               0

 dense_3 (Dense)             (None, 50)                5550

=================================================================
Total params: 323,510
Trainable params: 323,510
Non-trainable params: 0
_________________________________________________________________
```

[140]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[140]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 129, 150)
MaxPooling1D
input:
(None, 129, 150)
output:
(None, 12, 150)
Dropout
input:
(None, 12, 150)
output:
(None, 12, 150)
Flatten
input:
(None, 12, 150)
output:
(None, 1800)
Dense
input:
(None, 1800)
output:
(None, 110)
Dropout
input:
(None, 110)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[123]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[123]:

Conv1D
MaxPooling1D
Dropout
Flatten
Dense

[141]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 8ms/step - loss: 2.4444 - f1_score:
0.5510
```

[141]:
```
[2.4443717002868652, 0.5509907603263855]
```

[142]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 9ms/step - loss: 0.0151 - f1_score:
1.0000
```

[142]:
```
[0.015102454461157322, 1.0]
```

[143]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 8ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.500     0.667         8
    BACKPACK      0.545     1.000     0.706         6
  BASKETBALL      0.769     1.000     0.870        10
         BEE      0.600     0.600     0.600        10
        BELT      1.000     1.000     1.000         4
        BITE      0.000     0.000     0.000         8
   BREAKFAST      1.000     0.333     0.500         6
      CANCER      0.500     1.000     0.667         8
   CHRISTMAS      0.400     0.333     0.364         6
    CONFUSED      1.000     0.667     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.300     0.500     0.375         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      0.333     0.250     0.286         8
     DEVELOP      0.400     0.333     0.364         6
      DINNER      0.000     0.000     0.000         8
         DOG      0.857     1.000     0.923         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.200     0.250     0.222         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.250     0.500     0.333         6
    ELEVATOR      0.286     0.250     0.267         8
        FINE      0.400     0.500     0.444         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.500     0.667     0.571         6
       GUESS      0.500     0.250     0.333         8
   HALLOWEEN      0.889     1.000     0.941         8
    HOSPITAL      0.222     0.333     0.267         6
 HURDLE/TRIP      1.000     0.500     0.667         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.400     0.500     0.444         4
        LOCK      1.000     0.375     0.545         8
       LUNCH      0.375     0.375     0.375         8
       MAPLE      0.750     0.750     0.750         4
        MEAT      0.545     1.000     0.706         6
    MECHANIC      0.667     1.000     0.800         4
  MICROSCOPE      0.875     0.875     0.875         8
       MOVIE      0.400     0.500     0.444         8
        NOON      0.545     0.750     0.632         8
       PARTY      0.714     0.625     0.667         8
     PATIENT      0.167     0.167     0.167         6
       RAZOR      0.500     0.500     0.500         4
       RIVER      0.600     0.500     0.545         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.429     0.600     0.500        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.000     0.000     0.000         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.333     0.375     0.353         8
     WHATFOR      0.500     0.400     0.444        10

    accuracy                          0.565       324
   macro avg      0.578     0.570     0.551       324
weighted avg      0.571     0.565     0.545       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

3.5 Hyperparameter Tuning 2 1D CNN Layers

[119]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='gelu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[2, 3, 4, 5, 6, 7, 8, 9, 10],
                       default=2,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
                values=[2, 3, 4, 5, 6, 7, 8, 9, 10],
                default=2,
            )))
        model.add(
            Conv1D(filters=hp.Int('filters_2',
                                  min_value=50,
                                  max_value=200,
```

```
                                step=25,
                                default=150),
                kernel_size=hp.Choice(
                    'kernel_2',
                    values=[1, 2, 3, 4, 5],
                    default=2,
                ),
                activation=act_function,
                input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_2',
                values=[1, 2, 3, 4, 5],
                default=2,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.75,
                step=0.05,
            )))
        model.add(Flatten())
        model.add(
            Dense(units=hp.Int('units_2',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=90),
                  activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.5,
                step=0.05,
            )))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
```

```
                            default=0.001201687537647584)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

```
/tmp/ipykernel_1972693/1773258914.py:5: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='2_1D_CNN',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN/tuner0.json
```

[121]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 11
dense_activation (Choice)
{'default': 'gelu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5, 6, 7, 8, 9, 10],
'ordered': True}
pool_1 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5, 6, 7, 8, 9, 10],
'ordered': True}
filters_2 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_2 (Choice)
{'default': 2, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
```

```
pool_2 (Choice)
{'default': 2, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
dropout_1 (Float)
{'default': 0.75, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 90, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
{'default': 0.5, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.001201687537647584, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[122]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[123]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 08m 57s]
val_f1_score: 0.29330621659755707

Best val_f1_score So Far: 0.6954436302185059
Total elapsed time: 04h 28m 50s
INFO:tensorflow:Oracle triggered exit
```

[124]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0714 summary
Hyperparameters:
dense_activation: mish
filters_1: 125
kernel_1: 4
pool_1: 8
filters_2: 50
kernel_2: 4
```

```
pool_2: 4
dropout_1: 0.4
units_2: 110
dropout_2: 0.4
learning_rate: 0.0001715739875569636
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0713
Score: 0.6954436302185059

Trial 0723 summary
Hyperparameters:
dense_activation: elu
filters_1: 125
kernel_1: 10
pool_1: 5
filters_2: 200
kernel_2: 4
pool_2: 5
dropout_1: 0.65
units_2: 100
dropout_2: 0.15000000000000002
learning_rate: 0.00014141135967555134
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6725153923034668

Trial 0598 summary
Hyperparameters:
dense_activation: elu
filters_1: 125
kernel_1: 2
pool_1: 7
filters_2: 175
kernel_2: 1
pool_2: 3
dropout_1: 0.1
units_2: 110
dropout_2: 0.75
learning_rate: 0.0011697033399028763
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
```

```
tuner/trial_id: 0593
Score: 0.6607688367366791

Trial 0671 summary
Hyperparameters:
dense_activation: mish
filters_1: 50
kernel_1: 3
pool_1: 7
filters_2: 100
kernel_2: 5
pool_2: 2
dropout_1: 0.55
units_2: 110
dropout_2: 0.55
learning_rate: 0.0004906680052232292
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.652120053768158

Trial 0599 summary
Hyperparameters:
dense_activation: selu
filters_1: 50
kernel_1: 3
pool_1: 9
filters_2: 75
kernel_2: 1
pool_2: 4
dropout_1: 0.35000000000000003
units_2: 90
dropout_2: 0.65
learning_rate: 0.0018808082162961115
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0595
Score: 0.6305737495422363

Trial 0593 summary
Hyperparameters:
dense_activation: elu
filters_1: 125
kernel_1: 2
```

```
pool_1: 7
filters_2: 175
kernel_2: 1
pool_2: 3
dropout_1: 0.1
units_2: 110
dropout_2: 0.75
learning_rate: 0.0011697033399028763
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0583
Score: 0.6245631575584412

Trial 0701 summary
Hyperparameters:
dense_activation: relu
filters_1: 125
kernel_1: 3
pool_1: 6
filters_2: 200
kernel_2: 2
pool_2: 5
dropout_1: 0.6000000000000001
units_2: 100
dropout_2: 0.15000000000000002
learning_rate: 0.00030726550633355346
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0698
Score: 0.6158975660800934

Trial 0670 summary
Hyperparameters:
dense_activation: gelu
filters_1: 200
kernel_1: 9
pool_1: 9
filters_2: 200
kernel_2: 3
pool_2: 5
dropout_1: 0.05
units_2: 110
dropout_2: 0.4
learning_rate: 0.00011140229824079518
```

```
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0668
Score: 0.6020726263523102

Trial 0715 summary
Hyperparameters:
dense_activation: elu
filters_1: 75
kernel_1: 6
pool_1: 4
filters_2: 100
kernel_2: 5
pool_2: 3
dropout_1: 0.30000000000000004
units_2: 90
dropout_2: 0.45
learning_rate: 0.0002931259064707384
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0704
Score: 0.58294877409935

Trial 0722 summary
Hyperparameters:
dense_activation: selu
filters_1: 175
kernel_1: 8
pool_1: 8
filters_2: 125
kernel_2: 3
pool_2: 3
dropout_1: 0.35000000000000003
units_2: 100
dropout_2: 0.25
learning_rate: 0.00011654631348796121
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.5742192268371582
```

[125]:
```
best_model = tuner.get_best_models(num_models=1)[0]
```

[126]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 127, 125)          199625

 max_pooling1d (MaxPooling1D  (None, 15, 125)          0
 )

 conv1d_1 (Conv1D)           (None, 12, 50)            25050

 max_pooling1d_1 (MaxPooling  (None, 3, 50)            0
 1D)

 dropout (Dropout)           (None, 3, 50)             0

 flatten (Flatten)           (None, 150)               0

 dense (Dense)               (None, 110)               16610

 dropout_1 (Dropout)         (None, 110)               0

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 246,835
Trainable params: 246,835
Non-trainable params: 0
_________________________________________________________________
```

[127]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[127]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 127, 125)
MaxPooling1D
input: (None, 127, 125)
output: (None, 15, 125)
Conv1D
input: (None, 15, 125)
output: (None, 12, 50)
MaxPooling1D
input: (None, 12, 50)
output: (None, 3, 50)
Dropout
input: (None, 3, 50)
output: (None, 3, 50)
Flatten
input: (None, 3, 50)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 110)
Dropout
input: (None, 110)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[128]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 12ms/step - loss: 1.2194 - f1_score:
0.6954
```

[129]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 10ms/step - loss: 0.4310 - f1_score:
0.9274
```

[130]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 7ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.750     0.857         8
    BACKPACK      0.600     1.000     0.750         6
  BASKETBALL      0.714     1.000     0.833        10
         BEE      0.778     0.700     0.737        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.750     0.857         8
   BREAKFAST      0.429     0.500     0.462         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.667     0.333     0.444         6
      DECIDE      1.000     0.333     0.500         6
      DEMAND      1.000     0.375     0.545         8
     DEVELOP      0.400     0.667     0.500         6
      DINNER      1.000     1.000     1.000         8
         DOG      0.500     0.667     0.571         6
    DOWNSIZE      0.800     1.000     0.889         8
        DRAG      1.000     0.500     0.667         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.455     0.625     0.526         8
        FINE      0.286     0.500     0.364         4
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.833     0.833     0.833         6
       GUESS      1.000     1.000     1.000         8
   HALLOWEEN      1.000     1.000     1.000         8
```

```
    HOSPITAL      0.800     0.667     0.727         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.833     0.625     0.714         8
       MAPLE      0.750     0.750     0.750         4
        MEAT      0.429     0.500     0.462         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.400     0.750     0.522         8
        NOON      1.000     1.000     1.000         8
       PARTY      0.833     0.625     0.714         8
     PATIENT      0.429     0.500     0.462         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.800     0.667     0.727         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.800     0.400     0.533        10
        SINK      0.500     0.333     0.400         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.444     0.500     0.471         8
     WHATFOR      0.750     0.600     0.667        10

    accuracy                          0.713       324
   macro avg      0.741     0.697     0.695       324
weighted avg      0.754     0.713     0.710       324
```

[131]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[132]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[133]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
```

```
Epoch 1/500
27/28 [==========================>..] - ETA: 0s - loss: 3.9331 - f1_score:
0.0204

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 11s 302ms/step - loss: 3.9326 -
f1_score: 0.0210 - val_loss: 3.9142 - val_f1_score: 0.0029
Epoch 2/500
27/28 [==========================>..] - ETA: 0s - loss: 3.9137 - f1_score:
0.0206

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 4s 162ms/step - loss: 3.9145 -
f1_score: 0.0201 - val_loss: 3.9076 - val_f1_score: 0.0140
Epoch 3/500
28/28 [==============================] - 1s 45ms/step - loss: 3.9045 - f1_score:
0.0201 - val_loss: 3.8981 - val_f1_score: 0.0068
Epoch 4/500
28/28 [==============================] - 1s 46ms/step - loss: 3.8907 - f1_score:
0.0272 - val_loss: 3.8866 - val_f1_score: 0.0088
Epoch 5/500
27/28 [==========================>..] - ETA: 0s - loss: 3.8821 - f1_score:
0.0282

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 167ms/step - loss: 3.8805 -
f1_score: 0.0289 - val_loss: 3.8671 - val_f1_score: 0.0228
Epoch 6/500
28/28 [==============================] - 1s 46ms/step - loss: 3.8669 - f1_score:
0.0344 - val_loss: 3.8372 - val_f1_score: 0.0100
Epoch 7/500
27/28 [==========================>..] - ETA: 0s - loss: 3.8382 - f1_score:
0.0295
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 178ms/step - loss: 3.8364 -
f1_score: 0.0306 - val_loss: 3.8101 - val_f1_score: 0.0499
Epoch 8/500
28/28 [==============================] - 1s 46ms/step - loss: 3.8048 - f1_score:
0.0423 - val_loss: 3.7506 - val_f1_score: 0.0305
Epoch 9/500
28/28 [==============================] - 1s 44ms/step - loss: 3.7505 - f1_score:
0.0492 - val_loss: 3.7056 - val_f1_score: 0.0306
Epoch 10/500
28/28 [==============================] - 1s 45ms/step - loss: 3.6909 - f1_score:
0.0538 - val_loss: 3.6396 - val_f1_score: 0.0399
Epoch 11/500
28/28 [==============================] - 1s 46ms/step - loss: 3.6382 - f1_score:
0.0545 - val_loss: 3.5588 - val_f1_score: 0.0350
Epoch 12/500
28/28 [==============================] - 1s 46ms/step - loss: 3.5534 - f1_score:
0.0633 - val_loss: 3.4986 - val_f1_score: 0.0398
Epoch 13/500
28/28 [==============================] - 1s 45ms/step - loss: 3.5160 - f1_score:
0.0719 - val_loss: 3.4332 - val_f1_score: 0.0499
Epoch 14/500
27/28 [============================>..] - ETA: 0s - loss: 3.4577 - f1_score:
0.0785

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 175ms/step - loss: 3.4579 -
f1_score: 0.0784 - val_loss: 3.3752 - val_f1_score: 0.0794
Epoch 15/500
28/28 [==============================] - 1s 46ms/step - loss: 3.4014 - f1_score:
0.0829 - val_loss: 3.3223 - val_f1_score: 0.0660
Epoch 16/500
28/28 [==============================] - 1s 46ms/step - loss: 3.3562 - f1_score:
0.0850 - val_loss: 3.2335 - val_f1_score: 0.0669
Epoch 17/500
28/28 [==============================] - 1s 46ms/step - loss: 3.2840 - f1_score:
0.0975 - val_loss: 3.1733 - val_f1_score: 0.0794
```

```
Epoch 18/500
27/28 [==========================>..] - ETA: 0s - loss: 3.2428 - f1_score:
0.1068

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 22s 809ms/step - loss: 3.2420 -
f1_score: 0.1075 - val_loss: 3.1164 - val_f1_score: 0.0840
Epoch 19/500
27/28 [==========================>..] - ETA: 0s - loss: 3.2376 - f1_score:
0.1050

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 201ms/step - loss: 3.2391 -
f1_score: 0.1041 - val_loss: 3.0912 - val_f1_score: 0.0872
Epoch 20/500
27/28 [==========================>..] - ETA: 0s - loss: 3.1503 - f1_score:
0.1133

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 181ms/step - loss: 3.1527 -
f1_score: 0.1127 - val_loss: 3.0357 - val_f1_score: 0.1073
Epoch 21/500
27/28 [==========================>..] - ETA: 0s - loss: 3.1103 - f1_score:
0.1202

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 4s 163ms/step - loss: 3.1086 -
f1_score: 0.1218 - val_loss: 3.0080 - val_f1_score: 0.1073
```

```
Epoch 22/500
27/28 [==========================>..] - ETA: 0s - loss: 3.0712 - f1_score:
0.1203

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 178ms/step - loss: 3.0678 -
f1_score: 0.1210 - val_loss: 2.9333 - val_f1_score: 0.1151
Epoch 23/500
28/28 [==============================] - 1s 44ms/step - loss: 3.0357 - f1_score:
0.1422 - val_loss: 2.8918 - val_f1_score: 0.1048
Epoch 24/500
27/28 [==========================>..] - ETA: 0s - loss: 2.9842 - f1_score:
0.1481

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 179ms/step - loss: 2.9802 -
f1_score: 0.1505 - val_loss: 2.8409 - val_f1_score: 0.1535
Epoch 25/500
28/28 [==============================] - 1s 45ms/step - loss: 2.9453 - f1_score:
0.1607 - val_loss: 2.8045 - val_f1_score: 0.1502
Epoch 26/500
27/28 [==========================>..] - ETA: 0s - loss: 2.9376 - f1_score:
0.1558

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 182ms/step - loss: 2.9256 -
f1_score: 0.1578 - val_loss: 2.7755 - val_f1_score: 0.1624
Epoch 27/500
28/28 [==============================] - 1s 48ms/step - loss: 2.9102 - f1_score:
0.1623 - val_loss: 2.7482 - val_f1_score: 0.1503
Epoch 28/500
28/28 [==============================] - 1s 44ms/step - loss: 2.8655 - f1_score:
0.1687 - val_loss: 2.7177 - val_f1_score: 0.1536
```

```
Epoch 29/500
27/28 [==========================>..] - ETA: 0s - loss: 2.8339 - f1_score:
0.1745

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 172ms/step - loss: 2.8292 -
f1_score: 0.1755 - val_loss: 2.7105 - val_f1_score: 0.1627
Epoch 30/500
27/28 [==========================>..] - ETA: 0s - loss: 2.7982 - f1_score:
0.1799

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 225ms/step - loss: 2.7955 -
f1_score: 0.1784 - val_loss: 2.6936 - val_f1_score: 0.2003
Epoch 31/500
28/28 [==============================] - 1s 45ms/step - loss: 2.7842 - f1_score:
0.1933 - val_loss: 2.6642 - val_f1_score: 0.1794
Epoch 32/500
28/28 [==============================] - 1s 45ms/step - loss: 2.7561 - f1_score:
0.1837 - val_loss: 2.6130 - val_f1_score: 0.1636
Epoch 33/500
28/28 [==============================] - 1s 44ms/step - loss: 2.7006 - f1_score:
0.2045 - val_loss: 2.5833 - val_f1_score: 0.1939
Epoch 34/500
27/28 [==========================>..] - ETA: 0s - loss: 2.6921 - f1_score:
0.1993

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 184ms/step - loss: 2.6876 -
f1_score: 0.2004 - val_loss: 2.5776 - val_f1_score: 0.2097
Epoch 35/500
28/28 [==============================] - 1s 44ms/step - loss: 2.6577 - f1_score:
0.2131 - val_loss: 2.5411 - val_f1_score: 0.1997
```

```
Epoch 36/500
27/28 [==========================>..] - ETA: 0s - loss: 2.6518 - f1_score:
0.2136

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 4s 162ms/step - loss: 2.6463 -
f1_score: 0.2162 - val_loss: 2.5100 - val_f1_score: 0.2210
Epoch 37/500
28/28 [==============================] - 1s 44ms/step - loss: 2.6313 - f1_score:
0.2132 - val_loss: 2.5110 - val_f1_score: 0.1997
Epoch 38/500
27/28 [==========================>..] - ETA: 0s - loss: 2.5711 - f1_score:
0.2404

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 200ms/step - loss: 2.5677 -
f1_score: 0.2416 - val_loss: 2.4710 - val_f1_score: 0.2409
Epoch 39/500
27/28 [==========================>..] - ETA: 0s - loss: 2.5625 - f1_score:
0.2279

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 4s 164ms/step - loss: 2.5635 -
f1_score: 0.2269 - val_loss: 2.4418 - val_f1_score: 0.2481
Epoch 40/500
28/28 [==============================] - 1s 45ms/step - loss: 2.5489 - f1_score:
0.2400 - val_loss: 2.4574 - val_f1_score: 0.2275
Epoch 41/500
27/28 [==========================>..] - ETA: 0s - loss: 2.4993 - f1_score:
0.2551

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
```

```
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 175ms/step - loss: 2.5030 -
f1_score: 0.2562 - val_loss: 2.4428 - val_f1_score: 0.2564
Epoch 42/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5246 - f1_score:
0.2495

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 171ms/step - loss: 2.5228 -
f1_score: 0.2500 - val_loss: 2.4188 - val_f1_score: 0.2593
Epoch 43/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4860 - f1_score:
0.2485

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 165ms/step - loss: 2.4933 -
f1_score: 0.2490 - val_loss: 2.3660 - val_f1_score: 0.2797
Epoch 44/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4674 - f1_score:
0.2626

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 167ms/step - loss: 2.4713 -
f1_score: 0.2618 - val_loss: 2.3660 - val_f1_score: 0.2811
Epoch 45/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4265 - f1_score:
0.2657
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 4s 161ms/step - loss: 2.4268 -
f1_score: 0.2665 - val_loss: 2.3388 - val_f1_score: 0.3185
Epoch 46/500
27/28 [===========================>..] - ETA: 0s - loss: 2.4138 - f1_score:
0.2781

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 165ms/step - loss: 2.4152 -
f1_score: 0.2784 - val_loss: 2.3243 - val_f1_score: 0.3332
Epoch 47/500
28/28 [==============================] - 1s 47ms/step - loss: 2.3978 - f1_score:
0.2775 - val_loss: 2.2867 - val_f1_score: 0.3300
Epoch 48/500
28/28 [==============================] - 1s 45ms/step - loss: 2.3663 - f1_score:
0.2808 - val_loss: 2.2935 - val_f1_score: 0.3047
Epoch 49/500
28/28 [==============================] - 1s 45ms/step - loss: 2.3485 - f1_score:
0.2881 - val_loss: 2.2704 - val_f1_score: 0.3171
Epoch 50/500
27/28 [===========================>..] - ETA: 0s - loss: 2.3455 - f1_score:
0.2894

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 167ms/step - loss: 2.3418 -
f1_score: 0.2906 - val_loss: 2.2340 - val_f1_score: 0.3434
Epoch 51/500
27/28 [===========================>..] - ETA: 0s - loss: 2.3286 - f1_score:
0.2943

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 178ms/step - loss: 2.3309 -
f1_score: 0.2969 - val_loss: 2.2265 - val_f1_score: 0.3752
Epoch 52/500
28/28 [==============================] - 1s 46ms/step - loss: 2.3012 - f1_score:
0.2940 - val_loss: 2.2232 - val_f1_score: 0.3510
Epoch 53/500
28/28 [==============================] - 1s 46ms/step - loss: 2.2773 - f1_score:
0.3177 - val_loss: 2.2581 - val_f1_score: 0.3476
Epoch 54/500
28/28 [==============================] - 1s 45ms/step - loss: 2.3175 - f1_score:
0.2964 - val_loss: 2.2201 - val_f1_score: 0.3573
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 2.2451 - f1_score:
0.3233

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 206ms/step - loss: 2.2451 -
f1_score: 0.3233 - val_loss: 2.1746 - val_f1_score: 0.3775
Epoch 56/500
28/28 [==============================] - 1s 47ms/step - loss: 2.2432 - f1_score:
0.3221 - val_loss: 2.1679 - val_f1_score: 0.3559
Epoch 57/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2324 - f1_score:
0.3184

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 177ms/step - loss: 2.2329 -
f1_score: 0.3186 - val_loss: 2.1710 - val_f1_score: 0.3870
Epoch 58/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2185 - f1_score:
0.3096

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 167ms/step - loss: 2.2267 -
f1_score: 0.3089 - val_loss: 2.1299 - val_f1_score: 0.4010
Epoch 59/500
28/28 [==============================] - 1s 45ms/step - loss: 2.1543 - f1_score:
0.3399 - val_loss: 2.1383 - val_f1_score: 0.3874
Epoch 60/500
28/28 [==============================] - 1s 48ms/step - loss: 2.1458 - f1_score:
0.3457 - val_loss: 2.1133 - val_f1_score: 0.3943
Epoch 61/500
28/28 [==============================] - 1s 45ms/step - loss: 2.1481 - f1_score:
0.3448 - val_loss: 2.0948 - val_f1_score: 0.3974
Epoch 62/500
27/28 [============================>..] - ETA: 0s - loss: 2.1517 - f1_score:
0.3292

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 165ms/step - loss: 2.1478 -
f1_score: 0.3296 - val_loss: 2.1018 - val_f1_score: 0.4156
Epoch 63/500
27/28 [============================>..] - ETA: 0s - loss: 2.1083 - f1_score:
0.3564

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 171ms/step - loss: 2.1071 -
f1_score: 0.3559 - val_loss: 2.0692 - val_f1_score: 0.4182
Epoch 64/500
27/28 [============================>..] - ETA: 0s - loss: 2.0851 - f1_score:
0.3560

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets
```

```
28/28 [==============================] - 5s 176ms/step - loss: 2.0933 -
f1_score: 0.3569 - val_loss: 2.0766 - val_f1_score: 0.4236
Epoch 65/500
28/28 [==============================] - 1s 48ms/step - loss: 2.1016 - f1_score:
0.3470 - val_loss: 2.0245 - val_f1_score: 0.4095
Epoch 66/500
28/28 [==============================] - 1s 46ms/step - loss: 2.0614 - f1_score:
0.3653 - val_loss: 2.0776 - val_f1_score: 0.4094
Epoch 67/500
27/28 [===========================>..] - ETA: 0s - loss: 2.0454 - f1_score:
0.3626

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 179ms/step - loss: 2.0415 -
f1_score: 0.3622 - val_loss: 2.0006 - val_f1_score: 0.4444
Epoch 68/500
28/28 [==============================] - 1s 45ms/step - loss: 2.0140 - f1_score:
0.3777 - val_loss: 2.0312 - val_f1_score: 0.4268
Epoch 69/500
28/28 [==============================] - 1s 44ms/step - loss: 2.0357 - f1_score:
0.3658 - val_loss: 2.0374 - val_f1_score: 0.4273
Epoch 70/500
27/28 [===========================>..] - ETA: 0s - loss: 2.0103 - f1_score:
0.3896

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 172ms/step - loss: 2.0120 -
f1_score: 0.3884 - val_loss: 1.9676 - val_f1_score: 0.4524
Epoch 71/500
28/28 [==============================] - 1s 44ms/step - loss: 1.9998 - f1_score:
0.3867 - val_loss: 1.9898 - val_f1_score: 0.3993
Epoch 72/500
28/28 [==============================] - 1s 45ms/step - loss: 1.9523 - f1_score:
0.3983 - val_loss: 1.9571 - val_f1_score: 0.4477
Epoch 73/500
28/28 [==============================] - 1s 44ms/step - loss: 1.9377 - f1_score:
0.3898 - val_loss: 1.9618 - val_f1_score: 0.4420
Epoch 74/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 1.9292 - f1_score:
0.4043 - val_loss: 1.9510 - val_f1_score: 0.4218
Epoch 75/500
28/28 [==============================] - 1s 44ms/step - loss: 1.9247 - f1_score:
0.3918 - val_loss: 1.9290 - val_f1_score: 0.4486
Epoch 76/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9093 - f1_score:
0.4077

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 193ms/step - loss: 1.9138 -
f1_score: 0.4040 - val_loss: 1.9013 - val_f1_score: 0.4773
Epoch 77/500
28/28 [==============================] - 1s 45ms/step - loss: 1.8799 - f1_score:
0.4279 - val_loss: 1.8983 - val_f1_score: 0.4671
Epoch 78/500
28/28 [==============================] - 1s 44ms/step - loss: 1.8841 - f1_score:
0.3993 - val_loss: 1.8850 - val_f1_score: 0.4740
Epoch 79/500
28/28 [==============================] - 1s 47ms/step - loss: 1.8602 - f1_score:
0.4283 - val_loss: 1.8584 - val_f1_score: 0.4772
Epoch 80/500
28/28 [==============================] - 1s 47ms/step - loss: 1.8407 - f1_score:
0.4297 - val_loss: 1.8714 - val_f1_score: 0.4660
Epoch 81/500
28/28 [==============================] - 1s 45ms/step - loss: 1.8690 - f1_score:
0.4234 - val_loss: 1.8752 - val_f1_score: 0.4577
Epoch 82/500
28/28 [==============================] - 1s 44ms/step - loss: 1.8195 - f1_score:
0.4346 - val_loss: 1.8673 - val_f1_score: 0.4759
Epoch 83/500
27/28 [===========================>..] - ETA: 0s - loss: 1.8084 - f1_score:
0.4304

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 175ms/step - loss: 1.8029 -
f1_score: 0.4317 - val_loss: 1.8490 - val_f1_score: 0.4940
Epoch 84/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 1.7869 - f1_score:
0.4441 - val_loss: 1.8839 - val_f1_score: 0.4759
Epoch 85/500
27/28 [==========================>..] - ETA: 0s - loss: 1.7770 - f1_score:
0.4469

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 191ms/step - loss: 1.7746 -
f1_score: 0.4485 - val_loss: 1.8123 - val_f1_score: 0.5073
Epoch 86/500
28/28 [==============================] - 1s 44ms/step - loss: 1.7544 - f1_score:
0.4656 - val_loss: 1.8509 - val_f1_score: 0.4947
Epoch 87/500
28/28 [==============================] - 1s 45ms/step - loss: 1.7780 - f1_score:
0.4519 - val_loss: 1.7947 - val_f1_score: 0.5049
Epoch 88/500
28/28 [==============================] - 1s 47ms/step - loss: 1.7474 - f1_score:
0.4492 - val_loss: 1.8078 - val_f1_score: 0.4747
Epoch 89/500
28/28 [==============================] - ETA: 0s - loss: 1.6945 - f1_score:
0.4748

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 173ms/step - loss: 1.6945 -
f1_score: 0.4748 - val_loss: 1.7961 - val_f1_score: 0.5170
Epoch 90/500
28/28 [==============================] - 1s 47ms/step - loss: 1.7009 - f1_score:
0.4676 - val_loss: 1.7651 - val_f1_score: 0.5010
Epoch 91/500
27/28 [==========================>..] - ETA: 0s - loss: 1.6778 - f1_score:
0.4831

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets
```

```
28/28 [==============================] - 5s 199ms/step - loss: 1.6855 -
f1_score: 0.4813 - val_loss: 1.7460 - val_f1_score: 0.5320
Epoch 92/500
28/28 [==============================] - 1s 47ms/step - loss: 1.6774 - f1_score:
0.4729 - val_loss: 1.7449 - val_f1_score: 0.5108
Epoch 93/500
28/28 [==============================] - 1s 45ms/step - loss: 1.6522 - f1_score:
0.4681 - val_loss: 1.7912 - val_f1_score: 0.5249
Epoch 94/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6821 - f1_score:
0.4770

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 170ms/step - loss: 1.6731 -
f1_score: 0.4808 - val_loss: 1.7403 - val_f1_score: 0.5348
Epoch 95/500
28/28 [==============================] - 1s 45ms/step - loss: 1.6885 - f1_score:
0.4757 - val_loss: 1.7661 - val_f1_score: 0.5141
Epoch 96/500
28/28 [==============================] - 1s 45ms/step - loss: 1.6434 - f1_score:
0.4954 - val_loss: 1.7003 - val_f1_score: 0.5235
Epoch 97/500
28/28 [==============================] - 1s 46ms/step - loss: 1.6380 - f1_score:
0.4801 - val_loss: 1.7193 - val_f1_score: 0.5226
Epoch 98/500
28/28 [==============================] - 1s 46ms/step - loss: 1.6299 - f1_score:
0.4919 - val_loss: 1.7177 - val_f1_score: 0.5158
Epoch 99/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6071 - f1_score:
0.4850

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 166ms/step - loss: 1.6044 -
f1_score: 0.4845 - val_loss: 1.6872 - val_f1_score: 0.5394
Epoch 100/500
28/28 [==============================] - 1s 45ms/step - loss: 1.5824 - f1_score:
0.4984 - val_loss: 1.7067 - val_f1_score: 0.5153
Epoch 101/500
```

```
28/28 [==============================] - 1s 44ms/step - loss: 1.5957 - f1_score:
0.4992 - val_loss: 1.6804 - val_f1_score: 0.5304
Epoch 102/500
28/28 [==============================] - 1s 45ms/step - loss: 1.5602 - f1_score:
0.5176 - val_loss: 1.7618 - val_f1_score: 0.5124
Epoch 103/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5654 - f1_score:
0.5127

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 193ms/step - loss: 1.5688 -
f1_score: 0.5126 - val_loss: 1.6514 - val_f1_score: 0.5556
Epoch 104/500
28/28 [==============================] - 1s 48ms/step - loss: 1.5671 - f1_score:
0.5097 - val_loss: 1.6395 - val_f1_score: 0.5496
Epoch 105/500
28/28 [==============================] - 1s 46ms/step - loss: 1.5270 - f1_score:
0.5255 - val_loss: 1.6458 - val_f1_score: 0.5499
Epoch 106/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5368 - f1_score:
0.5226

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 199ms/step - loss: 1.5377 -
f1_score: 0.5219 - val_loss: 1.6189 - val_f1_score: 0.5571
Epoch 107/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5103 - f1_score:
0.5200

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 186ms/step - loss: 1.5201 -
f1_score: 0.5166 - val_loss: 1.6079 - val_f1_score: 0.5602
Epoch 108/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 1.5088 - f1_score:
0.5228 - val_loss: 1.6115 - val_f1_score: 0.5385
Epoch 109/500
28/28 [==============================] - 1s 45ms/step - loss: 1.5319 - f1_score:
0.5202 - val_loss: 1.6316 - val_f1_score: 0.5566
Epoch 110/500
28/28 [==============================] - 1s 45ms/step - loss: 1.4945 - f1_score:
0.5358 - val_loss: 1.6357 - val_f1_score: 0.5497
Epoch 111/500
28/28 [==============================] - 1s 46ms/step - loss: 1.4693 - f1_score:
0.5468 - val_loss: 1.6023 - val_f1_score: 0.5447
Epoch 112/500
27/28 [============================>..] - ETA: 0s - loss: 1.4563 - f1_score:
0.5463

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 172ms/step - loss: 1.4571 -
f1_score: 0.5466 - val_loss: 1.6056 - val_f1_score: 0.5651
Epoch 113/500
28/28 [==============================] - 1s 45ms/step - loss: 1.4808 - f1_score:
0.5370 - val_loss: 1.6319 - val_f1_score: 0.5399
Epoch 114/500
28/28 [==============================] - 1s 46ms/step - loss: 1.4551 - f1_score:
0.5493 - val_loss: 1.5859 - val_f1_score: 0.5601
Epoch 115/500
28/28 [==============================] - 1s 45ms/step - loss: 1.4381 - f1_score:
0.5529 - val_loss: 1.5793 - val_f1_score: 0.5483
Epoch 116/500
27/28 [============================>..] - ETA: 0s - loss: 1.4447 - f1_score:
0.5422

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 184ms/step - loss: 1.4384 -
f1_score: 0.5450 - val_loss: 1.5524 - val_f1_score: 0.5740
Epoch 117/500
28/28 [==============================] - 1s 44ms/step - loss: 1.4455 - f1_score:
0.5515 - val_loss: 1.5805 - val_f1_score: 0.5674
Epoch 118/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 1.4208 - f1_score:
0.5307 - val_loss: 1.5733 - val_f1_score: 0.5466
Epoch 119/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3956 - f1_score:
0.5619 - val_loss: 1.5687 - val_f1_score: 0.5637
Epoch 120/500
28/28 [==============================] - 1s 46ms/step - loss: 1.4132 - f1_score:
0.5545 - val_loss: 1.5433 - val_f1_score: 0.5523
Epoch 121/500
28/28 [==============================] - 1s 46ms/step - loss: 1.3788 - f1_score:
0.5649 - val_loss: 1.6024 - val_f1_score: 0.5629
Epoch 122/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3741 - f1_score:
0.5724

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 169ms/step - loss: 1.3802 -
f1_score: 0.5704 - val_loss: 1.5101 - val_f1_score: 0.5790
Epoch 123/500
28/28 [==============================] - 1s 44ms/step - loss: 1.3687 - f1_score:
0.5571 - val_loss: 1.6195 - val_f1_score: 0.5559
Epoch 124/500
28/28 [==============================] - 1s 44ms/step - loss: 1.3880 - f1_score:
0.5633 - val_loss: 1.5206 - val_f1_score: 0.5561
Epoch 125/500
28/28 [==============================] - 1s 45ms/step - loss: 1.3739 - f1_score:
0.5779 - val_loss: 1.5029 - val_f1_score: 0.5693
Epoch 126/500
28/28 [==============================] - 1s 46ms/step - loss: 1.3270 - f1_score:
0.5822 - val_loss: 1.5013 - val_f1_score: 0.5673
Epoch 127/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3521 - f1_score:
0.5741

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 178ms/step - loss: 1.3536 -
f1_score: 0.5733 - val_loss: 1.5193 - val_f1_score: 0.5810
Epoch 128/500
```

```
28/28 [==============================] - 1s 45ms/step - loss: 1.3253 - f1_score:
0.5890 - val_loss: 1.5897 - val_f1_score: 0.5528
Epoch 129/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3359 - f1_score:
0.5778

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 7s 254ms/step - loss: 1.3325 -
f1_score: 0.5793 - val_loss: 1.4923 - val_f1_score: 0.5817
Epoch 130/500
28/28 [==============================] - 1s 45ms/step - loss: 1.2997 - f1_score:
0.5880 - val_loss: 1.4927 - val_f1_score: 0.5773
Epoch 131/500
28/28 [==============================] - 1s 49ms/step - loss: 1.3109 - f1_score:
0.5960 - val_loss: 1.4689 - val_f1_score: 0.5698
Epoch 132/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2932 - f1_score:
0.5911

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 194ms/step - loss: 1.2932 -
f1_score: 0.5916 - val_loss: 1.4896 - val_f1_score: 0.5904
Epoch 133/500
28/28 [==============================] - 1s 45ms/step - loss: 1.2908 - f1_score:
0.5936 - val_loss: 1.5333 - val_f1_score: 0.5696
Epoch 134/500
28/28 [==============================] - 1s 48ms/step - loss: 1.2775 - f1_score:
0.6000 - val_loss: 1.4443 - val_f1_score: 0.5868
Epoch 135/500
28/28 [==============================] - 1s 50ms/step - loss: 1.2564 - f1_score:
0.6032 - val_loss: 1.4599 - val_f1_score: 0.5811
Epoch 136/500
28/28 [==============================] - 1s 51ms/step - loss: 1.2564 - f1_score:
0.6018 - val_loss: 1.4395 - val_f1_score: 0.5899
Epoch 137/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2410 - f1_score:
0.5922
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 194ms/step - loss: 1.2491 -
f1_score: 0.5898 - val_loss: 1.4329 - val_f1_score: 0.5936
Epoch 138/500
28/28 [==============================] - 1s 46ms/step - loss: 1.2778 - f1_score:
0.5983 - val_loss: 1.4760 - val_f1_score: 0.5743
Epoch 139/500
28/28 [==============================] - ETA: 0s - loss: 1.2286 - f1_score:
0.6250

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 177ms/step - loss: 1.2286 -
f1_score: 0.6250 - val_loss: 1.4539 - val_f1_score: 0.5974
Epoch 140/500
28/28 [==============================] - 1s 46ms/step - loss: 1.2531 - f1_score:
0.6020 - val_loss: 1.4904 - val_f1_score: 0.5753
Epoch 141/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2279 - f1_score:
0.6092

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 209ms/step - loss: 1.2262 -
f1_score: 0.6092 - val_loss: 1.4459 - val_f1_score: 0.5996
Epoch 142/500
28/28 [==============================] - 1s 48ms/step - loss: 1.2270 - f1_score:
0.6099 - val_loss: 1.4123 - val_f1_score: 0.5984
Epoch 143/500
28/28 [==============================] - 1s 52ms/step - loss: 1.2187 - f1_score:
0.6202 - val_loss: 1.4501 - val_f1_score: 0.5889
Epoch 144/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2345 - f1_score:
0.6117
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 171ms/step - loss: 1.2340 -
f1_score: 0.6109 - val_loss: 1.4055 - val_f1_score: 0.6071
Epoch 145/500
28/28 [==============================] - 1s 49ms/step - loss: 1.1912 - f1_score:
0.6291 - val_loss: 1.4115 - val_f1_score: 0.5959
Epoch 146/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1923 - f1_score:
0.6233

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 176ms/step - loss: 1.1883 -
f1_score: 0.6245 - val_loss: 1.4372 - val_f1_score: 0.6131
Epoch 147/500
28/28 [==============================] - 1s 50ms/step - loss: 1.1831 - f1_score:
0.6172 - val_loss: 1.4101 - val_f1_score: 0.6078
Epoch 148/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2008 - f1_score:
0.6168 - val_loss: 1.3983 - val_f1_score: 0.5890
Epoch 149/500
28/28 [==============================] - 1s 52ms/step - loss: 1.2116 - f1_score:
0.6182 - val_loss: 1.4180 - val_f1_score: 0.5883
Epoch 150/500
28/28 [==============================] - ETA: 0s - loss: 1.1710 - f1_score:
0.6282

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 7s 244ms/step - loss: 1.1710 -
f1_score: 0.6282 - val_loss: 1.3633 - val_f1_score: 0.6198
Epoch 151/500
28/28 [==============================] - 1s 48ms/step - loss: 1.1659 - f1_score:
0.6308 - val_loss: 1.3968 - val_f1_score: 0.5813
```

```
Epoch 152/500
28/28 [==============================] - ETA: 0s - loss: 1.1707 - f1_score:
0.6334

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 179ms/step - loss: 1.1707 -
f1_score: 0.6334 - val_loss: 1.3775 - val_f1_score: 0.6221
Epoch 153/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1290 - f1_score:
0.6448 - val_loss: 1.4049 - val_f1_score: 0.6092
Epoch 154/500
28/28 [==============================] - 1s 51ms/step - loss: 1.1244 - f1_score:
0.6410 - val_loss: 1.3749 - val_f1_score: 0.6187
Epoch 155/500
28/28 [==============================] - 1s 47ms/step - loss: 1.1307 - f1_score:
0.6540 - val_loss: 1.3661 - val_f1_score: 0.5976
Epoch 156/500
28/28 [==============================] - 1s 45ms/step - loss: 1.1322 - f1_score:
0.6433 - val_loss: 1.3650 - val_f1_score: 0.5956
Epoch 157/500
28/28 [==============================] - 1s 49ms/step - loss: 1.0958 - f1_score:
0.6542 - val_loss: 1.3584 - val_f1_score: 0.5977
Epoch 158/500
27/28 [============================>..] - ETA: 0s - loss: 1.1328 - f1_score:
0.6360

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 182ms/step - loss: 1.1289 -
f1_score: 0.6369 - val_loss: 1.3620 - val_f1_score: 0.6227
Epoch 159/500
28/28 [==============================] - 1s 45ms/step - loss: 1.0915 - f1_score:
0.6588 - val_loss: 1.3734 - val_f1_score: 0.5865
Epoch 160/500
28/28 [==============================] - 1s 47ms/step - loss: 1.0870 - f1_score:
0.6632 - val_loss: 1.3615 - val_f1_score: 0.6183
Epoch 161/500
28/28 [==============================] - 1s 49ms/step - loss: 1.0984 - f1_score:
0.6542 - val_loss: 1.3337 - val_f1_score: 0.6009
```

```
Epoch 162/500
28/28 [==============================] - 1s 52ms/step - loss: 1.0977 - f1_score:
0.6571 - val_loss: 1.3436 - val_f1_score: 0.5964
Epoch 163/500
28/28 [==============================] - ETA: 0s - loss: 1.0946 - f1_score:
0.6554

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 182ms/step - loss: 1.0946 -
f1_score: 0.6554 - val_loss: 1.3068 - val_f1_score: 0.6246
Epoch 164/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0703 - f1_score:
0.6628 - val_loss: 1.3558 - val_f1_score: 0.5911
Epoch 165/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0684 - f1_score:
0.6629 - val_loss: 1.3398 - val_f1_score: 0.6145
Epoch 166/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0642 - f1_score:
0.6615 - val_loss: 1.3090 - val_f1_score: 0.5990
Epoch 167/500
28/28 [==============================] - 1s 47ms/step - loss: 1.0754 - f1_score:
0.6681 - val_loss: 1.3148 - val_f1_score: 0.6046
Epoch 168/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0440 - f1_score:
0.6677 - val_loss: 1.3476 - val_f1_score: 0.5860
Epoch 169/500
28/28 [==============================] - 1s 45ms/step - loss: 1.0475 - f1_score:
0.6636 - val_loss: 1.3652 - val_f1_score: 0.5940
Epoch 170/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0384 - f1_score:
0.6678 - val_loss: 1.3697 - val_f1_score: 0.6194
Epoch 171/500
27/28 [===========================>..] - ETA: 0s - loss: 1.0371 - f1_score:
0.6679

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 177ms/step - loss: 1.0391 -
f1_score: 0.6649 - val_loss: 1.3021 - val_f1_score: 0.6537
```

```
Epoch 172/500
28/28 [==============================] - 1s 45ms/step - loss: 1.0113 - f1_score:
0.6773 - val_loss: 1.3306 - val_f1_score: 0.5969
Epoch 173/500
28/28 [==============================] - 1s 46ms/step - loss: 1.0297 - f1_score:
0.6756 - val_loss: 1.3444 - val_f1_score: 0.6240
Epoch 174/500
28/28 [==============================] - 1s 48ms/step - loss: 1.0167 - f1_score:
0.6743 - val_loss: 1.3316 - val_f1_score: 0.6217
Epoch 175/500
28/28 [==============================] - 1s 48ms/step - loss: 1.0045 - f1_score:
0.6917 - val_loss: 1.3236 - val_f1_score: 0.6047
Epoch 176/500
28/28 [==============================] - 1s 47ms/step - loss: 1.0071 - f1_score:
0.6813 - val_loss: 1.2910 - val_f1_score: 0.6291
Epoch 177/500
28/28 [==============================] - 1s 48ms/step - loss: 0.9945 - f1_score:
0.6831 - val_loss: 1.3011 - val_f1_score: 0.6351
Epoch 178/500
28/28 [==============================] - 1s 52ms/step - loss: 0.9928 - f1_score:
0.6813 - val_loss: 1.3256 - val_f1_score: 0.6034
Epoch 179/500
28/28 [==============================] - 1s 50ms/step - loss: 0.9906 - f1_score:
0.7002 - val_loss: 1.2784 - val_f1_score: 0.6228
Epoch 180/500
28/28 [==============================] - 1s 48ms/step - loss: 0.9860 - f1_score:
0.6887 - val_loss: 1.2923 - val_f1_score: 0.6267
Epoch 181/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9888 - f1_score:
0.6932 - val_loss: 1.2981 - val_f1_score: 0.6269
Epoch 182/500
28/28 [==============================] - 2s 58ms/step - loss: 0.9676 - f1_score:
0.6928 - val_loss: 1.2865 - val_f1_score: 0.6215
Epoch 183/500
28/28 [==============================] - 1s 49ms/step - loss: 0.9717 - f1_score:
0.6943 - val_loss: 1.3125 - val_f1_score: 0.6020
Epoch 184/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9607 - f1_score:
0.6935 - val_loss: 1.3016 - val_f1_score: 0.6170
Epoch 185/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9703 - f1_score:
0.6836 - val_loss: 1.2582 - val_f1_score: 0.6169
Epoch 186/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9639 - f1_score:
0.7000 - val_loss: 1.2492 - val_f1_score: 0.6339
Epoch 187/500
28/28 [==============================] - 1s 48ms/step - loss: 0.9377 - f1_score:
0.7033 - val_loss: 1.2743 - val_f1_score: 0.6449
```

```
Epoch 188/500
28/28 [==============================] - 1s 49ms/step - loss: 0.9479 - f1_score:
0.7022 - val_loss: 1.3506 - val_f1_score: 0.6181
Epoch 189/500
28/28 [==============================] - 1s 46ms/step - loss: 0.9697 - f1_score:
0.6807 - val_loss: 1.2701 - val_f1_score: 0.6291
Epoch 190/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9349 - f1_score:
0.7053 - val_loss: 1.2681 - val_f1_score: 0.6092
Epoch 191/500
28/28 [==============================] - 1s 45ms/step - loss: 0.9369 - f1_score:
0.7086 - val_loss: 1.2318 - val_f1_score: 0.6322
Epoch 192/500
28/28 [==============================] - 1s 47ms/step - loss: 0.9169 - f1_score:
0.7074 - val_loss: 1.2567 - val_f1_score: 0.6279
Epoch 193/500
28/28 [==============================] - 1s 48ms/step - loss: 0.9045 - f1_score:
0.7182 - val_loss: 1.2387 - val_f1_score: 0.6329
Epoch 194/500
28/28 [==============================] - 1s 50ms/step - loss: 0.9204 - f1_score:
0.7150 - val_loss: 1.2539 - val_f1_score: 0.6300
Epoch 195/500
28/28 [==============================] - 1s 50ms/step - loss: 0.9322 - f1_score:
0.7056 - val_loss: 1.1966 - val_f1_score: 0.6463
Epoch 196/500
28/28 [==============================] - 1s 50ms/step - loss: 0.9073 - f1_score:
0.7061 - val_loss: 1.2219 - val_f1_score: 0.6406
Epoch 197/500
28/28 [==============================] - 1s 49ms/step - loss: 0.8946 - f1_score:
0.7166 - val_loss: 1.2150 - val_f1_score: 0.6465
Epoch 198/500
28/28 [==============================] - 1s 47ms/step - loss: 0.9010 - f1_score:
0.7080 - val_loss: 1.1924 - val_f1_score: 0.6420
Epoch 199/500
28/28 [==============================] - 1s 47ms/step - loss: 0.9216 - f1_score:
0.7118 - val_loss: 1.2584 - val_f1_score: 0.6235
Epoch 200/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8778 - f1_score:
0.7247 - val_loss: 1.2327 - val_f1_score: 0.6439
Epoch 201/500
28/28 [==============================] - 2s 60ms/step - loss: 0.8837 - f1_score:
0.7132 - val_loss: 1.2887 - val_f1_score: 0.6319
Epoch 202/500
28/28 [==============================] - 1s 48ms/step - loss: 0.8878 - f1_score:
0.7109 - val_loss: 1.2075 - val_f1_score: 0.6518
Epoch 203/500
27/28 [============================>..] - ETA: 0s - loss: 0.8772 - f1_score:
0.7267
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 184ms/step - loss: 0.8764 -
f1_score: 0.7272 - val_loss: 1.2282 - val_f1_score: 0.6622
Epoch 204/500
28/28 [==============================] - 1s 48ms/step - loss: 0.8659 - f1_score:
0.7200 - val_loss: 1.2380 - val_f1_score: 0.6177
Epoch 205/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8731 - f1_score:
0.7234 - val_loss: 1.2122 - val_f1_score: 0.6274
Epoch 206/500
28/28 [==============================] - 1s 48ms/step - loss: 0.8704 - f1_score:
0.7221 - val_loss: 1.2979 - val_f1_score: 0.6167
Epoch 207/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8588 - f1_score:
0.7286 - val_loss: 1.1954 - val_f1_score: 0.6334
Epoch 208/500
28/28 [==============================] - 1s 51ms/step - loss: 0.8285 - f1_score:
0.7390 - val_loss: 1.2097 - val_f1_score: 0.6344
Epoch 209/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8415 - f1_score:
0.7353 - val_loss: 1.2093 - val_f1_score: 0.6353
Epoch 210/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8436 - f1_score:
0.7353 - val_loss: 1.1967 - val_f1_score: 0.6495
Epoch 211/500
28/28 [==============================] - 1s 46ms/step - loss: 0.8224 - f1_score:
0.7333 - val_loss: 1.2122 - val_f1_score: 0.6416
Epoch 212/500
27/28 [============================>..] - ETA: 0s - loss: 0.8208 - f1_score:
0.7437

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 188ms/step - loss: 0.8218 -
f1_score: 0.7455 - val_loss: 1.1902 - val_f1_score: 0.6759
Epoch 213/500
28/28 [==============================] - 1s 49ms/step - loss: 0.8362 - f1_score:
0.7254 - val_loss: 1.2831 - val_f1_score: 0.6595
```

```
Epoch 214/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8254 - f1_score:
0.7406 - val_loss: 1.2202 - val_f1_score: 0.6391
Epoch 215/500
28/28 [==============================] - 2s 60ms/step - loss: 0.8417 - f1_score:
0.7347 - val_loss: 1.2009 - val_f1_score: 0.6314
Epoch 216/500
28/28 [==============================] - 1s 48ms/step - loss: 0.8422 - f1_score:
0.7344 - val_loss: 1.2100 - val_f1_score: 0.6498
Epoch 217/500
28/28 [==============================] - 1s 44ms/step - loss: 0.8044 - f1_score:
0.7500 - val_loss: 1.1989 - val_f1_score: 0.6375
Epoch 218/500
28/28 [==============================] - 1s 47ms/step - loss: 0.8150 - f1_score:
0.7476 - val_loss: 1.2014 - val_f1_score: 0.6323
Epoch 219/500
28/28 [==============================] - 1s 46ms/step - loss: 0.8045 - f1_score:
0.7357 - val_loss: 1.2159 - val_f1_score: 0.6361
Epoch 220/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7978 - f1_score:
0.7452 - val_loss: 1.2139 - val_f1_score: 0.6273
Epoch 221/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8003 - f1_score:
0.7436 - val_loss: 1.1659 - val_f1_score: 0.6603
Epoch 222/500
28/28 [==============================] - 1s 45ms/step - loss: 0.7889 - f1_score:
0.7545 - val_loss: 1.1821 - val_f1_score: 0.6548
Epoch 223/500
28/28 [==============================] - 1s 45ms/step - loss: 0.8185 - f1_score:
0.7367 - val_loss: 1.2181 - val_f1_score: 0.6393
Epoch 224/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7840 - f1_score:
0.7546 - val_loss: 1.1929 - val_f1_score: 0.6356
Epoch 225/500
28/28 [==============================] - 1s 48ms/step - loss: 0.7941 - f1_score:
0.7500 - val_loss: 1.2020 - val_f1_score: 0.6465
Epoch 226/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7739 - f1_score:
0.7606 - val_loss: 1.1838 - val_f1_score: 0.6371
Epoch 227/500
28/28 [==============================] - 1s 48ms/step - loss: 0.7739 - f1_score:
0.7468 - val_loss: 1.1778 - val_f1_score: 0.6424
Epoch 228/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7454 - f1_score:
0.7604 - val_loss: 1.1838 - val_f1_score: 0.6506
Epoch 229/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7599 - f1_score:
0.7587 - val_loss: 1.2108 - val_f1_score: 0.6582
```

```
Epoch 230/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7591 - f1_score:
0.7514 - val_loss: 1.2199 - val_f1_score: 0.6471
Epoch 231/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7636 - f1_score:
0.7582 - val_loss: 1.1763 - val_f1_score: 0.6610
Epoch 232/500
28/28 [==============================] - 1s 48ms/step - loss: 0.7647 - f1_score:
0.7597 - val_loss: 1.2063 - val_f1_score: 0.6387
Epoch 233/500
28/28 [==============================] - 1s 50ms/step - loss: 0.7412 - f1_score:
0.7636 - val_loss: 1.1698 - val_f1_score: 0.6522
Epoch 234/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7338 - f1_score:
0.7690 - val_loss: 1.1766 - val_f1_score: 0.6690
Epoch 235/500
28/28 [==============================] - 1s 49ms/step - loss: 0.7119 - f1_score:
0.7795 - val_loss: 1.1652 - val_f1_score: 0.6672
Epoch 236/500
28/28 [==============================] - 1s 49ms/step - loss: 0.7346 - f1_score:
0.7601 - val_loss: 1.1549 - val_f1_score: 0.6511
Epoch 237/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7755 - f1_score:
0.7482 - val_loss: 1.2435 - val_f1_score: 0.6332
Epoch 238/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7388 - f1_score:
0.7651 - val_loss: 1.1931 - val_f1_score: 0.6381
Epoch 239/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7208 - f1_score:
0.7663 - val_loss: 1.1815 - val_f1_score: 0.6383
Epoch 240/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7046 - f1_score:
0.7811 - val_loss: 1.1840 - val_f1_score: 0.6516
Epoch 241/500
28/28 [==============================] - 1s 46ms/step - loss: 0.7271 - f1_score:
0.7699 - val_loss: 1.2293 - val_f1_score: 0.6502
Epoch 242/500
28/28 [==============================] - 1s 49ms/step - loss: 0.6940 - f1_score:
0.7805 - val_loss: 1.1736 - val_f1_score: 0.6426
Epoch 243/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7144 - f1_score:
0.7766 - val_loss: 1.1779 - val_f1_score: 0.6578
Epoch 244/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6935 - f1_score:
0.7834 - val_loss: 1.1474 - val_f1_score: 0.6745
Epoch 245/500
27/28 [===========================>..] - ETA: 0s - loss: 0.7114 - f1_score:
0.7672
```

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WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 216ms/step - loss: 0.7157 -
f1_score: 0.7661 - val_loss: 1.1520 - val_f1_score: 0.6794
Epoch 246/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7055 - f1_score:
0.7729 - val_loss: 1.1417 - val_f1_score: 0.6613
Epoch 247/500
28/28 [==============================] - 1s 47ms/step - loss: 0.7314 - f1_score:
0.7698 - val_loss: 1.2074 - val_f1_score: 0.6655
Epoch 248/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6854 - f1_score:
0.7884 - val_loss: 1.1678 - val_f1_score: 0.6480
Epoch 249/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6967 - f1_score:
0.7854 - val_loss: 1.2115 - val_f1_score: 0.6419
Epoch 250/500
28/28 [==============================] - 1s 51ms/step - loss: 0.6755 - f1_score:
0.7895 - val_loss: 1.1609 - val_f1_score: 0.6613
Epoch 251/500
28/28 [==============================] - ETA: 0s - loss: 0.6863 - f1_score:
0.7868

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 221ms/step - loss: 0.6863 -
f1_score: 0.7868 - val_loss: 1.1432 - val_f1_score: 0.6795
Epoch 252/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6904 - f1_score:
0.7836 - val_loss: 1.2283 - val_f1_score: 0.6611
Epoch 253/500
28/28 [==============================] - 1s 45ms/step - loss: 0.7407 - f1_score:
0.7624 - val_loss: 1.1583 - val_f1_score: 0.6455
Epoch 254/500
28/28 [==============================] - 1s 45ms/step - loss: 0.6517 - f1_score:
0.8031 - val_loss: 1.1969 - val_f1_score: 0.6531
Epoch 255/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6830 - f1_score:
0.7812 - val_loss: 1.1583 - val_f1_score: 0.6640
```

```
Epoch 256/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6685 - f1_score:
0.7949 - val_loss: 1.1609 - val_f1_score: 0.6432
Epoch 257/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6470 - f1_score:
0.7892 - val_loss: 1.1848 - val_f1_score: 0.6657
Epoch 258/500
28/28 [==============================] - 1s 49ms/step - loss: 0.6642 - f1_score:
0.7889 - val_loss: 1.1389 - val_f1_score: 0.6744
Epoch 259/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6784 - f1_score:
0.7805 - val_loss: 1.1786 - val_f1_score: 0.6727
Epoch 260/500
28/28 [==============================] - 1s 48ms/step - loss: 0.6780 - f1_score:
0.7750 - val_loss: 1.1475 - val_f1_score: 0.6612
Epoch 261/500
28/28 [==============================] - 1s 49ms/step - loss: 0.6516 - f1_score:
0.7918 - val_loss: 1.1724 - val_f1_score: 0.6618
Epoch 262/500
28/28 [==============================] - 1s 48ms/step - loss: 0.6425 - f1_score:
0.7916 - val_loss: 1.2216 - val_f1_score: 0.6611
Epoch 263/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6508 - f1_score:
0.7961 - val_loss: 1.1359 - val_f1_score: 0.6652
Epoch 264/500
28/28 [==============================] - 1s 50ms/step - loss: 0.6674 - f1_score:
0.7916 - val_loss: 1.1741 - val_f1_score: 0.6586
Epoch 265/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6703 - f1_score:
0.7908 - val_loss: 1.1885 - val_f1_score: 0.6632
Epoch 266/500
27/28 [===========================>..] - ETA: 0s - loss: 0.6613 - f1_score:
0.7933

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 221ms/step - loss: 0.6618 -
f1_score: 0.7930 - val_loss: 1.1688 - val_f1_score: 0.6810
Epoch 267/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6330 - f1_score:
0.8116 - val_loss: 1.1837 - val_f1_score: 0.6563
Epoch 268/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6127 - f1_score:
0.8093 - val_loss: 1.2212 - val_f1_score: 0.6554
```

```
Epoch 269/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6339 - f1_score:
0.8030 - val_loss: 1.1565 - val_f1_score: 0.6662
Epoch 270/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6172 - f1_score:
0.8071 - val_loss: 1.2112 - val_f1_score: 0.6488
Epoch 271/500
28/28 [==============================] - 1s 51ms/step - loss: 0.6250 - f1_score:
0.8034 - val_loss: 1.2029 - val_f1_score: 0.6639
Epoch 272/500
28/28 [==============================] - 1s 53ms/step - loss: 0.6266 - f1_score:
0.7982 - val_loss: 1.1879 - val_f1_score: 0.6669
Epoch 273/500
28/28 [==============================] - 1s 51ms/step - loss: 0.6383 - f1_score:
0.7968 - val_loss: 1.1288 - val_f1_score: 0.6685
Epoch 274/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6432 - f1_score:
0.7989 - val_loss: 1.1675 - val_f1_score: 0.6648
Epoch 275/500
28/28 [==============================] - 1s 47ms/step - loss: 0.6148 - f1_score:
0.8003 - val_loss: 1.1922 - val_f1_score: 0.6729
Epoch 276/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6215 - f1_score:
0.8005 - val_loss: 1.2105 - val_f1_score: 0.6574
Epoch 277/500
28/28 [==============================] - 1s 49ms/step - loss: 0.6078 - f1_score:
0.8120 - val_loss: 1.1992 - val_f1_score: 0.6520
Epoch 278/500
28/28 [==============================] - 1s 48ms/step - loss: 0.6089 - f1_score:
0.8014 - val_loss: 1.1326 - val_f1_score: 0.6777
Epoch 279/500
28/28 [==============================] - 1s 46ms/step - loss: 0.6206 - f1_score:
0.8001 - val_loss: 1.1674 - val_f1_score: 0.6606
Epoch 280/500
28/28 [==============================] - 1s 50ms/step - loss: 0.5719 - f1_score:
0.8211 - val_loss: 1.1554 - val_f1_score: 0.6476
Epoch 281/500
28/28 [==============================] - 1s 53ms/step - loss: 0.5885 - f1_score:
0.8087 - val_loss: 1.2003 - val_f1_score: 0.6676
Epoch 282/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6026 - f1_score:
0.8157 - val_loss: 1.1574 - val_f1_score: 0.6670
Epoch 283/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6145 - f1_score:
0.7996 - val_loss: 1.2607 - val_f1_score: 0.6540
Epoch 284/500
27/28 [============================>..] - ETA: 0s - loss: 0.6031 - f1_score:
0.8091
```

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WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 7s 255ms/step - loss: 0.6027 -
f1_score: 0.8093 - val_loss: 1.1813 - val_f1_score: 0.6813
Epoch 285/500
28/28 [==============================] - 1s 49ms/step - loss: 0.6158 - f1_score:
0.7944 - val_loss: 1.1559 - val_f1_score: 0.6744
Epoch 286/500
28/28 [==============================] - 1s 48ms/step - loss: 0.5862 - f1_score:
0.8141 - val_loss: 1.1613 - val_f1_score: 0.6702
Epoch 287/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5677 - f1_score:
0.8248 - val_loss: 1.1851 - val_f1_score: 0.6526
Epoch 288/500
27/28 [===========================>..] - ETA: 0s - loss: 0.5892 - f1_score:
0.8053

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 184ms/step - loss: 0.5855 -
f1_score: 0.8069 - val_loss: 1.1408 - val_f1_score: 0.6932
Epoch 289/500
28/28 [==============================] - 1s 48ms/step - loss: 0.5912 - f1_score:
0.8043 - val_loss: 1.2212 - val_f1_score: 0.6614
Epoch 290/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5715 - f1_score:
0.8198 - val_loss: 1.1560 - val_f1_score: 0.6916
Epoch 291/500
27/28 [===========================>..] - ETA: 0s - loss: 0.5730 - f1_score:
0.8231

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 226ms/step - loss: 0.5711 -
f1_score: 0.8249 - val_loss: 1.1286 - val_f1_score: 0.6939
```

```
Epoch 292/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5635 - f1_score:
0.8258 - val_loss: 1.1542 - val_f1_score: 0.6693
Epoch 293/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5575 - f1_score:
0.8215 - val_loss: 1.1824 - val_f1_score: 0.6721
Epoch 294/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5632 - f1_score:
0.8244 - val_loss: 1.1604 - val_f1_score: 0.6746
Epoch 295/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5750 - f1_score:
0.8136 - val_loss: 1.1466 - val_f1_score: 0.6831
Epoch 296/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5471 - f1_score:
0.8274 - val_loss: 1.1254 - val_f1_score: 0.6744
Epoch 297/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5717 - f1_score:
0.8121 - val_loss: 1.1575 - val_f1_score: 0.6784
Epoch 298/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5681 - f1_score:
0.8184 - val_loss: 1.1770 - val_f1_score: 0.6708
Epoch 299/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5827 - f1_score:
0.8070 - val_loss: 1.2370 - val_f1_score: 0.6693
Epoch 300/500
27/28 [===========================>..] - ETA: 0s - loss: 0.5491 - f1_score:
0.8242

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 194ms/step - loss: 0.5477 -
f1_score: 0.8253 - val_loss: 1.1251 - val_f1_score: 0.7010
Epoch 301/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5699 - f1_score:
0.8123 - val_loss: 1.1630 - val_f1_score: 0.6747
Epoch 302/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5576 - f1_score:
0.8226 - val_loss: 1.1351 - val_f1_score: 0.6810
Epoch 303/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5506 - f1_score:
0.8282 - val_loss: 1.1294 - val_f1_score: 0.6865
Epoch 304/500
28/28 [==============================] - ETA: 0s - loss: 0.5544 - f1_score:
0.8278
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 5s 193ms/step - loss: 0.5544 -
f1_score: 0.8278 - val_loss: 1.1353 - val_f1_score: 0.7011
Epoch 305/500
28/28 [==============================] - 1s 45ms/step - loss: 0.5488 - f1_score:
0.8244 - val_loss: 1.1754 - val_f1_score: 0.6836
Epoch 306/500
28/28 [==============================] - 1s 51ms/step - loss: 0.5544 - f1_score:
0.8241 - val_loss: 1.1676 - val_f1_score: 0.6788
Epoch 307/500
28/28 [==============================] - 1s 48ms/step - loss: 0.5308 - f1_score:
0.8337 - val_loss: 1.1938 - val_f1_score: 0.6783
Epoch 308/500
28/28 [==============================] - 1s 48ms/step - loss: 0.5452 - f1_score:
0.8254 - val_loss: 1.1570 - val_f1_score: 0.6785
Epoch 309/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5279 - f1_score:
0.8326 - val_loss: 1.1843 - val_f1_score: 0.6767
Epoch 310/500
28/28 [==============================] - 2s 54ms/step - loss: 0.5053 - f1_score:
0.8443 - val_loss: 1.1640 - val_f1_score: 0.6712
Epoch 311/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5222 - f1_score:
0.8346 - val_loss: 1.1985 - val_f1_score: 0.6572
Epoch 312/500
28/28 [==============================] - 2s 55ms/step - loss: 0.5434 - f1_score:
0.8335 - val_loss: 1.2213 - val_f1_score: 0.6656
Epoch 313/500
28/28 [==============================] - 2s 54ms/step - loss: 0.5650 - f1_score:
0.8242 - val_loss: 1.2014 - val_f1_score: 0.6707
Epoch 314/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5336 - f1_score:
0.8355 - val_loss: 1.2232 - val_f1_score: 0.6660
Epoch 315/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5017 - f1_score:
0.8424 - val_loss: 1.1342 - val_f1_score: 0.6744
Epoch 316/500
28/28 [==============================] - 1s 48ms/step - loss: 0.5214 - f1_score:
0.8384 - val_loss: 1.1925 - val_f1_score: 0.6797
Epoch 317/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5106 - f1_score:
0.8463 - val_loss: 1.2130 - val_f1_score: 0.6749
```

```
Epoch 318/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5181 - f1_score:
0.8417 - val_loss: 1.1898 - val_f1_score: 0.6727
Epoch 319/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5161 - f1_score:
0.8390 - val_loss: 1.1830 - val_f1_score: 0.6676
Epoch 320/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4954 - f1_score:
0.8442 - val_loss: 1.1508 - val_f1_score: 0.6948
Epoch 321/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4900 - f1_score:
0.8520 - val_loss: 1.1782 - val_f1_score: 0.6927
Epoch 322/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5163 - f1_score:
0.8371 - val_loss: 1.1591 - val_f1_score: 0.6791
Epoch 323/500
28/28 [==============================] - 1s 49ms/step - loss: 0.5069 - f1_score:
0.8461 - val_loss: 1.2190 - val_f1_score: 0.6705
Epoch 324/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4842 - f1_score:
0.8405 - val_loss: 1.1376 - val_f1_score: 0.6952
Epoch 325/500
28/28 [==============================] - 1s 46ms/step - loss: 0.5006 - f1_score:
0.8431 - val_loss: 1.1647 - val_f1_score: 0.6782
Epoch 326/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4881 - f1_score:
0.8435 - val_loss: 1.1855 - val_f1_score: 0.6685
Epoch 327/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4846 - f1_score:
0.8458 - val_loss: 1.1584 - val_f1_score: 0.6763
Epoch 328/500
28/28 [==============================] - 1s 47ms/step - loss: 0.5105 - f1_score:
0.8421 - val_loss: 1.1191 - val_f1_score: 0.6995
Epoch 329/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4850 - f1_score:
0.8455 - val_loss: 1.1723 - val_f1_score: 0.6839
Epoch 330/500
28/28 [==============================] - 1s 50ms/step - loss: 0.5025 - f1_score:
0.8418 - val_loss: 1.1518 - val_f1_score: 0.6725
Epoch 331/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4563 - f1_score:
0.8611 - val_loss: 1.1533 - val_f1_score: 0.6912
Epoch 332/500
28/28 [==============================] - 1s 53ms/step - loss: 0.4920 - f1_score:
0.8486 - val_loss: 1.1361 - val_f1_score: 0.6889
Epoch 333/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4754 - f1_score:
0.8467
```

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WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 207ms/step - loss: 0.4725 -
f1_score: 0.8492 - val_loss: 1.1571 - val_f1_score: 0.7063
Epoch 334/500
28/28 [==============================] - 1s 53ms/step - loss: 0.4761 - f1_score:
0.8551 - val_loss: 1.1272 - val_f1_score: 0.6853
Epoch 335/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4803 - f1_score:
0.8474 - val_loss: 1.1490 - val_f1_score: 0.6922
Epoch 336/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4734 - f1_score:
0.8592 - val_loss: 1.1610 - val_f1_score: 0.6917
Epoch 337/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4766 - f1_score:
0.8529 - val_loss: 1.1425 - val_f1_score: 0.6994
Epoch 338/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4841 - f1_score:
0.8413 - val_loss: 1.1497 - val_f1_score: 0.6939
Epoch 339/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4658 - f1_score:
0.8510 - val_loss: 1.1753 - val_f1_score: 0.6838
Epoch 340/500
27/28 [============================>..] - ETA: 0s - loss: 0.4754 - f1_score:
0.8540

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 209ms/step - loss: 0.4763 -
f1_score: 0.8549 - val_loss: 1.1340 - val_f1_score: 0.7067
Epoch 341/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4797 - f1_score:
0.8459 - val_loss: 1.1462 - val_f1_score: 0.6828
Epoch 342/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4629 - f1_score:
0.8578 - val_loss: 1.1669 - val_f1_score: 0.6626
Epoch 343/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4635 - f1_score:
0.8511 - val_loss: 1.1529 - val_f1_score: 0.6962
```

```
Epoch 344/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4796 - f1_score:
0.8525 - val_loss: 1.1358 - val_f1_score: 0.6858
Epoch 345/500
28/28 [==============================] - 1s 52ms/step - loss: 0.4446 - f1_score:
0.8652 - val_loss: 1.2262 - val_f1_score: 0.6678
Epoch 346/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4701 - f1_score:
0.8506 - val_loss: 1.1865 - val_f1_score: 0.6759
Epoch 347/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4570 - f1_score:
0.8566 - val_loss: 1.2509 - val_f1_score: 0.6699
Epoch 348/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4545 - f1_score:
0.8631 - val_loss: 1.1356 - val_f1_score: 0.6847
Epoch 349/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4483 - f1_score:
0.8577 - val_loss: 1.1363 - val_f1_score: 0.6994
Epoch 350/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4498 - f1_score:
0.8617 - val_loss: 1.2089 - val_f1_score: 0.6685
Epoch 351/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4587 - f1_score:
0.8568 - val_loss: 1.1828 - val_f1_score: 0.6715
Epoch 352/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4512 - f1_score:
0.8562 - val_loss: 1.2111 - val_f1_score: 0.6801
Epoch 353/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4489 - f1_score:
0.8551 - val_loss: 1.1878 - val_f1_score: 0.6864
Epoch 354/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4336 - f1_score:
0.8690 - val_loss: 1.1787 - val_f1_score: 0.6710
Epoch 355/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4569 - f1_score:
0.8500 - val_loss: 1.2106 - val_f1_score: 0.6749
Epoch 356/500
28/28 [==============================] - 1s 45ms/step - loss: 0.4596 - f1_score:
0.8522 - val_loss: 1.1153 - val_f1_score: 0.6827
Epoch 357/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4229 - f1_score:
0.8719 - val_loss: 1.1748 - val_f1_score: 0.6934
Epoch 358/500
28/28 [==============================] - 2s 55ms/step - loss: 0.4540 - f1_score:
0.8568 - val_loss: 1.2195 - val_f1_score: 0.6827
Epoch 359/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4391 - f1_score:
0.8630 - val_loss: 1.1892 - val_f1_score: 0.6949
```

```
Epoch 360/500
28/28 [==============================] - 2s 54ms/step - loss: 0.4508 - f1_score:
0.8704 - val_loss: 1.1776 - val_f1_score: 0.6920
Epoch 361/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4424 - f1_score:
0.8506 - val_loss: 1.1379 - val_f1_score: 0.6931
Epoch 362/500
28/28 [==============================] - 1s 51ms/step - loss: 0.4306 - f1_score:
0.8631 - val_loss: 1.1716 - val_f1_score: 0.6834
Epoch 363/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4115 - f1_score:
0.8642 - val_loss: 1.1682 - val_f1_score: 0.6780
Epoch 364/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4473 - f1_score:
0.8601 - val_loss: 1.1919 - val_f1_score: 0.6849
Epoch 365/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4357 - f1_score:
0.8598 - val_loss: 1.1538 - val_f1_score: 0.6933
Epoch 366/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4345 - f1_score:
0.8628 - val_loss: 1.2156 - val_f1_score: 0.6807
Epoch 367/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4249 - f1_score:
0.8635 - val_loss: 1.1653 - val_f1_score: 0.6830
Epoch 368/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4207 - f1_score:
0.8718 - val_loss: 1.1582 - val_f1_score: 0.6708
Epoch 369/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4364 - f1_score:
0.8669 - val_loss: 1.1720 - val_f1_score: 0.6766
Epoch 370/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4171 - f1_score:
0.8796 - val_loss: 1.1389 - val_f1_score: 0.7046
Epoch 371/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4090 - f1_score:
0.8710 - val_loss: 1.2231 - val_f1_score: 0.6532
Epoch 372/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4255 - f1_score:
0.8725 - val_loss: 1.1786 - val_f1_score: 0.6926
Epoch 373/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3940 - f1_score:
0.8734 - val_loss: 1.2057 - val_f1_score: 0.6998
Epoch 374/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4139 - f1_score:
0.8722 - val_loss: 1.1978 - val_f1_score: 0.6772
Epoch 375/500
28/28 [==============================] - 2s 55ms/step - loss: 0.3994 - f1_score:
0.8759 - val_loss: 1.1841 - val_f1_score: 0.6707
```

```
Epoch 376/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4135 - f1_score:
0.8624 - val_loss: 1.1613 - val_f1_score: 0.7050
Epoch 377/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4058 - f1_score:
0.8771 - val_loss: 1.2029 - val_f1_score: 0.6821
Epoch 378/500
28/28 [==============================] - 1s 46ms/step - loss: 0.4033 - f1_score:
0.8667 - val_loss: 1.1756 - val_f1_score: 0.6785
Epoch 379/500
28/28 [==============================] - 1s 47ms/step - loss: 0.4178 - f1_score:
0.8702 - val_loss: 1.2413 - val_f1_score: 0.6933
Epoch 380/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4244 - f1_score:
0.8674 - val_loss: 1.1255 - val_f1_score: 0.6832
Epoch 381/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4174 - f1_score:
0.8741 - val_loss: 1.2122 - val_f1_score: 0.6782
Epoch 382/500
28/28 [==============================] - 1s 49ms/step - loss: 0.4233 - f1_score:
0.8591 - val_loss: 1.1845 - val_f1_score: 0.6888
Epoch 383/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3931 - f1_score:
0.8727 - val_loss: 1.1325 - val_f1_score: 0.6980
Epoch 384/500
28/28 [==============================] - 1s 50ms/step - loss: 0.4053 - f1_score:
0.8713 - val_loss: 1.2010 - val_f1_score: 0.6915
Epoch 385/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3704 - f1_score:
0.8843 - val_loss: 1.2045 - val_f1_score: 0.6750
Epoch 386/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3962 - f1_score:
0.8766 - val_loss: 1.1669 - val_f1_score: 0.6926
Epoch 387/500
28/28 [==============================] - ETA: 0s - loss: 0.3965 - f1_score:
0.8782

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN/assets

INFO:tensorflow:Assets written to: 2 1DCNN/assets

28/28 [==============================] - 6s 210ms/step - loss: 0.3965 -
f1_score: 0.8782 - val_loss: 1.1180 - val_f1_score: 0.7272
Epoch 388/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3911 - f1_score:
0.8798 - val_loss: 1.2034 - val_f1_score: 0.6773
```

```
Epoch 389/500
28/28 [==============================] - 1s 48ms/step - loss: 0.4144 - f1_score:
0.8701 - val_loss: 1.2022 - val_f1_score: 0.6656
Epoch 390/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3956 - f1_score:
0.8742 - val_loss: 1.2168 - val_f1_score: 0.6807
Epoch 391/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3915 - f1_score:
0.8735 - val_loss: 1.1705 - val_f1_score: 0.6858
Epoch 392/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3871 - f1_score:
0.8806 - val_loss: 1.2086 - val_f1_score: 0.6855
Epoch 393/500
28/28 [==============================] - 2s 56ms/step - loss: 0.3844 - f1_score:
0.8815 - val_loss: 1.1930 - val_f1_score: 0.7002
Epoch 394/500
28/28 [==============================] - 2s 55ms/step - loss: 0.3951 - f1_score:
0.8768 - val_loss: 1.1854 - val_f1_score: 0.6843
Epoch 395/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3832 - f1_score:
0.8831 - val_loss: 1.1717 - val_f1_score: 0.7115
Epoch 396/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3821 - f1_score:
0.8809 - val_loss: 1.1827 - val_f1_score: 0.6928
Epoch 397/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3747 - f1_score:
0.8840 - val_loss: 1.1482 - val_f1_score: 0.6994
Epoch 398/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3874 - f1_score:
0.8762 - val_loss: 1.2248 - val_f1_score: 0.6711
Epoch 399/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3944 - f1_score:
0.8785 - val_loss: 1.2211 - val_f1_score: 0.6877
Epoch 400/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3909 - f1_score:
0.8725 - val_loss: 1.1541 - val_f1_score: 0.6817
Epoch 401/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3713 - f1_score:
0.8851 - val_loss: 1.2407 - val_f1_score: 0.6795
Epoch 402/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3838 - f1_score:
0.8746 - val_loss: 1.1447 - val_f1_score: 0.7006
Epoch 403/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3903 - f1_score:
0.8750 - val_loss: 1.1788 - val_f1_score: 0.6816
Epoch 404/500
28/28 [==============================] - 1s 52ms/step - loss: 0.4020 - f1_score:
0.8734 - val_loss: 1.1769 - val_f1_score: 0.7049
```

```
Epoch 405/500
28/28 [==============================] - 1s 54ms/step - loss: 0.3736 - f1_score:
0.8842 - val_loss: 1.1791 - val_f1_score: 0.7056
Epoch 406/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3581 - f1_score:
0.8827 - val_loss: 1.1955 - val_f1_score: 0.6846
Epoch 407/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3558 - f1_score:
0.8923 - val_loss: 1.1782 - val_f1_score: 0.6976
Epoch 408/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3561 - f1_score:
0.8983 - val_loss: 1.2099 - val_f1_score: 0.6907
Epoch 409/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3726 - f1_score:
0.8863 - val_loss: 1.1093 - val_f1_score: 0.7116
Epoch 410/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3704 - f1_score:
0.8876 - val_loss: 1.1829 - val_f1_score: 0.6827
Epoch 411/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3808 - f1_score:
0.8853 - val_loss: 1.2211 - val_f1_score: 0.6941
Epoch 412/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3314 - f1_score:
0.8966 - val_loss: 1.1750 - val_f1_score: 0.7065
Epoch 413/500
28/28 [==============================] - 2s 53ms/step - loss: 0.3575 - f1_score:
0.8845 - val_loss: 1.1930 - val_f1_score: 0.7015
Epoch 414/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3573 - f1_score:
0.8963 - val_loss: 1.1822 - val_f1_score: 0.6849
Epoch 415/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3486 - f1_score:
0.8905 - val_loss: 1.1417 - val_f1_score: 0.7109
Epoch 416/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3512 - f1_score:
0.8891 - val_loss: 1.1660 - val_f1_score: 0.7057
Epoch 417/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3448 - f1_score:
0.8877 - val_loss: 1.2811 - val_f1_score: 0.6618
Epoch 418/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3650 - f1_score:
0.8885 - val_loss: 1.1775 - val_f1_score: 0.6921
Epoch 419/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3525 - f1_score:
0.8938 - val_loss: 1.1839 - val_f1_score: 0.6787
Epoch 420/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3629 - f1_score:
0.8846 - val_loss: 1.2221 - val_f1_score: 0.6867
```

```
Epoch 421/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3620 - f1_score:
0.8777 - val_loss: 1.1559 - val_f1_score: 0.7052
Epoch 422/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3321 - f1_score:
0.9003 - val_loss: 1.2700 - val_f1_score: 0.6929
Epoch 423/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3497 - f1_score:
0.8943 - val_loss: 1.1949 - val_f1_score: 0.7022
Epoch 424/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3275 - f1_score:
0.9033 - val_loss: 1.1826 - val_f1_score: 0.6826
Epoch 425/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3539 - f1_score:
0.8795 - val_loss: 1.1556 - val_f1_score: 0.6855
Epoch 426/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3315 - f1_score:
0.9043 - val_loss: 1.1957 - val_f1_score: 0.6930
Epoch 427/500
28/28 [==============================] - 1s 54ms/step - loss: 0.3537 - f1_score:
0.8914 - val_loss: 1.2121 - val_f1_score: 0.6924
Epoch 428/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3531 - f1_score:
0.8846 - val_loss: 1.2280 - val_f1_score: 0.6981
Epoch 429/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3290 - f1_score:
0.8975 - val_loss: 1.1656 - val_f1_score: 0.7224
Epoch 430/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3363 - f1_score:
0.8986 - val_loss: 1.2003 - val_f1_score: 0.6764
Epoch 431/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3345 - f1_score:
0.8897 - val_loss: 1.2526 - val_f1_score: 0.6714
Epoch 432/500
28/28 [==============================] - 2s 55ms/step - loss: 0.3696 - f1_score:
0.8807 - val_loss: 1.2209 - val_f1_score: 0.7025
Epoch 433/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3279 - f1_score:
0.9015 - val_loss: 1.1716 - val_f1_score: 0.6918
Epoch 434/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3122 - f1_score:
0.8985 - val_loss: 1.2721 - val_f1_score: 0.6752
Epoch 435/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3257 - f1_score:
0.8983 - val_loss: 1.1987 - val_f1_score: 0.6868
Epoch 436/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3415 - f1_score:
0.8915 - val_loss: 1.1743 - val_f1_score: 0.7121
```

```
Epoch 437/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3503 - f1_score:
0.8973 - val_loss: 1.1595 - val_f1_score: 0.7063
Epoch 438/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3165 - f1_score:
0.9026 - val_loss: 1.2055 - val_f1_score: 0.6954
Epoch 439/500
28/28 [==============================] - 1s 54ms/step - loss: 0.3441 - f1_score:
0.8916 - val_loss: 1.2138 - val_f1_score: 0.6863
Epoch 440/500
28/28 [==============================] - 2s 54ms/step - loss: 0.3167 - f1_score:
0.9038 - val_loss: 1.1850 - val_f1_score: 0.6875
Epoch 441/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3298 - f1_score:
0.8975 - val_loss: 1.1824 - val_f1_score: 0.6830
Epoch 442/500
28/28 [==============================] - 1s 48ms/step - loss: 0.3392 - f1_score:
0.8950 - val_loss: 1.2421 - val_f1_score: 0.6990
Epoch 443/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3371 - f1_score:
0.8954 - val_loss: 1.1989 - val_f1_score: 0.6781
Epoch 444/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3321 - f1_score:
0.8973 - val_loss: 1.1750 - val_f1_score: 0.7041
Epoch 445/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3368 - f1_score:
0.8957 - val_loss: 1.2193 - val_f1_score: 0.7058
Epoch 446/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3427 - f1_score:
0.8959 - val_loss: 1.2436 - val_f1_score: 0.7036
Epoch 447/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3137 - f1_score:
0.8968 - val_loss: 1.2424 - val_f1_score: 0.6883
Epoch 448/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3292 - f1_score:
0.8967 - val_loss: 1.2480 - val_f1_score: 0.6825
Epoch 449/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3279 - f1_score:
0.9028 - val_loss: 1.2487 - val_f1_score: 0.6859
Epoch 450/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3007 - f1_score:
0.9092 - val_loss: 1.2458 - val_f1_score: 0.6846
Epoch 451/500
28/28 [==============================] - 2s 55ms/step - loss: 0.3303 - f1_score:
0.8982 - val_loss: 1.1868 - val_f1_score: 0.6924
Epoch 452/500
28/28 [==============================] - 2s 56ms/step - loss: 0.3475 - f1_score:
0.8930 - val_loss: 1.1928 - val_f1_score: 0.6835
```

```
Epoch 453/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3101 - f1_score:
0.9019 - val_loss: 1.2660 - val_f1_score: 0.6822
Epoch 454/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3217 - f1_score:
0.8986 - val_loss: 1.1895 - val_f1_score: 0.6915
Epoch 455/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3026 - f1_score:
0.9102 - val_loss: 1.2055 - val_f1_score: 0.7101
Epoch 456/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3133 - f1_score:
0.9004 - val_loss: 1.1444 - val_f1_score: 0.7028
Epoch 457/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3101 - f1_score:
0.9058 - val_loss: 1.2100 - val_f1_score: 0.7225
Epoch 458/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3078 - f1_score:
0.9002 - val_loss: 1.2065 - val_f1_score: 0.7039
Epoch 459/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3211 - f1_score:
0.9028 - val_loss: 1.2378 - val_f1_score: 0.6833
Epoch 460/500
28/28 [==============================] - 1s 52ms/step - loss: 0.2976 - f1_score:
0.9083 - val_loss: 1.2183 - val_f1_score: 0.7070
Epoch 461/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3026 - f1_score:
0.9063 - val_loss: 1.2278 - val_f1_score: 0.6831
Epoch 462/500
28/28 [==============================] - 1s 52ms/step - loss: 0.3078 - f1_score:
0.9005 - val_loss: 1.2020 - val_f1_score: 0.7049
Epoch 463/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3206 - f1_score:
0.8935 - val_loss: 1.1455 - val_f1_score: 0.7131
Epoch 464/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3071 - f1_score:
0.9006 - val_loss: 1.2170 - val_f1_score: 0.6976
Epoch 465/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3170 - f1_score:
0.9084 - val_loss: 1.2662 - val_f1_score: 0.6851
Epoch 466/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3097 - f1_score:
0.9087 - val_loss: 1.2176 - val_f1_score: 0.7170
Epoch 467/500
28/28 [==============================] - 1s 50ms/step - loss: 0.3198 - f1_score:
0.8953 - val_loss: 1.2163 - val_f1_score: 0.7112
Epoch 468/500
28/28 [==============================] - 1s 50ms/step - loss: 0.2971 - f1_score:
0.9111 - val_loss: 1.1725 - val_f1_score: 0.6970
```

```
Epoch 469/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3025 - f1_score:
0.9064 - val_loss: 1.2919 - val_f1_score: 0.7076
Epoch 470/500
28/28 [==============================] - 1s 51ms/step - loss: 0.3015 - f1_score:
0.9037 - val_loss: 1.2126 - val_f1_score: 0.7071
Epoch 471/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2659 - f1_score:
0.9215 - val_loss: 1.1776 - val_f1_score: 0.6976
Epoch 472/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2861 - f1_score:
0.9145 - val_loss: 1.1891 - val_f1_score: 0.7112
Epoch 473/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2795 - f1_score:
0.9133 - val_loss: 1.4428 - val_f1_score: 0.6645
Epoch 474/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2811 - f1_score:
0.9090 - val_loss: 1.2216 - val_f1_score: 0.7234
Epoch 475/500
28/28 [==============================] - 1s 51ms/step - loss: 0.2994 - f1_score:
0.9055 - val_loss: 1.2418 - val_f1_score: 0.6894
Epoch 476/500
28/28 [==============================] - 1s 50ms/step - loss: 0.2884 - f1_score:
0.9088 - val_loss: 1.2706 - val_f1_score: 0.6719
Epoch 477/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2831 - f1_score:
0.9187 - val_loss: 1.1893 - val_f1_score: 0.6976
Epoch 478/500
28/28 [==============================] - 1s 49ms/step - loss: 0.3051 - f1_score:
0.9077 - val_loss: 1.2239 - val_f1_score: 0.6907
Epoch 479/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2836 - f1_score:
0.9123 - val_loss: 1.2649 - val_f1_score: 0.6839
Epoch 480/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2831 - f1_score:
0.9123 - val_loss: 1.2444 - val_f1_score: 0.6736
Epoch 481/500
28/28 [==============================] - 2s 55ms/step - loss: 0.2984 - f1_score:
0.9123 - val_loss: 1.1951 - val_f1_score: 0.6879
Epoch 482/500
28/28 [==============================] - 1s 53ms/step - loss: 0.3020 - f1_score:
0.9042 - val_loss: 1.2546 - val_f1_score: 0.6747
Epoch 483/500
28/28 [==============================] - 1s 52ms/step - loss: 0.2826 - f1_score:
0.9152 - val_loss: 1.2396 - val_f1_score: 0.6991
Epoch 484/500
28/28 [==============================] - 1s 51ms/step - loss: 0.2694 - f1_score:
0.9147 - val_loss: 1.2109 - val_f1_score: 0.7056
```

```
Epoch 485/500
28/28 [==============================] - 1s 53ms/step - loss: 0.2968 - f1_score:
0.9109 - val_loss: 1.2255 - val_f1_score: 0.7090
Epoch 486/500
28/28 [==============================] - 1s 51ms/step - loss: 0.2972 - f1_score:
0.9022 - val_loss: 1.1627 - val_f1_score: 0.6822
Epoch 487/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2964 - f1_score:
0.9067 - val_loss: 1.2240 - val_f1_score: 0.7175
Epoch 488/500
28/28 [==============================] - 1s 48ms/step - loss: 0.2996 - f1_score:
0.9059 - val_loss: 1.1907 - val_f1_score: 0.6869
Epoch 489/500
28/28 [==============================] - 1s 48ms/step - loss: 0.2840 - f1_score:
0.9109 - val_loss: 1.1807 - val_f1_score: 0.7164
Epoch 490/500
28/28 [==============================] - 1s 47ms/step - loss: 0.2842 - f1_score:
0.9163 - val_loss: 1.1697 - val_f1_score: 0.6898
Epoch 491/500
28/28 [==============================] - 1s 48ms/step - loss: 0.2820 - f1_score:
0.9107 - val_loss: 1.2017 - val_f1_score: 0.7013
Epoch 492/500
28/28 [==============================] - 2s 54ms/step - loss: 0.2896 - f1_score:
0.9096 - val_loss: 1.2572 - val_f1_score: 0.6658
Epoch 493/500
28/28 [==============================] - 1s 47ms/step - loss: 0.2762 - f1_score:
0.9186 - val_loss: 1.3005 - val_f1_score: 0.6731
Epoch 494/500
28/28 [==============================] - 1s 47ms/step - loss: 0.2716 - f1_score:
0.9202 - val_loss: 1.2260 - val_f1_score: 0.7137
Epoch 495/500
28/28 [==============================] - 1s 48ms/step - loss: 0.2830 - f1_score:
0.9121 - val_loss: 1.1580 - val_f1_score: 0.7136
Epoch 496/500
28/28 [==============================] - 1s 50ms/step - loss: 0.2876 - f1_score:
0.9058 - val_loss: 1.1766 - val_f1_score: 0.7261
Epoch 497/500
28/28 [==============================] - 1s 48ms/step - loss: 0.2796 - f1_score:
0.9142 - val_loss: 1.2380 - val_f1_score: 0.6929
Epoch 498/500
28/28 [==============================] - 1s 47ms/step - loss: 0.2722 - f1_score:
0.9099 - val_loss: 1.1784 - val_f1_score: 0.7226
Epoch 499/500
28/28 [==============================] - 1s 46ms/step - loss: 0.2842 - f1_score:
0.9147 - val_loss: 1.2144 - val_f1_score: 0.6934
Epoch 500/500
28/28 [==============================] - 1s 49ms/step - loss: 0.2870 - f1_score:
0.9112 - val_loss: 1.1994 - val_f1_score: 0.7053
```

[135]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '2 1DCNN/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[121]:
```
hist_df = pd.read_csv('2 1DCNN/history.csv', index_col=0)
hist_df.tail()
```

[121]:

	loss	f1_score	val_loss	val_f1_score
495	0.287618	0.905777	1.176595	0.726073
496	0.279625	0.914159	1.237959	0.692942
497	0.272159	0.909928	1.178351	0.722594
498	0.284180	0.914742	1.214367	0.693400
499	0.287038	0.911243	1.199387	0.705317

[122]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[123]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[143]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 8ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.667     1.000     0.800         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.714     0.500     0.588        10
        BELT      1.000     1.000     1.000         4
        BITE      0.833     0.625     0.714         8
   BREAKFAST      0.600     0.500     0.545         6
      CANCER      0.889     1.000     0.941         8
```

CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.571	0.667	0.615	6
DARK	1.000	1.000	1.000	4
DEAF	0.000	0.000	0.000	6
DECIDE	1.000	0.333	0.500	6
DEMAND	0.800	0.500	0.615	8
DEVELOP	0.308	0.667	0.421	6
DINNER	1.000	0.625	0.769	8
DOG	0.444	0.667	0.533	6
DOWNSIZE	0.538	0.875	0.667	8
DRAG	1.000	0.500	0.667	4
EAT	1.000	1.000	1.000	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.500	0.375	0.429	8
FINE	0.200	0.500	0.286	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	0.750	1.000	0.857	6
GUESS	0.875	0.875	0.875	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.571	0.667	0.615	6
HURDLE/TRIP	0.500	0.500	0.500	4
JEWELRY	1.000	0.750	0.857	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.667	0.750	0.706	8
LUNCH	0.600	0.375	0.462	8
MAPLE	0.600	0.750	0.667	4
MEAT	0.667	1.000	0.800	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	1.000	1.000	8
MOVIE	0.600	0.750	0.667	8
NOON	0.727	1.000	0.842	8
PARTY	1.000	0.750	0.857	8
PATIENT	0.429	0.500	0.462	6
RAZOR	0.286	0.500	0.364	4
RIVER	1.000	0.667	0.800	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	1.000	0.400	0.571	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.500	0.250	0.333	4
THEY	0.667	1.000	0.800	4
TWINS	0.714	0.625	0.667	8
WHATFOR	0.889	0.800	0.842	10
accuracy			0.719	324
macro avg	0.755	0.711	0.705	324
weighted avg	0.765	0.719	0.716	324

[119]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN")
```

```
2023-09-11 20:18:23.485242: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-11 20:18:23.668254: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 539 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[145]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_2 (Conv1D)           (None, 127, 125)          199625

 max_pooling1d_2 (MaxPooling  (None, 15, 125)          0
 1D)

 conv1d_3 (Conv1D)           (None, 12, 50)            25050

 max_pooling1d_3 (MaxPooling  (None, 3, 50)            0
 1D)

 dropout_2 (Dropout)         (None, 3, 50)             0

 flatten_1 (Flatten)         (None, 150)               0

 dense_2 (Dense)             (None, 110)               16610

 dropout_3 (Dropout)         (None, 110)               0

 dense_3 (Dense)             (None, 50)                5550

=================================================================
Total params: 246,835
Trainable params: 246,835
Non-trainable params: 0
_________________________________________________________________
```

[146]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[146]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 127, 125)
MaxPooling1D
input: (None, 127, 125)
output: (None, 15, 125)
Conv1D
input: (None, 15, 125)
output: (None, 12, 50)
MaxPooling1D
input: (None, 12, 50)
output: (None, 3, 50)
Dropout
input: (None, 3, 50)
output: (None, 3, 50)
Flatten
input: (None, 3, 50)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 110)
Dropout
input: (None, 110)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[120]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[120]:

Conv1D
MaxPooling1D
Dropout
Flatten
Dense

[147]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 9ms/step - loss: 1.1180 - f1_score:
0.7272
```

[147]: [1.1179518699645996, 0.727241575717926]

[149]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 10ms/step - loss: 0.0722 - f1_score:
0.9983
```

[149]: [0.07216788083314896, 0.9982861280441284]

[148]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 7ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.600     1.000     0.750         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.700     0.700     0.700        10
        BELT      1.000     1.000     1.000         4
        BITE      0.750     0.750     0.750         8
   BREAKFAST      0.667     0.667     0.667         6
      CANCER      1.000     1.000     1.000         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      1.000     0.333     0.500         6
      DEMAND      0.750     0.375     0.500         8
     DEVELOP      0.400     0.667     0.500         6
      DINNER      1.000     0.875     0.933         8
         DOG      0.500     0.500     0.500         6
    DOWNSIZE      0.600     0.750     0.667         8
        DRAG      0.667     0.500     0.571         4
         EAT      1.000     1.000     1.000         6
        EDIT      1.000     1.000     1.000         6
    ELEVATOR      0.500     0.500     0.500         8
        FINE      0.200     0.500     0.286         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      0.857     0.750     0.800         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.667     0.667     0.667         6
 HURDLE/TRIP      0.500     0.500     0.500         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.714     0.625     0.667         8
       LUNCH      0.600     0.375     0.462         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.600     1.000     0.750         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     1.000     1.000         8
       MOVIE      0.625     0.625     0.625         8
        NOON      1.000     1.000     1.000         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.375     0.500     0.429         6
       RAZOR      0.333     0.500     0.400         4
       RIVER      1.000     0.667     0.800         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      1.000     0.400     0.571        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.667     1.000     0.800         4
       TWINS      0.714     0.625     0.667         8
     WHATFOR      0.818     0.900     0.857        10

    accuracy                          0.741       324
   macro avg      0.770     0.733     0.727       324
weighted avg      0.782     0.741     0.738       324
```

3.6 Hyperparameter Tuning 3 1D CNN Layers

[119]:
```
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_2521404/1222377179.py:2: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
```

```python
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='relu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[2, 3, 4, 5],
                       default=2,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(MaxPooling1D(pool_size=2))
        model.add(
            Conv1D(filters=hp.Int('filters_2',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_2',
                       values=[2, 3, 4, 5],
                       default=2,
                   ),
                   activation=act_function))
        model.add(MaxPooling1D(pool_size=2))
        model.add(
            Conv1D(filters=hp.Int('filters_3',
                                  min_value=50,
```

```
                                max_value=200,
                                step=25,
                                default=150),
                kernel_size=hp.Choice(
                    'kernel_3',
                    values=[2, 3, 4, 5],
                    default=2,
                ),
                activation=act_function))
        model.add(MaxPooling1D(pool_size=2))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.5,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(Flatten())
        model.add(
            Dense(units=hp.Int('units_5',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=80),
                  activation=act_function))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.5,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.0008273819395816823)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model
```

```
hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

[121]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='3_1D_CNN',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/3_1D_CNN/tuner0.json
```

[124]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 11
dense_activation (Choice)
{'default': 'relu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5], 'ordered': True}
filters_2 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_2 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5], 'ordered': True}
filters_3 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_3 (Choice)
{'default': 2, 'conditions': [], 'values': [2, 3, 4, 5], 'ordered': True}
dropout_1 (Float)
{'default': 0.8, 'conditions': [], 'min_value': 0.5, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_5 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
dropout_2 (Float)
```

```
{'default': 0.8, 'conditions': [], 'min_value': 0.5, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0008273819395816823, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[125]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[127]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 14m 47s]
val_f1_score: 0.6045276522636414

Best val_f1_score So Far: 0.6567659080028534
Total elapsed time: 10h 35m 20s
INFO:tensorflow:Oracle triggered exit
```

[121]:
```
best_model = tuner.get_best_models(num_models=6)[0]
```

```
2023-09-07 15:28:44.940453: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-07 15:28:45.924527: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1151 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
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object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
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object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
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See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
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object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
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```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```

```
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object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
```

[ ]:

```python

```

[122]:

```python
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 129, 150)          119850

 max_pooling1d (MaxPooling1D  (None, 64, 150)          0
 )

 conv1d_1 (Conv1D)           (None, 60, 75)            56325

 max_pooling1d_1 (MaxPooling  (None, 30, 75)           0
 1D)

 conv1d_2 (Conv1D)           (None, 27, 50)            15050
```

```
 max_pooling1d_2 (MaxPooling  (None, 13, 50)           0
 1D)

 dropout (Dropout)           (None, 13, 50)            0

 flatten (Flatten)           (None, 650)               0

 dense (Dense)               (None, 80)                52080

 dropout_1 (Dropout)         (None, 80)                0

 dense_1 (Dense)             (None, 50)                4050

=================================================================
Total params: 247,355
Trainable params: 247,355
Non-trainable params: 0
_________________________________________________________________
```

[123]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[123]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 129, 150)
MaxPooling1D
input: (None, 129, 150)
output: (None, 64, 150)
Conv1D
input: (None, 64, 150)
output: (None, 60, 75)
MaxPooling1D
input: (None, 60, 75)
output: (None, 30, 75)
Conv1D
input: (None, 30, 75)
output: (None, 27, 50)
MaxPooling1D
input: (None, 27, 50)
output: (None, 13, 50)
Dropout
input: (None, 13, 50)
output: (None, 13, 50)
Flatten
input: (None, 13, 50)
output: (None, 650)
Dense
input: (None, 650)
output: (None, 80)
Dropout
input: (None, 80)
output: (None, 80)
Dense
input: (None, 80)
output: (None, 50)

[129]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/3_1D_CNN
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0714 summary
Hyperparameters:
dense_activation: gelu
filters_1: 150
kernel_1: 2
filters_2: 75
kernel_2: 5
filters_3: 50
kernel_3: 4
dropout_1: 0.6
units_5: 80
dropout_2: 0.8
learning_rate: 0.0010731058974110062
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0711
Score: 0.6567659080028534

Trial 0671 summary
Hyperparameters:
dense_activation: gelu
filters_1: 150
kernel_1: 4
filters_2: 150
kernel_2: 4
filters_3: 50
kernel_3: 2
dropout_1: 0.5
units_5: 100
dropout_2: 0.6
learning_rate: 0.00034113846912856477
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0667
```

```
Score: 0.6532615125179291

Trial 0718 summary
Hyperparameters:
dense_activation: elu
filters_1: 175
kernel_1: 5
filters_2: 50
kernel_2: 3
filters_3: 75
kernel_3: 2
dropout_1: 0.8500000000000001
units_5: 120
dropout_2: 0.6
learning_rate: 0.00027660256617556995
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6496768295764923

Trial 0670 summary
Hyperparameters:
dense_activation: gelu
filters_1: 125
kernel_1: 2
filters_2: 50
kernel_2: 2
filters_3: 125
kernel_3: 2
dropout_1: 0.8
units_5: 70
dropout_2: 0.6
learning_rate: 0.0009829951294038418
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0668
Score: 0.6408900916576385

Trial 0598 summary
Hyperparameters:
dense_activation: elu
filters_1: 100
kernel_1: 3
filters_2: 175
kernel_2: 5
```

```
filters_3: 150
kernel_3: 2
dropout_1: 0.7
units_5: 80
dropout_2: 0.65
learning_rate: 0.000737956160144406
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0597
Score: 0.6405307054519653

Trial 0702 summary
Hyperparameters:
dense_activation: mish
filters_1: 150
kernel_1: 2
filters_2: 50
kernel_2: 4
filters_3: 125
kernel_3: 5
dropout_1: 0.65
units_5: 100
dropout_2: 0.7
learning_rate: 0.0001520991980668577
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0699
Score: 0.6199380457401276

Trial 0700 summary
Hyperparameters:
dense_activation: mish
filters_1: 75
kernel_1: 3
filters_2: 175
kernel_2: 5
filters_3: 175
kernel_3: 3
dropout_1: 0.65
units_5: 90
dropout_2: 0.55
learning_rate: 0.0003515867073645459
tuner/epochs: 300
tuner/initial_epoch: 100
```

```
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.608711838722229

Trial 0715 summary
Hyperparameters:
dense_activation: elu
filters_1: 75
kernel_1: 2
filters_2: 150
kernel_2: 5
filters_3: 200
kernel_3: 2
dropout_1: 0.75
units_5: 80
dropout_2: 0.6
learning_rate: 0.00030095252014948165
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0706
Score: 0.6073598861694336

Trial 0724 summary
Hyperparameters:
dense_activation: gelu
filters_1: 175
kernel_1: 3
filters_2: 50
kernel_2: 3
filters_3: 125
kernel_3: 2
dropout_1: 0.5
units_5: 110
dropout_2: 0.75
learning_rate: 0.0002566590573584278
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6045276522636414

Trial 0716 summary
Hyperparameters:
dense_activation: mish
filters_1: 125
```

```
kernel_1: 3
filters_2: 150
kernel_2: 2
filters_3: 150
kernel_3: 4
dropout_1: 0.7
units_5: 110
dropout_2: 0.7
learning_rate: 0.0001715739875569636
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0713
Score: 0.6032571792602539
```

[124]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
2023-09-07 15:29:18.065761: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [==============================] - 11s 36ms/step - loss: 1.3640 -
f1_score: 0.6603
```

[125]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 12ms/step - loss: 0.4578 - f1_score:
0.9051

2023-09-07 15:29:48.527565: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 475.44MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
```

[124]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=6)[0]
```

[125]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='3 1D CNN/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[126]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
```

```
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
```

```
2023-09-06 11:17:49.891273: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 842.83MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-06 11:17:50.022525: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 713.74MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-06 11:17:50.094878: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x7fa150d13fe0 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
2023-09-06 11:17:50.094913: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-06 11:17:50.104444: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-06 11:17:50.573784: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.
```

```
28/28 [==============================] - ETA: 0s - loss: 3.9512 - f1_score:
0.0225
```

```
2023-09-06 11:17:53.165813: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 784.82MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-06 11:17:53.265091: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 626.52MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-06 11:17:53.838636: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 552.79MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 9s 206ms/step - loss: 3.9512 -
f1_score: 0.0225 - val_loss: 3.9113 - val_f1_score: 0.0039
Epoch 2/500
27/28 [===========================>..] - ETA: 0s - loss: 3.9179 - f1_score:
0.0229

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 167ms/step - loss: 3.9184 -
f1_score: 0.0227 - val_loss: 3.9079 - val_f1_score: 0.0167
Epoch 3/500
28/28 [==============================] - 1s 51ms/step - loss: 3.9150 - f1_score:
0.0236 - val_loss: 3.9045 - val_f1_score: 0.0018
Epoch 4/500
28/28 [==============================] - 1s 51ms/step - loss: 3.9112 - f1_score:
0.0196 - val_loss: 3.9006 - val_f1_score: 0.0076
Epoch 5/500
28/28 [==============================] - 1s 51ms/step - loss: 3.9044 - f1_score:
0.0168 - val_loss: 3.8838 - val_f1_score: 0.0117
Epoch 6/500
27/28 [===========================>..] - ETA: 0s - loss: 3.8830 - f1_score:
0.0312

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 4s 161ms/step - loss: 3.8836 -
f1_score: 0.0307 - val_loss: 3.8398 - val_f1_score: 0.0244
Epoch 7/500
28/28 [==============================] - 1s 51ms/step - loss: 3.8395 - f1_score:
0.0356 - val_loss: 3.7278 - val_f1_score: 0.0147
Epoch 8/500
27/28 [===========================>..] - ETA: 0s - loss: 3.7663 - f1_score:
0.0461

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 186ms/step - loss: 3.7680 -
f1_score: 0.0466 - val_loss: 3.6364 - val_f1_score: 0.0410
Epoch 9/500
28/28 [==============================] - 1s 51ms/step - loss: 3.6679 - f1_score:
0.0532 - val_loss: 3.4854 - val_f1_score: 0.0323
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 3.5896 - f1_score:
0.0625

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 169ms/step - loss: 3.5896 -
f1_score: 0.0625 - val_loss: 3.4178 - val_f1_score: 0.0481
Epoch 11/500
27/28 [===========================>..] - ETA: 0s - loss: 3.5354 - f1_score:
0.0615

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 169ms/step - loss: 3.5300 -
f1_score: 0.0616 - val_loss: 3.2876 - val_f1_score: 0.0591
Epoch 12/500
27/28 [===========================>..] - ETA: 0s - loss: 3.4350 - f1_score:
0.0687

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 166ms/step - loss: 3.4293 -
f1_score: 0.0704 - val_loss: 3.2548 - val_f1_score: 0.0592
Epoch 13/500
27/28 [===========================>..] - ETA: 0s - loss: 3.3899 - f1_score:
0.0836
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 179ms/step - loss: 3.3867 -
f1_score: 0.0851 - val_loss: 3.1611 - val_f1_score: 0.1017
Epoch 14/500
27/28 [===========================>..] - ETA: 0s - loss: 3.3365 - f1_score:
0.0857

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 191ms/step - loss: 3.3340 -
f1_score: 0.0855 - val_loss: 3.1208 - val_f1_score: 0.1131
Epoch 15/500
28/28 [==============================] - 1s 51ms/step - loss: 3.2820 - f1_score:
0.0918 - val_loss: 3.1006 - val_f1_score: 0.0877
Epoch 16/500
28/28 [==============================] - 1s 51ms/step - loss: 3.2272 - f1_score:
0.0953 - val_loss: 2.9881 - val_f1_score: 0.1025
Epoch 17/500
27/28 [===========================>..] - ETA: 0s - loss: 3.1760 - f1_score:
0.1023

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 179ms/step - loss: 3.1791 -
f1_score: 0.1031 - val_loss: 2.9556 - val_f1_score: 0.1170
Epoch 18/500
28/28 [==============================] - 1s 51ms/step - loss: 3.1501 - f1_score:
0.1258 - val_loss: 2.9362 - val_f1_score: 0.1129
Epoch 19/500
27/28 [===========================>..] - ETA: 0s - loss: 3.0882 - f1_score:
0.1281

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 170ms/step - loss: 3.0897 -
f1_score: 0.1286 - val_loss: 2.8730 - val_f1_score: 0.1356
Epoch 20/500
28/28 [==============================] - 1s 51ms/step - loss: 3.0195 - f1_score:
0.1293 - val_loss: 2.8321 - val_f1_score: 0.1242
Epoch 21/500
27/28 [===========================>..] - ETA: 0s - loss: 2.9828 - f1_score:
0.1417

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 168ms/step - loss: 2.9772 -
f1_score: 0.1439 - val_loss: 2.7385 - val_f1_score: 0.1371
Epoch 22/500
28/28 [==============================] - ETA: 0s - loss: 2.9202 - f1_score:
0.1474

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 175ms/step - loss: 2.9202 -
f1_score: 0.1474 - val_loss: 2.6942 - val_f1_score: 0.1505
Epoch 23/500
27/28 [===========================>..] - ETA: 0s - loss: 2.8900 - f1_score:
0.1556

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 171ms/step - loss: 2.8839 -
f1_score: 0.1560 - val_loss: 2.6292 - val_f1_score: 0.1597
Epoch 24/500
27/28 [===========================>..] - ETA: 0s - loss: 2.8699 - f1_score:
0.1635
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 209ms/step - loss: 2.8689 -
f1_score: 0.1644 - val_loss: 2.5852 - val_f1_score: 0.1903
Epoch 25/500
28/28 [==============================] - 1s 51ms/step - loss: 2.8187 - f1_score:
0.1747 - val_loss: 2.6227 - val_f1_score: 0.1806
Epoch 26/500
27/28 [===========================>..] - ETA: 0s - loss: 2.7639 - f1_score:
0.1833

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 186ms/step - loss: 2.7530 -
f1_score: 0.1844 - val_loss: 2.5867 - val_f1_score: 0.2088
Epoch 27/500
28/28 [==============================] - 1s 51ms/step - loss: 2.7429 - f1_score:
0.1898 - val_loss: 2.6042 - val_f1_score: 0.1887
Epoch 28/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6864 - f1_score:
0.1896

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 190ms/step - loss: 2.6878 -
f1_score: 0.1900 - val_loss: 2.5714 - val_f1_score: 0.2140
Epoch 29/500
28/28 [==============================] - 1s 51ms/step - loss: 2.7018 - f1_score:
0.1972 - val_loss: 2.4389 - val_f1_score: 0.2052
Epoch 30/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6810 - f1_score:
0.2060

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 178ms/step - loss: 2.6771 -
f1_score: 0.2054 - val_loss: 2.4754 - val_f1_score: 0.2160
Epoch 31/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5961 - f1_score:
0.2231

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 189ms/step - loss: 2.5968 -
f1_score: 0.2226 - val_loss: 2.4049 - val_f1_score: 0.2451
Epoch 32/500
28/28 [==============================] - 1s 51ms/step - loss: 2.6134 - f1_score:
0.2030 - val_loss: 2.4697 - val_f1_score: 0.2379
Epoch 33/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5573 - f1_score:
0.2155

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 201ms/step - loss: 2.5525 -
f1_score: 0.2176 - val_loss: 2.4032 - val_f1_score: 0.2506
Epoch 34/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5166 - f1_score:
0.2261

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 184ms/step - loss: 2.5117 -
f1_score: 0.2275 - val_loss: 2.3450 - val_f1_score: 0.2731
Epoch 35/500
28/28 [==============================] - 1s 52ms/step - loss: 2.5601 - f1_score:
0.2279 - val_loss: 2.3568 - val_f1_score: 0.2700
Epoch 36/500
```

```
27/28 [==========================>..] - ETA: 0s - loss: 2.5134 - f1_score:
0.2301

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 183ms/step - loss: 2.5171 -
f1_score: 0.2287 - val_loss: 2.3343 - val_f1_score: 0.2825
Epoch 37/500
28/28 [==============================] - 1s 52ms/step - loss: 2.4657 - f1_score:
0.2495 - val_loss: 2.3844 - val_f1_score: 0.2685
Epoch 38/500
28/28 [==============================] - 1s 52ms/step - loss: 2.4258 - f1_score:
0.2492 - val_loss: 2.2722 - val_f1_score: 0.2691
Epoch 39/500
27/28 [==========================>..] - ETA: 0s - loss: 2.4227 - f1_score:
0.2402

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 190ms/step - loss: 2.4244 -
f1_score: 0.2384 - val_loss: 2.2980 - val_f1_score: 0.2933
Epoch 40/500
27/28 [==========================>..] - ETA: 0s - loss: 2.3829 - f1_score:
0.2561

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 181ms/step - loss: 2.3700 -
f1_score: 0.2596 - val_loss: 2.2394 - val_f1_score: 0.3103
Epoch 41/500
28/28 [==============================] - 1s 51ms/step - loss: 2.4234 - f1_score:
0.2597 - val_loss: 2.2476 - val_f1_score: 0.2892
Epoch 42/500
28/28 [==============================] - ETA: 0s - loss: 2.3449 - f1_score:
0.2710
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 192ms/step - loss: 2.3449 -
f1_score: 0.2710 - val_loss: 2.1843 - val_f1_score: 0.3134
Epoch 43/500
28/28 [==============================] - 1s 51ms/step - loss: 2.3190 - f1_score:
0.2773 - val_loss: 2.1943 - val_f1_score: 0.3101
Epoch 44/500
28/28 [==============================] - ETA: 0s - loss: 2.2846 - f1_score:
0.2780

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 206ms/step - loss: 2.2846 -
f1_score: 0.2780 - val_loss: 2.1673 - val_f1_score: 0.3483
Epoch 45/500
28/28 [==============================] - 1s 52ms/step - loss: 2.2983 - f1_score:
0.2939 - val_loss: 2.1516 - val_f1_score: 0.3186
Epoch 46/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2426 - f1_score:
0.2880

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 183ms/step - loss: 2.2479 -
f1_score: 0.2862 - val_loss: 2.0943 - val_f1_score: 0.3743
Epoch 47/500
28/28 [==============================] - 1s 52ms/step - loss: 2.2434 - f1_score:
0.2959 - val_loss: 2.0841 - val_f1_score: 0.3213
Epoch 48/500
28/28 [==============================] - 1s 52ms/step - loss: 2.2102 - f1_score:
0.3004 - val_loss: 2.0500 - val_f1_score: 0.3250
Epoch 49/500
28/28 [==============================] - 1s 52ms/step - loss: 2.2251 - f1_score:
0.3156 - val_loss: 2.0821 - val_f1_score: 0.3642
```

```
Epoch 50/500
28/28 [==============================] - 1s 53ms/step - loss: 2.2060 - f1_score:
0.2956 - val_loss: 2.0287 - val_f1_score: 0.3614
Epoch 51/500
28/28 [==============================] - ETA: 0s - loss: 2.1339 - f1_score:
0.3292

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 215ms/step - loss: 2.1339 -
f1_score: 0.3292 - val_loss: 2.0083 - val_f1_score: 0.3773
Epoch 52/500
27/28 [===========================>..] - ETA: 0s - loss: 2.1642 - f1_score:
0.3157

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 200ms/step - loss: 2.1632 -
f1_score: 0.3148 - val_loss: 2.1306 - val_f1_score: 0.3841
Epoch 53/500
28/28 [==============================] - 1s 52ms/step - loss: 2.1469 - f1_score:
0.3305 - val_loss: 2.0201 - val_f1_score: 0.3329
Epoch 54/500
28/28 [==============================] - 1s 52ms/step - loss: 2.1391 - f1_score:
0.3247 - val_loss: 2.0657 - val_f1_score: 0.3695
Epoch 55/500
27/28 [===========================>..] - ETA: 0s - loss: 2.1414 - f1_score:
0.3277

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 191ms/step - loss: 2.1432 -
f1_score: 0.3281 - val_loss: 1.9474 - val_f1_score: 0.4026
Epoch 56/500
28/28 [==============================] - 1s 52ms/step - loss: 2.1059 - f1_score:
0.3435 - val_loss: 1.9655 - val_f1_score: 0.3989
```

```
Epoch 57/500
27/28 [==========================>..] - ETA: 0s - loss: 2.1231 - f1_score:
0.3436

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 185ms/step - loss: 2.1244 -
f1_score: 0.3428 - val_loss: 2.0384 - val_f1_score: 0.4237
Epoch 58/500
28/28 [==============================] - 1s 51ms/step - loss: 2.0506 - f1_score:
0.3506 - val_loss: 1.9966 - val_f1_score: 0.4054
Epoch 59/500
28/28 [==============================] - 1s 51ms/step - loss: 2.0548 - f1_score:
0.3457 - val_loss: 1.9752 - val_f1_score: 0.4167
Epoch 60/500
28/28 [==============================] - ETA: 0s - loss: 2.0475 - f1_score:
0.3464

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 178ms/step - loss: 2.0475 -
f1_score: 0.3464 - val_loss: 1.9573 - val_f1_score: 0.4301
Epoch 61/500
28/28 [==============================] - 1s 52ms/step - loss: 2.0111 - f1_score:
0.3697 - val_loss: 1.9636 - val_f1_score: 0.3257
Epoch 62/500
27/28 [==========================>..] - ETA: 0s - loss: 1.9696 - f1_score:
0.3716

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 209ms/step - loss: 1.9623 -
f1_score: 0.3745 - val_loss: 1.8781 - val_f1_score: 0.4334
Epoch 63/500
28/28 [==============================] - 1s 51ms/step - loss: 1.9948 - f1_score:
0.3676 - val_loss: 1.9153 - val_f1_score: 0.4089
```

```
Epoch 64/500
28/28 [==============================] - 1s 52ms/step - loss: 1.9804 - f1_score:
0.3688 - val_loss: 1.9295 - val_f1_score: 0.4246
Epoch 65/500
28/28 [==============================] - 1s 52ms/step - loss: 1.9714 - f1_score:
0.3522 - val_loss: 1.8649 - val_f1_score: 0.3941
Epoch 66/500
28/28 [==============================] - 1s 52ms/step - loss: 1.9678 - f1_score:
0.3661 - val_loss: 1.7590 - val_f1_score: 0.4142
Epoch 67/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9402 - f1_score:
0.3870

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 191ms/step - loss: 1.9403 -
f1_score: 0.3875 - val_loss: 1.8273 - val_f1_score: 0.4662
Epoch 68/500
28/28 [==============================] - 1s 52ms/step - loss: 1.9271 - f1_score:
0.3946 - val_loss: 1.7706 - val_f1_score: 0.4577
Epoch 69/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8944 - f1_score:
0.3710 - val_loss: 1.8271 - val_f1_score: 0.4353
Epoch 70/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8976 - f1_score:
0.3978 - val_loss: 1.7368 - val_f1_score: 0.4231
Epoch 71/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8561 - f1_score:
0.3974 - val_loss: 1.8236 - val_f1_score: 0.4260
Epoch 72/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8440 - f1_score:
0.4132 - val_loss: 1.8814 - val_f1_score: 0.4406
Epoch 73/500
27/28 [===========================>..] - ETA: 0s - loss: 1.8542 - f1_score:
0.3958

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 200ms/step - loss: 1.8581 -
f1_score: 0.3955 - val_loss: 1.7570 - val_f1_score: 0.4805
```

```
Epoch 74/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8491 - f1_score:
0.3935 - val_loss: 1.7916 - val_f1_score: 0.4640
Epoch 75/500
28/28 [==============================] - 1s 51ms/step - loss: 1.8504 - f1_score:
0.4021 - val_loss: 1.7489 - val_f1_score: 0.4474
Epoch 76/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8463 - f1_score:
0.4122 - val_loss: 1.8463 - val_f1_score: 0.4715
Epoch 77/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7859 - f1_score:
0.4185 - val_loss: 1.7279 - val_f1_score: 0.4720
Epoch 78/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7658 - f1_score:
0.4327 - val_loss: 1.6711 - val_f1_score: 0.4698
Epoch 79/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7909 - f1_score:
0.4179 - val_loss: 1.7574 - val_f1_score: 0.4420
Epoch 80/500
28/28 [==============================] - 1s 52ms/step - loss: 1.8030 - f1_score:
0.4409 - val_loss: 1.6993 - val_f1_score: 0.4449
Epoch 81/500
27/28 [===========================>..] - ETA: 0s - loss: 1.7515 - f1_score:
0.4195

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 183ms/step - loss: 1.7515 -
f1_score: 0.4217 - val_loss: 1.7164 - val_f1_score: 0.4966
Epoch 82/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7365 - f1_score:
0.4349 - val_loss: 1.7252 - val_f1_score: 0.4936
Epoch 83/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7459 - f1_score:
0.4371 - val_loss: 1.7438 - val_f1_score: 0.4878
Epoch 84/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7678 - f1_score:
0.4296 - val_loss: 1.8521 - val_f1_score: 0.4563
Epoch 85/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7011 - f1_score:
0.4536 - val_loss: 1.7623 - val_f1_score: 0.4908
Epoch 86/500
28/28 [==============================] - 1s 53ms/step - loss: 1.7154 - f1_score:
0.4447 - val_loss: 1.7731 - val_f1_score: 0.4439
```

```
Epoch 87/500
27/28 [==========================>..] - ETA: 0s - loss: 1.6971 - f1_score:
0.4551

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 174ms/step - loss: 1.6947 -
f1_score: 0.4536 - val_loss: 1.6260 - val_f1_score: 0.5014
Epoch 88/500
28/28 [==============================] - 1s 52ms/step - loss: 1.7318 - f1_score:
0.4390 - val_loss: 1.7192 - val_f1_score: 0.4623
Epoch 89/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6671 - f1_score:
0.4576 - val_loss: 1.6763 - val_f1_score: 0.4300
Epoch 90/500
28/28 [==============================] - ETA: 0s - loss: 1.7289 - f1_score:
0.4488

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 181ms/step - loss: 1.7289 -
f1_score: 0.4488 - val_loss: 1.6797 - val_f1_score: 0.5086
Epoch 91/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6776 - f1_score:
0.4525 - val_loss: 1.7078 - val_f1_score: 0.5037
Epoch 92/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6764 - f1_score:
0.4448 - val_loss: 1.6385 - val_f1_score: 0.5064
Epoch 93/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6381 - f1_score:
0.4652 - val_loss: 1.7114 - val_f1_score: 0.4931
Epoch 94/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6307 - f1_score:
0.4644 - val_loss: 1.6696 - val_f1_score: 0.4875
Epoch 95/500
27/28 [==========================>..] - ETA: 0s - loss: 1.6442 - f1_score:
0.4646

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
```

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3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 187ms/step - loss: 1.6461 -
f1_score: 0.4637 - val_loss: 1.6546 - val_f1_score: 0.5318
Epoch 96/500
28/28 [==============================] - 1s 53ms/step - loss: 1.6199 - f1_score:
0.4758 - val_loss: 1.6306 - val_f1_score: 0.4740
Epoch 97/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5841 - f1_score:
0.4811 - val_loss: 1.5760 - val_f1_score: 0.5261
Epoch 98/500
28/28 [==============================] - 1s 53ms/step - loss: 1.6307 - f1_score:
0.4615 - val_loss: 1.5789 - val_f1_score: 0.5229
Epoch 99/500
28/28 [==============================] - 1s 53ms/step - loss: 1.6146 - f1_score:
0.4764 - val_loss: 1.6133 - val_f1_score: 0.4683
Epoch 100/500
28/28 [==============================] - 1s 52ms/step - loss: 1.6097 - f1_score:
0.4806 - val_loss: 1.6274 - val_f1_score: 0.5208
Epoch 101/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5997 - f1_score:
0.4788 - val_loss: 1.7131 - val_f1_score: 0.4479
Epoch 102/500
27/28 [============================>..] - ETA: 0s - loss: 1.5843 - f1_score:
0.4789

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 205ms/step - loss: 1.5868 -
f1_score: 0.4756 - val_loss: 1.6253 - val_f1_score: 0.5498
Epoch 103/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5339 - f1_score:
0.4989 - val_loss: 1.5952 - val_f1_score: 0.5070
Epoch 104/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5565 - f1_score:
0.4880 - val_loss: 1.6159 - val_f1_score: 0.5095
Epoch 105/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5330 - f1_score:
0.4977 - val_loss: 1.6188 - val_f1_score: 0.5212
Epoch 106/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5829 - f1_score:
```

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0.4856 - val_loss: 1.6390 - val_f1_score: 0.5120
Epoch 107/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5148 - f1_score:
0.5012 - val_loss: 1.5939 - val_f1_score: 0.5055
Epoch 108/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5373 - f1_score:
0.4989 - val_loss: 1.5416 - val_f1_score: 0.5020
Epoch 109/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5187 - f1_score:
0.4997 - val_loss: 1.4779 - val_f1_score: 0.5368
Epoch 110/500
28/28 [==============================] - 1s 52ms/step - loss: 1.5010 - f1_score:
0.5227 - val_loss: 1.6384 - val_f1_score: 0.5243
Epoch 111/500
28/28 [==============================] - 2s 55ms/step - loss: 1.5531 - f1_score:
0.4819 - val_loss: 1.5822 - val_f1_score: 0.5493
Epoch 112/500
28/28 [==============================] - 2s 54ms/step - loss: 1.4979 - f1_score:
0.5156 - val_loss: 1.5175 - val_f1_score: 0.5203
Epoch 113/500
28/28 [==============================] - 2s 54ms/step - loss: 1.5121 - f1_score:
0.5079 - val_loss: 1.4995 - val_f1_score: 0.5230
Epoch 114/500
28/28 [==============================] - 1s 53ms/step - loss: 1.5166 - f1_score:
0.5006 - val_loss: 1.6209 - val_f1_score: 0.5130
Epoch 115/500
28/28 [==============================] - 2s 54ms/step - loss: 1.4816 - f1_score:
0.5148 - val_loss: 1.5546 - val_f1_score: 0.5431
Epoch 116/500
28/28 [==============================] - 2s 59ms/step - loss: 1.5061 - f1_score:
0.5198 - val_loss: 1.5137 - val_f1_score: 0.5135
Epoch 117/500
27/28 [============================>..] - ETA: 0s - loss: 1.4350 - f1_score:
0.5174

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 202ms/step - loss: 1.4334 -
f1_score: 0.5186 - val_loss: 1.5292 - val_f1_score: 0.5566
Epoch 118/500
28/28 [==============================] - 1s 52ms/step - loss: 1.4625 - f1_score:
0.5181 - val_loss: 1.4901 - val_f1_score: 0.5336
Epoch 119/500
28/28 [==============================] - 1s 52ms/step - loss: 1.4625 - f1_score:
```

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0.5253 - val_loss: 1.5651 - val_f1_score: 0.5351
Epoch 120/500
28/28 [==============================] - 1s 53ms/step - loss: 1.4320 - f1_score:
0.5190 - val_loss: 1.6121 - val_f1_score: 0.5388
Epoch 121/500
28/28 [==============================] - 2s 55ms/step - loss: 1.4414 - f1_score:
0.5335 - val_loss: 1.4313 - val_f1_score: 0.5311
Epoch 122/500
28/28 [==============================] - 2s 57ms/step - loss: 1.4686 - f1_score:
0.5271 - val_loss: 1.5083 - val_f1_score: 0.5452
Epoch 123/500
28/28 [==============================] - 2s 58ms/step - loss: 1.4179 - f1_score:
0.5359 - val_loss: 1.4626 - val_f1_score: 0.5559
Epoch 124/500
28/28 [==============================] - 2s 59ms/step - loss: 1.4128 - f1_score:
0.5420 - val_loss: 1.5013 - val_f1_score: 0.5021
Epoch 125/500
28/28 [==============================] - 2s 54ms/step - loss: 1.4053 - f1_score:
0.5464 - val_loss: 1.4768 - val_f1_score: 0.5417
Epoch 126/500
28/28 [==============================] - 2s 54ms/step - loss: 1.4371 - f1_score:
0.5304 - val_loss: 1.5031 - val_f1_score: 0.5321
Epoch 127/500
28/28 [==============================] - ETA: 0s - loss: 1.4237 - f1_score:
0.5412

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 218ms/step - loss: 1.4237 -
f1_score: 0.5412 - val_loss: 1.4777 - val_f1_score: 0.5619
Epoch 128/500
28/28 [==============================] - 1s 53ms/step - loss: 1.4357 - f1_score:
0.5171 - val_loss: 1.5618 - val_f1_score: 0.5430
Epoch 129/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3967 - f1_score:
0.5478 - val_loss: 1.5878 - val_f1_score: 0.5333
Epoch 130/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3840 - f1_score:
0.5357 - val_loss: 1.5188 - val_f1_score: 0.5375
Epoch 131/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3868 - f1_score:
0.5366 - val_loss: 1.4959 - val_f1_score: 0.5345
Epoch 132/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3925 - f1_score:
```

```
0.5515

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 206ms/step - loss: 1.3863 -
f1_score: 0.5532 - val_loss: 1.5001 - val_f1_score: 0.5909
Epoch 133/500
28/28 [==============================] - 2s 60ms/step - loss: 1.3870 - f1_score:
0.5364 - val_loss: 1.4941 - val_f1_score: 0.5292
Epoch 134/500
28/28 [==============================] - 2s 55ms/step - loss: 1.3769 - f1_score:
0.5452 - val_loss: 1.4827 - val_f1_score: 0.5429
Epoch 135/500
27/28 [============================>..] - ETA: 0s - loss: 1.3830 - f1_score:
0.5499

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 202ms/step - loss: 1.3828 -
f1_score: 0.5500 - val_loss: 1.4247 - val_f1_score: 0.5992
Epoch 136/500
28/28 [==============================] - 1s 54ms/step - loss: 1.3630 - f1_score:
0.5481 - val_loss: 1.4013 - val_f1_score: 0.5554
Epoch 137/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3934 - f1_score:
0.5299 - val_loss: 1.4635 - val_f1_score: 0.5556
Epoch 138/500
28/28 [==============================] - 2s 58ms/step - loss: 1.3455 - f1_score:
0.5487 - val_loss: 1.4671 - val_f1_score: 0.5777
Epoch 139/500
28/28 [==============================] - 2s 55ms/step - loss: 1.3359 - f1_score:
0.5558 - val_loss: 1.5555 - val_f1_score: 0.5588
Epoch 140/500
28/28 [==============================] - 2s 55ms/step - loss: 1.2807 - f1_score:
0.5707 - val_loss: 1.4388 - val_f1_score: 0.5371
Epoch 141/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3350 - f1_score:
0.5561 - val_loss: 1.4027 - val_f1_score: 0.5465
Epoch 142/500
28/28 [==============================] - 1s 52ms/step - loss: 1.3208 - f1_score:
```

```
0.5717 - val_loss: 1.4282 - val_f1_score: 0.5718
Epoch 143/500
28/28 [==============================] - 1s 52ms/step - loss: 1.3547 - f1_score:
0.5557 - val_loss: 1.5891 - val_f1_score: 0.5537
Epoch 144/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3078 - f1_score:
0.5724 - val_loss: 1.4494 - val_f1_score: 0.5418
Epoch 145/500
28/28 [==============================] - 1s 54ms/step - loss: 1.3191 - f1_score:
0.5614 - val_loss: 1.4927 - val_f1_score: 0.5498
Epoch 146/500
28/28 [==============================] - 1s 52ms/step - loss: 1.3215 - f1_score:
0.5611 - val_loss: 1.4213 - val_f1_score: 0.5746
Epoch 147/500
28/28 [==============================] - 1s 51ms/step - loss: 1.3132 - f1_score:
0.5644 - val_loss: 1.4161 - val_f1_score: 0.5751
Epoch 148/500
28/28 [==============================] - 1s 52ms/step - loss: 1.3409 - f1_score:
0.5597 - val_loss: 1.4913 - val_f1_score: 0.5733
Epoch 149/500
28/28 [==============================] - 1s 53ms/step - loss: 1.3027 - f1_score:
0.5630 - val_loss: 1.4789 - val_f1_score: 0.5567
Epoch 150/500
28/28 [==============================] - 2s 60ms/step - loss: 1.2705 - f1_score:
0.5829 - val_loss: 1.4147 - val_f1_score: 0.5600
Epoch 151/500
28/28 [==============================] - 2s 58ms/step - loss: 1.2905 - f1_score:
0.5697 - val_loss: 1.4182 - val_f1_score: 0.5111
Epoch 152/500
28/28 [==============================] - 2s 57ms/step - loss: 1.2810 - f1_score:
0.5628 - val_loss: 1.4905 - val_f1_score: 0.5618
Epoch 153/500
28/28 [==============================] - 2s 54ms/step - loss: 1.2861 - f1_score:
0.5679 - val_loss: 1.4201 - val_f1_score: 0.5483
Epoch 154/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2854 - f1_score:
0.5699 - val_loss: 1.3687 - val_f1_score: 0.5431
Epoch 155/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2746 - f1_score:
0.5768 - val_loss: 1.4084 - val_f1_score: 0.5412
Epoch 156/500
28/28 [==============================] - 2s 54ms/step - loss: 1.2421 - f1_score:
0.5939 - val_loss: 1.5949 - val_f1_score: 0.5412
Epoch 157/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2709 - f1_score:
0.5847 - val_loss: 1.3949 - val_f1_score: 0.5533
Epoch 158/500
28/28 [==============================] - 2s 54ms/step - loss: 1.2486 - f1_score:
```

```
0.5845 - val_loss: 1.4053 - val_f1_score: 0.5543
Epoch 159/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2733 - f1_score:
0.5752 - val_loss: 1.5242 - val_f1_score: 0.5477
Epoch 160/500
28/28 [==============================] - 2s 55ms/step - loss: 1.2360 - f1_score:
0.5955 - val_loss: 1.4314 - val_f1_score: 0.5431
Epoch 161/500
28/28 [==============================] - 2s 54ms/step - loss: 1.2547 - f1_score:
0.5796 - val_loss: 1.3869 - val_f1_score: 0.5622
Epoch 162/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2665 - f1_score:
0.5771 - val_loss: 1.4719 - val_f1_score: 0.5731
Epoch 163/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2280 - f1_score:
0.5893 - val_loss: 1.4372 - val_f1_score: 0.5483
Epoch 164/500
28/28 [==============================] - 1s 53ms/step - loss: 1.2907 - f1_score:
0.5788 - val_loss: 1.4223 - val_f1_score: 0.5806
Epoch 165/500
28/28 [==============================] - 1s 54ms/step - loss: 1.2225 - f1_score:
0.5899 - val_loss: 1.3868 - val_f1_score: 0.5827
Epoch 166/500
28/28 [==============================] - 2s 55ms/step - loss: 1.2122 - f1_score:
0.5900 - val_loss: 1.4083 - val_f1_score: 0.5914
Epoch 167/500
28/28 [==============================] - 2s 54ms/step - loss: 1.2390 - f1_score:
0.5967 - val_loss: 1.3759 - val_f1_score: 0.5745
Epoch 168/500
28/28 [==============================] - 1s 54ms/step - loss: 1.1645 - f1_score:
0.6128 - val_loss: 1.4347 - val_f1_score: 0.5642
Epoch 169/500
28/28 [==============================] - 1s 53ms/step - loss: 1.2146 - f1_score:
0.5909 - val_loss: 1.4194 - val_f1_score: 0.5626
Epoch 170/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2002 - f1_score:
0.6001 - val_loss: 1.5197 - val_f1_score: 0.5437
Epoch 171/500
28/28 [==============================] - 1s 53ms/step - loss: 1.2184 - f1_score:
0.5937 - val_loss: 1.4456 - val_f1_score: 0.5970
Epoch 172/500
28/28 [==============================] - 2s 57ms/step - loss: 1.2315 - f1_score:
0.5867 - val_loss: 1.3829 - val_f1_score: 0.5804
Epoch 173/500
28/28 [==============================] - 2s 58ms/step - loss: 1.1911 - f1_score:
0.6130 - val_loss: 1.5230 - val_f1_score: 0.5423
Epoch 174/500
28/28 [==============================] - ETA: 0s - loss: 1.1897 - f1_score:
```

```
0.5990

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 7s 257ms/step - loss: 1.1897 -
f1_score: 0.5990 - val_loss: 1.3279 - val_f1_score: 0.6312
Epoch 175/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1977 - f1_score:
0.5875 - val_loss: 1.3439 - val_f1_score: 0.6127
Epoch 176/500
28/28 [==============================] - 1s 53ms/step - loss: 1.2002 - f1_score:
0.6037 - val_loss: 1.4964 - val_f1_score: 0.5339
Epoch 177/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1778 - f1_score:
0.6140 - val_loss: 1.4967 - val_f1_score: 0.5714
Epoch 178/500
28/28 [==============================] - 1s 53ms/step - loss: 1.2166 - f1_score:
0.6019 - val_loss: 1.3488 - val_f1_score: 0.5894
Epoch 179/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1786 - f1_score:
0.6045 - val_loss: 1.4442 - val_f1_score: 0.5655
Epoch 180/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1595 - f1_score:
0.6162 - val_loss: 1.3930 - val_f1_score: 0.5753
Epoch 181/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1773 - f1_score:
0.5956 - val_loss: 1.5232 - val_f1_score: 0.5702
Epoch 182/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1188 - f1_score:
0.6235 - val_loss: 1.4155 - val_f1_score: 0.5680
Epoch 183/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1409 - f1_score:
0.6240 - val_loss: 1.3631 - val_f1_score: 0.5657
Epoch 184/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1773 - f1_score:
0.6035 - val_loss: 1.5148 - val_f1_score: 0.5589
Epoch 185/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1760 - f1_score:
0.6157 - val_loss: 1.3953 - val_f1_score: 0.5722
Epoch 186/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1468 - f1_score:
0.6202 - val_loss: 1.4001 - val_f1_score: 0.5770
Epoch 187/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1803 - f1_score:
```

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0.6158 - val_loss: 1.4100 - val_f1_score: 0.5950
Epoch 188/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1476 - f1_score:
0.6119 - val_loss: 1.3448 - val_f1_score: 0.6029
Epoch 189/500
28/28 [==============================] - 1s 54ms/step - loss: 1.1469 - f1_score:
0.6191 - val_loss: 1.3730 - val_f1_score: 0.5793
Epoch 190/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1388 - f1_score:
0.6156 - val_loss: 1.4429 - val_f1_score: 0.5878
Epoch 191/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1435 - f1_score:
0.6322 - val_loss: 1.4699 - val_f1_score: 0.5571
Epoch 192/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1282 - f1_score:
0.6334 - val_loss: 1.5265 - val_f1_score: 0.5599
Epoch 193/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1117 - f1_score:
0.6403 - val_loss: 1.3552 - val_f1_score: 0.5718
Epoch 194/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1121 - f1_score:
0.6445 - val_loss: 1.4262 - val_f1_score: 0.5739
Epoch 195/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1470 - f1_score:
0.6212 - val_loss: 1.4971 - val_f1_score: 0.5695
Epoch 196/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1035 - f1_score:
0.6401 - val_loss: 1.4004 - val_f1_score: 0.5811
Epoch 197/500
28/28 [==============================] - 2s 54ms/step - loss: 1.1380 - f1_score:
0.6364 - val_loss: 1.4338 - val_f1_score: 0.5960
Epoch 198/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0753 - f1_score:
0.6376 - val_loss: 1.4019 - val_f1_score: 0.5988
Epoch 199/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0836 - f1_score:
0.6248 - val_loss: 1.4302 - val_f1_score: 0.5628
Epoch 200/500
28/28 [==============================] - 1s 53ms/step - loss: 1.1142 - f1_score:
0.6362 - val_loss: 1.3605 - val_f1_score: 0.5835
Epoch 201/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1323 - f1_score:
0.6264 - val_loss: 1.4861 - val_f1_score: 0.5666
Epoch 202/500
28/28 [==============================] - 2s 55ms/step - loss: 1.1053 - f1_score:
0.6264 - val_loss: 1.5323 - val_f1_score: 0.5783
Epoch 203/500
28/28 [==============================] - 2s 58ms/step - loss: 1.1022 - f1_score:
```

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0.6413 - val_loss: 1.3827 - val_f1_score: 0.5870
Epoch 204/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0619 - f1_score:
0.6487 - val_loss: 1.3606 - val_f1_score: 0.5900
Epoch 205/500
28/28 [==============================] - 1s 54ms/step - loss: 1.1212 - f1_score:
0.6316 - val_loss: 1.4732 - val_f1_score: 0.5472
Epoch 206/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0965 - f1_score:
0.6413 - val_loss: 1.4948 - val_f1_score: 0.5907
Epoch 207/500
28/28 [==============================] - 1s 54ms/step - loss: 1.0916 - f1_score:
0.6476 - val_loss: 1.3411 - val_f1_score: 0.6200
Epoch 208/500
28/28 [==============================] - 1s 54ms/step - loss: 1.1023 - f1_score:
0.6277 - val_loss: 1.4119 - val_f1_score: 0.5987
Epoch 209/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0750 - f1_score:
0.6430 - val_loss: 1.5822 - val_f1_score: 0.6057
Epoch 210/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1203 - f1_score:
0.6310

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 7s 247ms/step - loss: 1.1251 -
f1_score: 0.6293 - val_loss: 1.2910 - val_f1_score: 0.6390
Epoch 211/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0521 - f1_score:
0.6507 - val_loss: 1.2927 - val_f1_score: 0.6079
Epoch 212/500
28/28 [==============================] - 1s 52ms/step - loss: 1.0999 - f1_score:
0.6413 - val_loss: 1.4452 - val_f1_score: 0.5883
Epoch 213/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0450 - f1_score:
0.6555 - val_loss: 1.4393 - val_f1_score: 0.5759
Epoch 214/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0679 - f1_score:
0.6351 - val_loss: 1.3245 - val_f1_score: 0.6363
Epoch 215/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0508 - f1_score:
0.6603 - val_loss: 1.3798 - val_f1_score: 0.5824
Epoch 216/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0769 - f1_score:
```

```
0.6481 - val_loss: 1.4090 - val_f1_score: 0.6081
Epoch 217/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0219 - f1_score:
0.6578 - val_loss: 1.4111 - val_f1_score: 0.6028
Epoch 218/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0719 - f1_score:
0.6427 - val_loss: 1.3258 - val_f1_score: 0.5885
Epoch 219/500
28/28 [==============================] - 1s 54ms/step - loss: 1.0248 - f1_score:
0.6647 - val_loss: 1.3310 - val_f1_score: 0.6096
Epoch 220/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0350 - f1_score:
0.6586 - val_loss: 1.4718 - val_f1_score: 0.5934
Epoch 221/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0847 - f1_score:
0.6477 - val_loss: 1.4293 - val_f1_score: 0.5858
Epoch 222/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0896 - f1_score:
0.6375 - val_loss: 1.4225 - val_f1_score: 0.5764
Epoch 223/500
28/28 [==============================] - 2s 58ms/step - loss: 1.0547 - f1_score:
0.6441 - val_loss: 1.3292 - val_f1_score: 0.5988
Epoch 224/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0425 - f1_score:
0.6511 - val_loss: 1.3703 - val_f1_score: 0.6112
Epoch 225/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0322 - f1_score:
0.6389 - val_loss: 1.2756 - val_f1_score: 0.6223
Epoch 226/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0473 - f1_score:
0.6498 - val_loss: 1.5218 - val_f1_score: 0.5799
Epoch 227/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0262 - f1_score:
0.6786 - val_loss: 1.3699 - val_f1_score: 0.6156
Epoch 228/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0226 - f1_score:
0.6521 - val_loss: 1.4093 - val_f1_score: 0.6006
Epoch 229/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0243 - f1_score:
0.6525 - val_loss: 1.4483 - val_f1_score: 0.6019
Epoch 230/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0125 - f1_score:
0.6692 - val_loss: 1.4613 - val_f1_score: 0.5971
Epoch 231/500
28/28 [==============================] - 1s 53ms/step - loss: 1.0494 - f1_score:
0.6501 - val_loss: 1.4474 - val_f1_score: 0.6123
Epoch 232/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0073 - f1_score:
```

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0.6523 - val_loss: 1.3975 - val_f1_score: 0.5590
Epoch 233/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0378 - f1_score:
0.6661 - val_loss: 1.3713 - val_f1_score: 0.6020
Epoch 234/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0318 - f1_score:
0.6608 - val_loss: 1.5098 - val_f1_score: 0.5860
Epoch 235/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0290 - f1_score:
0.6544 - val_loss: 1.5099 - val_f1_score: 0.5839
Epoch 236/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0025 - f1_score:
0.6616 - val_loss: 1.3841 - val_f1_score: 0.6070
Epoch 237/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9768 - f1_score:
0.6831 - val_loss: 1.3848 - val_f1_score: 0.6290
Epoch 238/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0069 - f1_score:
0.6582 - val_loss: 1.2846 - val_f1_score: 0.6272
Epoch 239/500
28/28 [==============================] - 1s 54ms/step - loss: 0.9876 - f1_score:
0.6808 - val_loss: 1.3968 - val_f1_score: 0.6088
Epoch 240/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9997 - f1_score:
0.6683 - val_loss: 1.4307 - val_f1_score: 0.6354
Epoch 241/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9872 - f1_score:
0.6692 - val_loss: 1.4237 - val_f1_score: 0.5963
Epoch 242/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9983 - f1_score:
0.6768 - val_loss: 1.3893 - val_f1_score: 0.6020
Epoch 243/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9901 - f1_score:
0.6666 - val_loss: 1.3959 - val_f1_score: 0.6298
Epoch 244/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9828 - f1_score:
0.6751 - val_loss: 1.3916 - val_f1_score: 0.5871
Epoch 245/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9708 - f1_score:
0.6716 - val_loss: 1.4569 - val_f1_score: 0.6211
Epoch 246/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0117 - f1_score:
0.6572 - val_loss: 1.4403 - val_f1_score: 0.6036
Epoch 247/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9896 - f1_score:
0.6699 - val_loss: 1.3614 - val_f1_score: 0.6239
Epoch 248/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9690 - f1_score:
```

```
0.6766 - val_loss: 1.4119 - val_f1_score: 0.6077
Epoch 249/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0095 - f1_score:
0.6692 - val_loss: 1.4254 - val_f1_score: 0.6027
Epoch 250/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9889 - f1_score:
0.6737 - val_loss: 1.3640 - val_f1_score: 0.6011
Epoch 251/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9848 - f1_score:
0.6775 - val_loss: 1.3908 - val_f1_score: 0.6019
Epoch 252/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9773 - f1_score:
0.6704 - val_loss: 1.4952 - val_f1_score: 0.6111
Epoch 253/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0082 - f1_score:
0.6659 - val_loss: 1.4528 - val_f1_score: 0.6050
Epoch 254/500
28/28 [==============================] - 2s 54ms/step - loss: 1.0090 - f1_score:
0.6612 - val_loss: 1.6502 - val_f1_score: 0.5744
Epoch 255/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9620 - f1_score:
0.6719 - val_loss: 1.4131 - val_f1_score: 0.6271
Epoch 256/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9648 - f1_score:
0.6737 - val_loss: 1.4580 - val_f1_score: 0.6246
Epoch 257/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9665 - f1_score:
0.6806 - val_loss: 1.3649 - val_f1_score: 0.6163
Epoch 258/500
27/28 [============================>..] - ETA: 0s - loss: 0.9482 - f1_score:
0.6800

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

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28/28 [==============================] - 6s 212ms/step - loss: 0.9449 -
f1_score: 0.6827 - val_loss: 1.3977 - val_f1_score: 0.6393
Epoch 259/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9435 - f1_score:
0.6838 - val_loss: 1.4833 - val_f1_score: 0.6079
Epoch 260/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9462 - f1_score:
0.6782 - val_loss: 1.4409 - val_f1_score: 0.6030
Epoch 261/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9521 - f1_score:
```

```
0.6893 - val_loss: 1.5326 - val_f1_score: 0.6002
Epoch 262/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9745 - f1_score:
0.6851 - val_loss: 1.3699 - val_f1_score: 0.6383
Epoch 263/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9232 - f1_score:
0.6933 - val_loss: 1.4277 - val_f1_score: 0.6038
Epoch 264/500
27/28 [===========================>..] - ETA: 0s - loss: 0.9399 - f1_score:
0.6918

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 193ms/step - loss: 0.9397 -
f1_score: 0.6912 - val_loss: 1.2755 - val_f1_score: 0.6463
Epoch 265/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9062 - f1_score:
0.6999 - val_loss: 1.5533 - val_f1_score: 0.6144
Epoch 266/500
28/28 [==============================] - ETA: 0s - loss: 0.9341 - f1_score:
0.6875

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 5s 193ms/step - loss: 0.9341 -
f1_score: 0.6875 - val_loss: 1.2842 - val_f1_score: 0.6480
Epoch 267/500
28/28 [==============================] - 1s 52ms/step - loss: 0.9820 - f1_score:
0.6793 - val_loss: 1.3334 - val_f1_score: 0.6328
Epoch 268/500
28/28 [==============================] - 1s 52ms/step - loss: 0.9444 - f1_score:
0.6871 - val_loss: 1.4983 - val_f1_score: 0.6036
Epoch 269/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9476 - f1_score:
0.6779 - val_loss: 1.3623 - val_f1_score: 0.6253
Epoch 270/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9498 - f1_score:
0.6824 - val_loss: 1.4406 - val_f1_score: 0.5852
Epoch 271/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9335 - f1_score:
```

```
0.6912 - val_loss: 1.5382 - val_f1_score: 0.6041
Epoch 272/500
28/28 [==============================] - ETA: 0s - loss: 0.9796 - f1_score:
0.6876

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 235ms/step - loss: 0.9796 -
f1_score: 0.6876 - val_loss: 1.3677 - val_f1_score: 0.6588
Epoch 273/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9599 - f1_score:
0.6805 - val_loss: 1.5790 - val_f1_score: 0.6012
Epoch 274/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9362 - f1_score:
0.6831 - val_loss: 1.5277 - val_f1_score: 0.6101
Epoch 275/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9325 - f1_score:
0.6920 - val_loss: 1.2657 - val_f1_score: 0.6391
Epoch 276/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9283 - f1_score:
0.6834 - val_loss: 1.4553 - val_f1_score: 0.6272
Epoch 277/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9683 - f1_score:
0.6733 - val_loss: 1.4052 - val_f1_score: 0.6236
Epoch 278/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9324 - f1_score:
0.6850 - val_loss: 1.3340 - val_f1_score: 0.6307
Epoch 279/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9367 - f1_score:
0.7053 - val_loss: 1.4186 - val_f1_score: 0.6269
Epoch 280/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9474 - f1_score:
0.6949 - val_loss: 1.5246 - val_f1_score: 0.6124
Epoch 281/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8922 - f1_score:
0.7012 - val_loss: 1.3010 - val_f1_score: 0.6474
Epoch 282/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9240 - f1_score:
0.6890 - val_loss: 1.3644 - val_f1_score: 0.6536
Epoch 283/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9014 - f1_score:
0.6977 - val_loss: 1.3290 - val_f1_score: 0.6353
Epoch 284/500
28/28 [==============================] - 1s 53ms/step - loss: 0.9168 - f1_score:
```

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0.6849 - val_loss: 1.5723 - val_f1_score: 0.6009
Epoch 285/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8942 - f1_score:
0.7097 - val_loss: 1.4875 - val_f1_score: 0.6378
Epoch 286/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9341 - f1_score:
0.6970 - val_loss: 1.5240 - val_f1_score: 0.6179
Epoch 287/500
28/28 [==============================] - 1s 54ms/step - loss: 0.9438 - f1_score:
0.6869 - val_loss: 1.5768 - val_f1_score: 0.6065
Epoch 288/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9199 - f1_score:
0.7000 - val_loss: 1.7045 - val_f1_score: 0.6160
Epoch 289/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9057 - f1_score:
0.7044 - val_loss: 1.3324 - val_f1_score: 0.6342
Epoch 290/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8610 - f1_score:
0.7225 - val_loss: 1.3676 - val_f1_score: 0.6382
Epoch 291/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8914 - f1_score:
0.7106 - val_loss: 1.6823 - val_f1_score: 0.6154
Epoch 292/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9352 - f1_score:
0.6895 - val_loss: 1.3634 - val_f1_score: 0.6289
Epoch 293/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8700 - f1_score:
0.7098 - val_loss: 1.7176 - val_f1_score: 0.6177
Epoch 294/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8832 - f1_score:
0.7038 - val_loss: 1.4247 - val_f1_score: 0.6284
Epoch 295/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9021 - f1_score:
0.7101 - val_loss: 1.4486 - val_f1_score: 0.6255
Epoch 296/500
28/28 [==============================] - 1s 54ms/step - loss: 0.9123 - f1_score:
0.7062 - val_loss: 1.4094 - val_f1_score: 0.6175
Epoch 297/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9236 - f1_score:
0.6808 - val_loss: 1.5754 - val_f1_score: 0.6437
Epoch 298/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8784 - f1_score:
0.7085 - val_loss: 1.5548 - val_f1_score: 0.6179
Epoch 299/500
27/28 [============================>..] - ETA: 0s - loss: 0.8928 - f1_score:
0.7022

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 204ms/step - loss: 0.8975 -
f1_score: 0.7019 - val_loss: 1.3183 - val_f1_score: 0.6601
Epoch 300/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8924 - f1_score:
0.6962 - val_loss: 1.3568 - val_f1_score: 0.6248
Epoch 301/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8858 - f1_score:
0.7164 - val_loss: 1.3082 - val_f1_score: 0.6480
Epoch 302/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8761 - f1_score:
0.7154 - val_loss: 1.3687 - val_f1_score: 0.6192
Epoch 303/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8500 - f1_score:
0.7065 - val_loss: 1.4713 - val_f1_score: 0.6191
Epoch 304/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8578 - f1_score:
0.7176 - val_loss: 1.3515 - val_f1_score: 0.6372
Epoch 305/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8730 - f1_score:
0.7178 - val_loss: 1.3763 - val_f1_score: 0.6289
Epoch 306/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8867 - f1_score:
0.7015 - val_loss: 1.3785 - val_f1_score: 0.6369
Epoch 307/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8400 - f1_score:
0.7271 - val_loss: 1.2877 - val_f1_score: 0.6369
Epoch 308/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8936 - f1_score:
0.7023 - val_loss: 1.5021 - val_f1_score: 0.6298
Epoch 309/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8928 - f1_score:
0.7034 - val_loss: 1.4880 - val_f1_score: 0.6142
Epoch 310/500
28/28 [==============================] - 2s 60ms/step - loss: 0.8934 - f1_score:
0.7029 - val_loss: 1.7628 - val_f1_score: 0.6114
Epoch 311/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8522 - f1_score:
0.7331 - val_loss: 1.3644 - val_f1_score: 0.6562
Epoch 312/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8833 - f1_score:
0.7047 - val_loss: 1.2572 - val_f1_score: 0.6427
Epoch 313/500
```

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28/28 [==============================] - 2s 55ms/step - loss: 0.8401 - f1_score:
0.7241 - val_loss: 1.3701 - val_f1_score: 0.6440
Epoch 314/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8514 - f1_score:
0.7126 - val_loss: 1.4106 - val_f1_score: 0.6286
Epoch 315/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8679 - f1_score:
0.7084 - val_loss: 1.5249 - val_f1_score: 0.6172
Epoch 316/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8682 - f1_score:
0.7073 - val_loss: 1.5226 - val_f1_score: 0.6205
Epoch 317/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8536 - f1_score:
0.7174

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

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28/28 [==============================] - 6s 217ms/step - loss: 0.8542 -
f1_score: 0.7181 - val_loss: 1.4144 - val_f1_score: 0.6697
Epoch 318/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8468 - f1_score:
0.7187 - val_loss: 1.6611 - val_f1_score: 0.6256
Epoch 319/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8762 - f1_score:
0.7050 - val_loss: 1.5013 - val_f1_score: 0.6124
Epoch 320/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8561 - f1_score:
0.7213 - val_loss: 1.3108 - val_f1_score: 0.6469
Epoch 321/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8739 - f1_score:
0.7042 - val_loss: 1.6089 - val_f1_score: 0.6237
Epoch 322/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8430 - f1_score:
0.7180 - val_loss: 1.3677 - val_f1_score: 0.6505
Epoch 323/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8284 - f1_score:
0.7225 - val_loss: 1.4689 - val_f1_score: 0.6237
Epoch 324/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8406 - f1_score:
0.7220 - val_loss: 1.4149 - val_f1_score: 0.6428
Epoch 325/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8232 - f1_score:
0.7263 - val_loss: 1.3240 - val_f1_score: 0.6307
Epoch 326/500
```

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28/28 [==============================] - 2s 54ms/step - loss: 0.8053 - f1_score:
0.7268 - val_loss: 1.3814 - val_f1_score: 0.6438
Epoch 327/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8306 - f1_score:
0.7133 - val_loss: 1.4111 - val_f1_score: 0.6550
Epoch 328/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8515 - f1_score:
0.7159 - val_loss: 1.4166 - val_f1_score: 0.6388
Epoch 329/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8400 - f1_score:
0.7330 - val_loss: 1.4610 - val_f1_score: 0.6572
Epoch 330/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8205 - f1_score:
0.7333 - val_loss: 1.3504 - val_f1_score: 0.6528
Epoch 331/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8502 - f1_score:
0.7121 - val_loss: 1.5578 - val_f1_score: 0.6129
Epoch 332/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8388 - f1_score:
0.7329

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

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28/28 [==============================] - 5s 193ms/step - loss: 0.8407 -
f1_score: 0.7317 - val_loss: 1.4743 - val_f1_score: 0.6713
Epoch 333/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8580 - f1_score:
0.7117 - val_loss: 1.4484 - val_f1_score: 0.6221
Epoch 334/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8053 - f1_score:
0.7411 - val_loss: 1.4515 - val_f1_score: 0.6389
Epoch 335/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8628 - f1_score:
0.7100 - val_loss: 1.6145 - val_f1_score: 0.6373
Epoch 336/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8284 - f1_score:
0.7339 - val_loss: 1.5477 - val_f1_score: 0.6480
Epoch 337/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8071 - f1_score:
0.7344 - val_loss: 1.3933 - val_f1_score: 0.6487
Epoch 338/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8498 - f1_score:
0.7137 - val_loss: 1.5404 - val_f1_score: 0.6258
Epoch 339/500
```

```
28/28 [==============================] - 1s 53ms/step - loss: 0.8366 - f1_score:
0.7190 - val_loss: 1.4945 - val_f1_score: 0.6514
Epoch 340/500
28/28 [==============================] - 2s 54ms/step - loss: 0.9043 - f1_score:
0.6957 - val_loss: 1.4526 - val_f1_score: 0.6343
Epoch 341/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8233 - f1_score:
0.7192 - val_loss: 1.4481 - val_f1_score: 0.6532
Epoch 342/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8053 - f1_score:
0.7312 - val_loss: 1.3809 - val_f1_score: 0.6605
Epoch 343/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8111 - f1_score:
0.7175 - val_loss: 1.3922 - val_f1_score: 0.6541
Epoch 344/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8137 - f1_score:
0.7304 - val_loss: 1.4955 - val_f1_score: 0.6219
Epoch 345/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7947 - f1_score:
0.7484 - val_loss: 1.3918 - val_f1_score: 0.6600
Epoch 346/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8070 - f1_score:
0.7362 - val_loss: 1.3617 - val_f1_score: 0.6473
Epoch 347/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8025 - f1_score:
0.7303 - val_loss: 1.4234 - val_f1_score: 0.6451
Epoch 348/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8184 - f1_score:
0.7232 - val_loss: 1.5154 - val_f1_score: 0.6407
Epoch 349/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8353 - f1_score:
0.7261 - val_loss: 1.5614 - val_f1_score: 0.6479
Epoch 350/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8015 - f1_score:
0.7373 - val_loss: 1.6290 - val_f1_score: 0.6214
Epoch 351/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7988 - f1_score:
0.7316 - val_loss: 1.4889 - val_f1_score: 0.6094
Epoch 352/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7799 - f1_score:
0.7463 - val_loss: 1.4486 - val_f1_score: 0.6395
Epoch 353/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8170 - f1_score:
0.7333 - val_loss: 1.7386 - val_f1_score: 0.6200
Epoch 354/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8074 - f1_score:
0.7456 - val_loss: 1.5469 - val_f1_score: 0.6423
Epoch 355/500
```

```
28/28 [==============================] - 2s 55ms/step - loss: 0.8055 - f1_score:
0.7315 - val_loss: 1.4048 - val_f1_score: 0.6476
Epoch 356/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8293 - f1_score:
0.7197

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 219ms/step - loss: 0.8249 -
f1_score: 0.7226 - val_loss: 1.3735 - val_f1_score: 0.6754
Epoch 357/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7977 - f1_score:
0.7247 - val_loss: 1.5932 - val_f1_score: 0.6446
Epoch 358/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8202 - f1_score:
0.7335 - val_loss: 1.7377 - val_f1_score: 0.6072
Epoch 359/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8183 - f1_score:
0.7310 - val_loss: 1.2457 - val_f1_score: 0.6698
Epoch 360/500
28/28 [==============================] - 1s 54ms/step - loss: 0.8152 - f1_score:
0.7258 - val_loss: 1.3934 - val_f1_score: 0.6318
Epoch 361/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8054 - f1_score:
0.7293 - val_loss: 1.4377 - val_f1_score: 0.6448
Epoch 362/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7857 - f1_score:
0.7416 - val_loss: 1.5750 - val_f1_score: 0.6458
Epoch 363/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7969 - f1_score:
0.7456 - val_loss: 1.4128 - val_f1_score: 0.6567
Epoch 364/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8000 - f1_score:
0.7427 - val_loss: 1.4090 - val_f1_score: 0.6526
Epoch 365/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8048 - f1_score:
0.7371 - val_loss: 1.3587 - val_f1_score: 0.6384
Epoch 366/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8101 - f1_score:
0.7375 - val_loss: 1.5419 - val_f1_score: 0.6407
Epoch 367/500
28/28 [==============================] - 1s 53ms/step - loss: 0.8528 - f1_score:
0.7087 - val_loss: 1.4038 - val_f1_score: 0.6620
Epoch 368/500
```

```
28/28 [==============================] - 1s 53ms/step - loss: 0.8055 - f1_score:
0.7304 - val_loss: 1.6260 - val_f1_score: 0.6294
Epoch 369/500
28/28 [==============================] - 2s 54ms/step - loss: 0.8452 - f1_score:
0.7153 - val_loss: 1.3514 - val_f1_score: 0.6415
Epoch 370/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7738 - f1_score:
0.7423 - val_loss: 1.4058 - val_f1_score: 0.6653
Epoch 371/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7984 - f1_score:
0.7440 - val_loss: 1.3865 - val_f1_score: 0.6708
Epoch 372/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7786 - f1_score:
0.7364 - val_loss: 1.4884 - val_f1_score: 0.6661
Epoch 373/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7870 - f1_score:
0.7352 - val_loss: 1.6286 - val_f1_score: 0.6329
Epoch 374/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7816 - f1_score:
0.7402 - val_loss: 1.7655 - val_f1_score: 0.6218
Epoch 375/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7629 - f1_score:
0.7508 - val_loss: 1.5332 - val_f1_score: 0.6520
Epoch 376/500
28/28 [==============================] - 2s 58ms/step - loss: 0.7451 - f1_score:
0.7521 - val_loss: 1.5865 - val_f1_score: 0.6461
Epoch 377/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7682 - f1_score:
0.7462 - val_loss: 1.4323 - val_f1_score: 0.6540
Epoch 378/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7648 - f1_score:
0.7342 - val_loss: 1.4079 - val_f1_score: 0.6544
Epoch 379/500
28/28 [==============================] - 2s 58ms/step - loss: 0.7936 - f1_score:
0.7369 - val_loss: 1.3567 - val_f1_score: 0.6438
Epoch 380/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7880 - f1_score:
0.7218 - val_loss: 1.4394 - val_f1_score: 0.6291
Epoch 381/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7295 - f1_score:
0.7605 - val_loss: 1.4572 - val_f1_score: 0.6650
Epoch 382/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7377 - f1_score:
0.7504 - val_loss: 1.4342 - val_f1_score: 0.6525
Epoch 383/500
28/28 [==============================] - 2s 55ms/step - loss: 0.8226 - f1_score:
0.7345 - val_loss: 1.5173 - val_f1_score: 0.6230
Epoch 384/500
```

```
28/28 [==============================] - 2s 54ms/step - loss: 0.7264 - f1_score:
0.7567 - val_loss: 1.6594 - val_f1_score: 0.6095
Epoch 385/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7703 - f1_score:
0.7424 - val_loss: 1.4294 - val_f1_score: 0.6445
Epoch 386/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7804 - f1_score:
0.7511 - val_loss: 1.4125 - val_f1_score: 0.6475
Epoch 387/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7918 - f1_score:
0.7412 - val_loss: 1.5302 - val_f1_score: 0.6497
Epoch 388/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7859 - f1_score:
0.7417 - val_loss: 1.5118 - val_f1_score: 0.6356
Epoch 389/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7683 - f1_score:
0.7439 - val_loss: 1.4241 - val_f1_score: 0.6497
Epoch 390/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7940 - f1_score:
0.7309 - val_loss: 1.3848 - val_f1_score: 0.6544
Epoch 391/500
28/28 [==============================] - 2s 58ms/step - loss: 0.7258 - f1_score:
0.7648 - val_loss: 1.5582 - val_f1_score: 0.6284
Epoch 392/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7377 - f1_score:
0.7549 - val_loss: 1.4770 - val_f1_score: 0.6290
Epoch 393/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7481 - f1_score:
0.7524 - val_loss: 1.5270 - val_f1_score: 0.6418
Epoch 394/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7279 - f1_score:
0.7512 - val_loss: 1.6034 - val_f1_score: 0.6252
Epoch 395/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7272 - f1_score:
0.7525 - val_loss: 1.5223 - val_f1_score: 0.6682
Epoch 396/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7489 - f1_score:
0.7480 - val_loss: 1.6242 - val_f1_score: 0.6580
Epoch 397/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7838 - f1_score:
0.7414 - val_loss: 1.4077 - val_f1_score: 0.6501
Epoch 398/500
27/28 [============================>..] - ETA: 0s - loss: 0.7493 - f1_score:
0.7501

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
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INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

28/28 [==============================] - 6s 213ms/step - loss: 0.7492 -
f1_score: 0.7511 - val_loss: 1.5676 - val_f1_score: 0.6769
Epoch 399/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7721 - f1_score:
0.7399 - val_loss: 1.5220 - val_f1_score: 0.6680
Epoch 400/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7763 - f1_score:
0.7460 - val_loss: 1.3851 - val_f1_score: 0.6645
Epoch 401/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7264 - f1_score:
0.7575 - val_loss: 1.5952 - val_f1_score: 0.6411
Epoch 402/500
28/28 [==============================] - 1s 53ms/step - loss: 0.6972 - f1_score:
0.7621 - val_loss: 1.4393 - val_f1_score: 0.6486
Epoch 403/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7337 - f1_score:
0.7537 - val_loss: 1.5430 - val_f1_score: 0.6293
Epoch 404/500
28/28 [==============================] - 1s 54ms/step - loss: 0.7535 - f1_score:
0.7565 - val_loss: 1.5157 - val_f1_score: 0.6501
Epoch 405/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7660 - f1_score:
0.7417 - val_loss: 1.3624 - val_f1_score: 0.6625
Epoch 406/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7922 - f1_score:
0.7393 - val_loss: 1.6426 - val_f1_score: 0.6307
Epoch 407/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7042 - f1_score:
0.7620 - val_loss: 1.4690 - val_f1_score: 0.6683
Epoch 408/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7343 - f1_score:
0.7552 - val_loss: 1.4974 - val_f1_score: 0.6466
Epoch 409/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7711 - f1_score:
0.7464 - val_loss: 1.5025 - val_f1_score: 0.6623
Epoch 410/500
27/28 [============================>..] - ETA: 0s - loss: 0.7211 - f1_score:
0.7590

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN2/assets

INFO:tensorflow:Assets written to: 3 1D CNN2/assets
```

```
28/28 [==============================] - 6s 223ms/step - loss: 0.7260 -
f1_score: 0.7566 - val_loss: 1.3335 - val_f1_score: 0.6891
Epoch 411/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7257 - f1_score:
0.7546 - val_loss: 1.6610 - val_f1_score: 0.6454
Epoch 412/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7792 - f1_score:
0.7475 - val_loss: 1.3853 - val_f1_score: 0.6542
Epoch 413/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7136 - f1_score:
0.7701 - val_loss: 1.6595 - val_f1_score: 0.6304
Epoch 414/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7659 - f1_score:
0.7446 - val_loss: 1.4163 - val_f1_score: 0.6499
Epoch 415/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7876 - f1_score:
0.7457 - val_loss: 1.4424 - val_f1_score: 0.6494
Epoch 416/500
28/28 [==============================] - 1s 53ms/step - loss: 0.7567 - f1_score:
0.7548 - val_loss: 1.4546 - val_f1_score: 0.6497
Epoch 417/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7536 - f1_score:
0.7498 - val_loss: 1.4024 - val_f1_score: 0.6796
Epoch 418/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7116 - f1_score:
0.7654 - val_loss: 1.4332 - val_f1_score: 0.6691
Epoch 419/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7280 - f1_score:
0.7570 - val_loss: 1.4172 - val_f1_score: 0.6593
Epoch 420/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7253 - f1_score:
0.7605 - val_loss: 1.5463 - val_f1_score: 0.6395
Epoch 421/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7068 - f1_score:
0.7543 - val_loss: 1.5114 - val_f1_score: 0.6538
Epoch 422/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7168 - f1_score:
0.7597 - val_loss: 1.4074 - val_f1_score: 0.6647
Epoch 423/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7181 - f1_score:
0.7668 - val_loss: 1.3933 - val_f1_score: 0.6541
Epoch 424/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7594 - f1_score:
0.7396 - val_loss: 1.7154 - val_f1_score: 0.6202
Epoch 425/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7616 - f1_score:
0.7519 - val_loss: 1.4530 - val_f1_score: 0.6366
Epoch 426/500
```

```
28/28 [==============================] - 2s 54ms/step - loss: 0.7594 - f1_score:
0.7467 - val_loss: 1.4238 - val_f1_score: 0.6651
Epoch 427/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7644 - f1_score:
0.7511 - val_loss: 1.4461 - val_f1_score: 0.6542
Epoch 428/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7455 - f1_score:
0.7538 - val_loss: 1.5396 - val_f1_score: 0.6340
Epoch 429/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7029 - f1_score:
0.7641 - val_loss: 1.4590 - val_f1_score: 0.6601
Epoch 430/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6887 - f1_score:
0.7755 - val_loss: 1.4689 - val_f1_score: 0.6585
Epoch 431/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7143 - f1_score:
0.7589 - val_loss: 1.6037 - val_f1_score: 0.6411
Epoch 432/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7186 - f1_score:
0.7564 - val_loss: 1.4226 - val_f1_score: 0.6889
Epoch 433/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7161 - f1_score:
0.7691 - val_loss: 1.5184 - val_f1_score: 0.6431
Epoch 434/500
28/28 [==============================] - 2s 60ms/step - loss: 0.7331 - f1_score:
0.7622 - val_loss: 1.5658 - val_f1_score: 0.6385
Epoch 435/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7092 - f1_score:
0.7545 - val_loss: 1.4357 - val_f1_score: 0.6413
Epoch 436/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6941 - f1_score:
0.7787 - val_loss: 1.5052 - val_f1_score: 0.6496
Epoch 437/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7223 - f1_score:
0.7598 - val_loss: 1.5331 - val_f1_score: 0.6304
Epoch 438/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7305 - f1_score:
0.7651 - val_loss: 1.3610 - val_f1_score: 0.6851
Epoch 439/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7178 - f1_score:
0.7648 - val_loss: 1.3287 - val_f1_score: 0.6667
Epoch 440/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7222 - f1_score:
0.7693 - val_loss: 1.3897 - val_f1_score: 0.6315
Epoch 441/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7155 - f1_score:
0.7602 - val_loss: 1.4025 - val_f1_score: 0.6623
Epoch 442/500
```

```
28/28 [==============================] - 2s 54ms/step - loss: 0.7226 - f1_score:
0.7557 - val_loss: 1.3544 - val_f1_score: 0.6716
Epoch 443/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7255 - f1_score:
0.7573 - val_loss: 1.4056 - val_f1_score: 0.6546
Epoch 444/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7091 - f1_score:
0.7634 - val_loss: 1.4436 - val_f1_score: 0.6350
Epoch 445/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6679 - f1_score:
0.7739 - val_loss: 1.4390 - val_f1_score: 0.6512
Epoch 446/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6824 - f1_score:
0.7826 - val_loss: 1.4190 - val_f1_score: 0.6543
Epoch 447/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7345 - f1_score:
0.7595 - val_loss: 1.5577 - val_f1_score: 0.6604
Epoch 448/500
28/28 [==============================] - 2s 58ms/step - loss: 0.7299 - f1_score:
0.7671 - val_loss: 1.5578 - val_f1_score: 0.6287
Epoch 449/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7240 - f1_score:
0.7603 - val_loss: 1.4478 - val_f1_score: 0.6430
Epoch 450/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6928 - f1_score:
0.7696 - val_loss: 1.3944 - val_f1_score: 0.6660
Epoch 451/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7022 - f1_score:
0.7622 - val_loss: 1.4834 - val_f1_score: 0.6479
Epoch 452/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6695 - f1_score:
0.7831 - val_loss: 1.5247 - val_f1_score: 0.6276
Epoch 453/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6718 - f1_score:
0.7862 - val_loss: 1.7639 - val_f1_score: 0.6204
Epoch 454/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7078 - f1_score:
0.7645 - val_loss: 1.4983 - val_f1_score: 0.6483
Epoch 455/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6871 - f1_score:
0.7661 - val_loss: 1.4280 - val_f1_score: 0.6553
Epoch 456/500
28/28 [==============================] - 2s 54ms/step - loss: 0.7101 - f1_score:
0.7680 - val_loss: 1.5572 - val_f1_score: 0.6601
Epoch 457/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6944 - f1_score:
0.7755 - val_loss: 1.5788 - val_f1_score: 0.6783
Epoch 458/500
```

```
28/28 [==============================] - 2s 56ms/step - loss: 0.7069 - f1_score:
0.7589 - val_loss: 1.6415 - val_f1_score: 0.6529
Epoch 459/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6939 - f1_score:
0.7778 - val_loss: 1.6787 - val_f1_score: 0.6429
Epoch 460/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6647 - f1_score:
0.7807 - val_loss: 1.4285 - val_f1_score: 0.6658
Epoch 461/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6502 - f1_score:
0.7747 - val_loss: 1.9925 - val_f1_score: 0.6264
Epoch 462/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7134 - f1_score:
0.7625 - val_loss: 1.5089 - val_f1_score: 0.6579
Epoch 463/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7147 - f1_score:
0.7609 - val_loss: 1.4573 - val_f1_score: 0.6761
Epoch 464/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6676 - f1_score:
0.7824 - val_loss: 1.4948 - val_f1_score: 0.6622
Epoch 465/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6440 - f1_score:
0.7818 - val_loss: 1.6454 - val_f1_score: 0.6437
Epoch 466/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6643 - f1_score:
0.7781 - val_loss: 1.5415 - val_f1_score: 0.6685
Epoch 467/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6724 - f1_score:
0.7753 - val_loss: 1.4572 - val_f1_score: 0.6348
Epoch 468/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6646 - f1_score:
0.7832 - val_loss: 1.4906 - val_f1_score: 0.6380
Epoch 469/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7163 - f1_score:
0.7670 - val_loss: 1.4488 - val_f1_score: 0.6546
Epoch 470/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6736 - f1_score:
0.7777 - val_loss: 1.7224 - val_f1_score: 0.6491
Epoch 471/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6477 - f1_score:
0.7796 - val_loss: 1.6369 - val_f1_score: 0.6483
Epoch 472/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6686 - f1_score:
0.7734 - val_loss: 1.4393 - val_f1_score: 0.6563
Epoch 473/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7274 - f1_score:
0.7669 - val_loss: 1.5934 - val_f1_score: 0.6716
Epoch 474/500
```

```
28/28 [==============================] - 2s 58ms/step - loss: 0.7107 - f1_score:
0.7694 - val_loss: 1.4938 - val_f1_score: 0.6439
Epoch 475/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6438 - f1_score:
0.7910 - val_loss: 1.3647 - val_f1_score: 0.6728
Epoch 476/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7105 - f1_score:
0.7690 - val_loss: 1.3356 - val_f1_score: 0.6615
Epoch 477/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6960 - f1_score:
0.7644 - val_loss: 1.5362 - val_f1_score: 0.6433
Epoch 478/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6503 - f1_score:
0.7832 - val_loss: 1.5320 - val_f1_score: 0.6229
Epoch 479/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6831 - f1_score:
0.7711 - val_loss: 1.4128 - val_f1_score: 0.6441
Epoch 480/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7097 - f1_score:
0.7631 - val_loss: 1.5366 - val_f1_score: 0.6490
Epoch 481/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7295 - f1_score:
0.7657 - val_loss: 1.5142 - val_f1_score: 0.6579
Epoch 482/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6730 - f1_score:
0.7855 - val_loss: 1.4785 - val_f1_score: 0.6418
Epoch 483/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6797 - f1_score:
0.7683 - val_loss: 1.5011 - val_f1_score: 0.6734
Epoch 484/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6939 - f1_score:
0.7710 - val_loss: 1.6390 - val_f1_score: 0.6427
Epoch 485/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7020 - f1_score:
0.7721 - val_loss: 1.5586 - val_f1_score: 0.6709
Epoch 486/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6741 - f1_score:
0.7623 - val_loss: 1.4872 - val_f1_score: 0.6463
Epoch 487/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6482 - f1_score:
0.7888 - val_loss: 1.4905 - val_f1_score: 0.6567
Epoch 488/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6596 - f1_score:
0.7851 - val_loss: 1.6467 - val_f1_score: 0.6396
Epoch 489/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6913 - f1_score:
0.7756 - val_loss: 1.4405 - val_f1_score: 0.6713
Epoch 490/500
```

```
28/28 [==============================] - 2s 55ms/step - loss: 0.7268 - f1_score:
0.7705 - val_loss: 1.6377 - val_f1_score: 0.6376
Epoch 491/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6363 - f1_score:
0.7899 - val_loss: 1.3711 - val_f1_score: 0.6634
Epoch 492/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6751 - f1_score:
0.7801 - val_loss: 1.7892 - val_f1_score: 0.6544
Epoch 493/500
28/28 [==============================] - 2s 55ms/step - loss: 0.7103 - f1_score:
0.7607 - val_loss: 1.5953 - val_f1_score: 0.6845
Epoch 494/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6477 - f1_score:
0.7914 - val_loss: 1.4132 - val_f1_score: 0.6730
Epoch 495/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6691 - f1_score:
0.7827 - val_loss: 1.6568 - val_f1_score: 0.6250
Epoch 496/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6974 - f1_score:
0.7656 - val_loss: 1.7041 - val_f1_score: 0.6532
Epoch 497/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6692 - f1_score:
0.7797 - val_loss: 1.6474 - val_f1_score: 0.6625
Epoch 498/500
28/28 [==============================] - 2s 55ms/step - loss: 0.6482 - f1_score:
0.7775 - val_loss: 1.6079 - val_f1_score: 0.6629
Epoch 499/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6583 - f1_score:
0.7869 - val_loss: 1.4506 - val_f1_score: 0.6730
Epoch 500/500
28/28 [==============================] - 2s 54ms/step - loss: 0.6077 - f1_score:
0.8106 - val_loss: 1.5432 - val_f1_score: 0.6781
```

[127]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 9ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.667     1.000     0.800         6
  BASKETBALL      0.889     0.800     0.842        10
         BEE      0.667     0.600     0.632        10
        BELT      0.667     1.000     0.800         4
        BITE      0.833     0.625     0.714         8
```

BREAKFAST	0.429	0.500	0.462	6
CANCER	1.000	0.875	0.933	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	1.000	1.000	1.000	6
DARK	1.000	1.000	1.000	4
DEAF	0.429	0.500	0.462	6
DECIDE	1.000	0.333	0.500	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.625	0.833	0.714	6
DINNER	1.000	0.250	0.400	8
DOG	0.444	0.667	0.533	6
DOWNSIZE	0.545	0.750	0.632	8
DRAG	0.667	0.500	0.571	4
EAT	0.600	1.000	0.750	6
EDIT	1.000	0.833	0.909	6
ELEVATOR	0.875	0.875	0.875	8
FINE	0.500	0.500	0.500	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	1.000	1.000	1.000	8
HALLOWEEN	1.000	0.875	0.933	8
HOSPITAL	0.750	1.000	0.857	6
HURDLE/TRIP	0.125	0.250	0.167	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.222	0.250	0.235	8
LUNCH	1.000	0.500	0.667	8
MAPLE	0.500	0.500	0.500	4
MEAT	0.571	0.667	0.615	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.400	0.750	0.522	8
NOON	1.000	1.000	1.000	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.250	0.333	0.286	6
RAZOR	0.600	0.750	0.667	4
RIVER	0.667	0.667	0.667	6
ROCKINGCHAIR	0.875	0.875	0.875	8
SHAVE	0.500	0.400	0.444	10
SINK	0.800	0.667	0.727	6
SQUEEZE	0.667	0.500	0.571	4
THEY	0.400	0.500	0.444	4
TWINS	0.571	0.500	0.533	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.685	324
macro avg	0.725	0.683	0.678	324
weighted avg	0.745	0.685	0.688	324

[119]:
```
reconstructed_model = tf.keras.models.load_model("3 1D CNN")
```

[120]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 3s 31ms/step - loss: 1.5136 - f1_score:
0.7012
```

[120]:
```
[1.5136113166809082, 0.7011691927909851]
```

[121]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 10ms/step - loss: 0.1096 - f1_score:
0.9866

2023-09-23 11:20:27.331021: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 475.44MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
```

[121]:
```
[0.10961440950632095, 0.9866245985031128]
```

[140]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_3 (Conv1D)           (None, 129, 150)          119850

 max_pooling1d_3 (MaxPooling  (None, 64, 150)          0
 1D)

 conv1d_4 (Conv1D)           (None, 60, 75)            56325

 max_pooling1d_4 (MaxPooling  (None, 30, 75)           0
 1D)

 conv1d_5 (Conv1D)           (None, 27, 50)            15050

 max_pooling1d_5 (MaxPooling  (None, 13, 50)           0
 1D)

 dropout_2 (Dropout)         (None, 13, 50)            0

 flatten_1 (Flatten)         (None, 650)               0

 dense_2 (Dense)             (None, 80)                52080
```

```
 dropout_3 (Dropout)         (None, 80)                0

 dense_3 (Dense)             (None, 50)                4050

=================================================================
Total params: 247,355
Trainable params: 247,355
Non-trainable params: 0
_________________________________________________________________
```

[141]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[141]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 129, 150)
MaxPooling1D
input: (None, 129, 150)
output: (None, 64, 150)
Conv1D
input: (None, 64, 150)
output: (None, 60, 75)
MaxPooling1D
input: (None, 60, 75)
output: (None, 30, 75)
Conv1D
input: (None, 30, 75)
output: (None, 27, 50)
MaxPooling1D
input: (None, 27, 50)
output: (None, 13, 50)
Dropout
input: (None, 13, 50)
output: (None, 13, 50)
Flatten
input: (None, 13, 50)
output: (None, 650)
Dense
input: (None, 650)
output: (None, 80)
Dropout
input: (None, 80)
output: (None, 80)
Dense
input: (None, 80)
output: (None, 50)

[142]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 9ms/step
              precision    recall  f1-score   support

         AXE      0.875     0.875     0.875         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.875     0.700     0.778        10
        BELT      1.000     0.750     0.857         4
        BITE      0.833     0.625     0.714         8
   BREAKFAST      0.600     0.500     0.545         6
      CANCER      0.727     1.000     0.842         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.333     0.333     0.333         6
      DECIDE      1.000     0.333     0.500         6
      DEMAND      1.000     0.625     0.769         8
     DEVELOP      0.444     0.667     0.533         6
      DINNER      1.000     0.625     0.769         8
         DOG      0.714     0.833     0.769         6
    DOWNSIZE      0.667     1.000     0.800         8
        DRAG      0.667     0.500     0.571         4
         EAT      0.500     0.833     0.625         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      1.000     0.375     0.545         8
        FINE      0.333     0.500     0.400         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      1.000     1.000     1.000         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.571     0.667     0.615         6
 HURDLE/TRIP      0.273     0.750     0.400         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.833     0.625     0.714         8
       LUNCH      0.500     0.250     0.333         8
       MAPLE      0.500     0.500     0.500         4
        MEAT      0.500     0.667     0.571         6
    MECHANIC      1.000     1.000     1.000         4
```

```
  MICROSCOPE      1.000     0.875     0.933         8
       MOVIE      0.533     1.000     0.696         8
        NOON      0.889     1.000     0.941         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.286     0.333     0.308         6
       RAZOR      0.571     1.000     0.727         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.800     0.400     0.533        10
        SINK      1.000     0.167     0.286         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.444     0.500     0.471         8
     WHATFOR      0.750     0.600     0.667        10

    accuracy                          0.716       324
   macro avg      0.761     0.710     0.701       324
weighted avg      0.769     0.716     0.710       324
```

3.6.1 3 1D CNN Trial 718

[122]:
```
best_model = tuner.get_best_models(num_models=3)[2]
```

```
2023-09-10 16:23:47.086860: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-10 16:23:47.184730: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1739 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
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object: (root).optimizer._u_product
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object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
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object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
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values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
```

[123]:
```
best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-10 16:23:56.321620: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

84/84 [==============================] - 2s 15ms/step - loss: 0.4830 - f1_score:
0.8864
```

[123]:
```
[0.4829612970352173, 0.8863658905029297]
```

[124]:
```
best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 21ms/step - loss: 1.4396 - f1_score:
0.6577
```

[124]:
```
[1.4396306276321411, 0.6576815843582153]
```

[125]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=3)[2]
```

[126]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='3 1D CNN Trial 718/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[127]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500

2023-09-10 16:24:16.773228: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 839.49MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-10 16:24:16.877017: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 713.21MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-10 16:24:16.980748: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x33a1a650 initialized for platform CUDA (this does not guarantee
that XLA will be used). Devices:
2023-09-10 16:24:16.980790: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-10 16:24:16.990994: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-10 16:24:17.167455: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.

28/28 [==============================] - ETA: 0s - loss: 4.4825 - f1_score:
0.0191

2023-09-10 16:24:20.298346: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 771.81MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
```

```
2023-09-10 16:24:20.370562: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 626.06MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-10 16:24:20.384784: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 1.84GiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
2023-09-10 16:24:20.982942: W
tensorflow/core/common_runtime/bfc_allocator.cc:290] Allocator (GPU_0_bfc) ran
out of memory trying to allocate 501.11MiB with freed_by_count=0. The caller
indicates that this is not a failure, but this may mean that there could be
performance gains if more memory were available.
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 12s 305ms/step - loss: 4.4825 -
f1_score: 0.0191 - val_loss: 3.9168 - val_f1_score: 0.0103
Epoch 2/500
28/28 [==============================] - 2s 61ms/step - loss: 4.1618 - f1_score:
0.0224 - val_loss: 3.9070 - val_f1_score: 0.0064
Epoch 3/500
28/28 [==============================] - ETA: 0s - loss: 4.0973 - f1_score:
0.0185

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 178ms/step - loss: 4.0973 -
f1_score: 0.0185 - val_loss: 3.9075 - val_f1_score: 0.0183
Epoch 4/500
28/28 [==============================] - ETA: 0s - loss: 4.0420 - f1_score:
0.0206

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets
```

```
28/28 [==============================] - 6s 206ms/step - loss: 4.0420 -
f1_score: 0.0206 - val_loss: 3.8995 - val_f1_score: 0.0242
Epoch 5/500
28/28 [==============================] - ETA: 0s - loss: 4.0247 - f1_score:
0.0201

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 225ms/step - loss: 4.0247 -
f1_score: 0.0201 - val_loss: 3.8726 - val_f1_score: 0.0364
Epoch 6/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9935 - f1_score:
0.0302 - val_loss: 3.8720 - val_f1_score: 0.0199
Epoch 7/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9881 - f1_score:
0.0278 - val_loss: 3.8664 - val_f1_score: 0.0230
Epoch 8/500
28/28 [==============================] - 2s 65ms/step - loss: 3.9702 - f1_score:
0.0254 - val_loss: 3.8537 - val_f1_score: 0.0103
Epoch 9/500
28/28 [==============================] - 2s 62ms/step - loss: 3.9441 - f1_score:
0.0331 - val_loss: 3.8375 - val_f1_score: 0.0169
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 3.9255 - f1_score:
0.0307

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 194ms/step - loss: 3.9255 -
f1_score: 0.0307 - val_loss: 3.8029 - val_f1_score: 0.0401
Epoch 11/500
28/28 [==============================] - 2s 64ms/step - loss: 3.9019 - f1_score:
0.0322 - val_loss: 3.7745 - val_f1_score: 0.0214
Epoch 12/500
28/28 [==============================] - 2s 64ms/step - loss: 3.8757 - f1_score:
0.0438 - val_loss: 3.7417 - val_f1_score: 0.0283
Epoch 13/500
28/28 [==============================] - 2s 65ms/step - loss: 3.8516 - f1_score:
0.0435 - val_loss: 3.7295 - val_f1_score: 0.0258
Epoch 14/500
```

```
28/28 [==============================] - 2s 63ms/step - loss: 3.8182 - f1_score:
0.0365 - val_loss: 3.6604 - val_f1_score: 0.0322
Epoch 15/500
28/28 [==============================] - 2s 63ms/step - loss: 3.7815 - f1_score:
0.0450 - val_loss: 3.6187 - val_f1_score: 0.0366
Epoch 16/500
28/28 [==============================] - ETA: 0s - loss: 3.7694 - f1_score:
0.0555

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 191ms/step - loss: 3.7694 -
f1_score: 0.0555 - val_loss: 3.5582 - val_f1_score: 0.0605
Epoch 17/500
28/28 [==============================] - 2s 63ms/step - loss: 3.7079 - f1_score:
0.0550 - val_loss: 3.5148 - val_f1_score: 0.0477
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 3.6682 - f1_score:
0.0588

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 197ms/step - loss: 3.6682 -
f1_score: 0.0588 - val_loss: 3.4379 - val_f1_score: 0.0745
Epoch 19/500
28/28 [==============================] - 2s 63ms/step - loss: 3.6439 - f1_score:
0.0643 - val_loss: 3.4224 - val_f1_score: 0.0455
Epoch 20/500
28/28 [==============================] - 2s 62ms/step - loss: 3.5816 - f1_score:
0.0704 - val_loss: 3.3530 - val_f1_score: 0.0507
Epoch 21/500
28/28 [==============================] - 2s 63ms/step - loss: 3.5728 - f1_score:
0.0675 - val_loss: 3.3139 - val_f1_score: 0.0727
Epoch 22/500
28/28 [==============================] - 2s 65ms/step - loss: 3.5371 - f1_score:
0.0795 - val_loss: 3.2653 - val_f1_score: 0.0721
Epoch 23/500
28/28 [==============================] - 2s 63ms/step - loss: 3.4690 - f1_score:
0.0877 - val_loss: 3.2257 - val_f1_score: 0.0688
Epoch 24/500
```

```
28/28 [==============================] - ETA: 0s - loss: 3.4478 - f1_score:
0.0878

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 221ms/step - loss: 3.4478 -
f1_score: 0.0878 - val_loss: 3.1858 - val_f1_score: 0.1050
Epoch 25/500
28/28 [==============================] - 2s 65ms/step - loss: 3.3892 - f1_score:
0.0920 - val_loss: 3.1226 - val_f1_score: 0.0947
Epoch 26/500
28/28 [==============================] - 2s 63ms/step - loss: 3.3697 - f1_score:
0.0979 - val_loss: 3.0983 - val_f1_score: 0.1011
Epoch 27/500
28/28 [==============================] - ETA: 0s - loss: 3.3028 - f1_score:
0.0997

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 219ms/step - loss: 3.3028 -
f1_score: 0.0997 - val_loss: 3.1100 - val_f1_score: 0.1362
Epoch 28/500
28/28 [==============================] - 2s 65ms/step - loss: 3.2746 - f1_score:
0.1031 - val_loss: 3.0083 - val_f1_score: 0.1000
Epoch 29/500
28/28 [==============================] - 2s 66ms/step - loss: 3.2822 - f1_score:
0.1170 - val_loss: 3.0196 - val_f1_score: 0.1125
Epoch 30/500
28/28 [==============================] - 2s 66ms/step - loss: 3.2907 - f1_score:
0.1056 - val_loss: 3.0040 - val_f1_score: 0.1294
Epoch 31/500
28/28 [==============================] - 2s 65ms/step - loss: 3.1826 - f1_score:
0.1369 - val_loss: 2.9238 - val_f1_score: 0.1271
Epoch 32/500
28/28 [==============================] - ETA: 0s - loss: 3.1699 - f1_score:
0.1300

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 219ms/step - loss: 3.1699 -
f1_score: 0.1300 - val_loss: 2.8661 - val_f1_score: 0.1787
Epoch 33/500
28/28 [==============================] - 2s 65ms/step - loss: 3.1280 - f1_score:
0.1306 - val_loss: 2.8818 - val_f1_score: 0.1549
Epoch 34/500
28/28 [==============================] - ETA: 0s - loss: 3.1042 - f1_score:
0.1344

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 207ms/step - loss: 3.1042 -
f1_score: 0.1344 - val_loss: 2.8190 - val_f1_score: 0.1912
Epoch 35/500
28/28 [==============================] - 2s 63ms/step - loss: 3.0634 - f1_score:
0.1389 - val_loss: 2.7997 - val_f1_score: 0.1720
Epoch 36/500
28/28 [==============================] - 2s 63ms/step - loss: 3.0706 - f1_score:
0.1412 - val_loss: 2.7802 - val_f1_score: 0.1774
Epoch 37/500
28/28 [==============================] - 2s 64ms/step - loss: 3.0280 - f1_score:
0.1393 - val_loss: 2.9295 - val_f1_score: 0.1675
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 2.9891 - f1_score:
0.1598

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 194ms/step - loss: 2.9891 -
f1_score: 0.1598 - val_loss: 2.7409 - val_f1_score: 0.2057
Epoch 39/500
28/28 [==============================] - 2s 63ms/step - loss: 2.9581 - f1_score:
0.1524 - val_loss: 2.7223 - val_f1_score: 0.1982
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 2.9821 - f1_score:
0.1455
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 199ms/step - loss: 2.9821 -
f1_score: 0.1455 - val_loss: 2.6771 - val_f1_score: 0.2283
Epoch 41/500
28/28 [==============================] - ETA: 0s - loss: 2.9111 - f1_score:
0.1659

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 198ms/step - loss: 2.9111 -
f1_score: 0.1659 - val_loss: 2.6592 - val_f1_score: 0.2463
Epoch 42/500
28/28 [==============================] - 2s 65ms/step - loss: 2.9067 - f1_score:
0.1637 - val_loss: 2.6770 - val_f1_score: 0.1999
Epoch 43/500
28/28 [==============================] - 2s 63ms/step - loss: 2.9173 - f1_score:
0.1680 - val_loss: 2.6301 - val_f1_score: 0.2131
Epoch 44/500
28/28 [==============================] - 2s 64ms/step - loss: 2.8874 - f1_score:
0.1767 - val_loss: 2.6341 - val_f1_score: 0.2347
Epoch 45/500
28/28 [==============================] - 2s 67ms/step - loss: 2.8725 - f1_score:
0.1678 - val_loss: 2.6428 - val_f1_score: 0.2146
Epoch 46/500
28/28 [==============================] - ETA: 0s - loss: 2.8385 - f1_score:
0.1827

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 227ms/step - loss: 2.8385 -
f1_score: 0.1827 - val_loss: 2.5883 - val_f1_score: 0.2495
Epoch 47/500
28/28 [==============================] - ETA: 0s - loss: 2.8526 - f1_score:
0.1747
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 8s 288ms/step - loss: 2.8526 -
f1_score: 0.1747 - val_loss: 2.5534 - val_f1_score: 0.2568
Epoch 48/500
28/28 [==============================] - 2s 63ms/step - loss: 2.8189 - f1_score:
0.1821 - val_loss: 2.6148 - val_f1_score: 0.2536
Epoch 49/500
28/28 [==============================] - ETA: 0s - loss: 2.7982 - f1_score:
0.1990

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 198ms/step - loss: 2.7982 -
f1_score: 0.1990 - val_loss: 2.5303 - val_f1_score: 0.2723
Epoch 50/500
28/28 [==============================] - 2s 63ms/step - loss: 2.7394 - f1_score:
0.2014 - val_loss: 2.5449 - val_f1_score: 0.2459
Epoch 51/500
28/28 [==============================] - ETA: 0s - loss: 2.7361 - f1_score:
0.2097

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 194ms/step - loss: 2.7361 -
f1_score: 0.2097 - val_loss: 2.5278 - val_f1_score: 0.2742
Epoch 52/500
28/28 [==============================] - 2s 63ms/step - loss: 2.7134 - f1_score:
0.2044 - val_loss: 2.4948 - val_f1_score: 0.2602
Epoch 53/500
28/28 [==============================] - ETA: 0s - loss: 2.6708 - f1_score:
0.2209

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 197ms/step - loss: 2.6708 -
f1_score: 0.2209 - val_loss: 2.4808 - val_f1_score: 0.2963
Epoch 54/500
28/28 [==============================] - 2s 63ms/step - loss: 2.6983 - f1_score:
0.2114 - val_loss: 2.5323 - val_f1_score: 0.2743
Epoch 55/500
28/28 [==============================] - 2s 63ms/step - loss: 2.6643 - f1_score:
0.2138 - val_loss: 2.4797 - val_f1_score: 0.2426
Epoch 56/500
28/28 [==============================] - ETA: 0s - loss: 2.6605 - f1_score:
0.2231

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 208ms/step - loss: 2.6605 -
f1_score: 0.2231 - val_loss: 2.4634 - val_f1_score: 0.3263
Epoch 57/500
28/28 [==============================] - 2s 63ms/step - loss: 2.6758 - f1_score:
0.2029 - val_loss: 2.4210 - val_f1_score: 0.2831
Epoch 58/500
28/28 [==============================] - 2s 63ms/step - loss: 2.6061 - f1_score:
0.2326 - val_loss: 2.3867 - val_f1_score: 0.3114
Epoch 59/500
28/28 [==============================] - 2s 64ms/step - loss: 2.5962 - f1_score:
0.2441 - val_loss: 2.3950 - val_f1_score: 0.3164
Epoch 60/500
28/28 [==============================] - 2s 64ms/step - loss: 2.5829 - f1_score:
0.2423 - val_loss: 2.3945 - val_f1_score: 0.2845
Epoch 61/500
28/28 [==============================] - 2s 64ms/step - loss: 2.5668 - f1_score:
0.2429 - val_loss: 2.4903 - val_f1_score: 0.2676
Epoch 62/500
28/28 [==============================] - 2s 64ms/step - loss: 2.5373 - f1_score:
0.2577 - val_loss: 2.4731 - val_f1_score: 0.2318
Epoch 63/500
28/28 [==============================] - ETA: 0s - loss: 2.5181 - f1_score:
0.2581

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 195ms/step - loss: 2.5181 -
f1_score: 0.2581 - val_loss: 2.3171 - val_f1_score: 0.3669
Epoch 64/500
28/28 [==============================] - 2s 63ms/step - loss: 2.5239 - f1_score:
0.2565 - val_loss: 2.3478 - val_f1_score: 0.2942
Epoch 65/500
28/28 [==============================] - 2s 65ms/step - loss: 2.5041 - f1_score:
0.2592 - val_loss: 2.2892 - val_f1_score: 0.3353
Epoch 66/500
28/28 [==============================] - ETA: 0s - loss: 2.5009 - f1_score:
0.2535

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 7s 263ms/step - loss: 2.5009 -
f1_score: 0.2535 - val_loss: 2.2643 - val_f1_score: 0.3737
Epoch 67/500
28/28 [==============================] - ETA: 0s - loss: 2.4399 - f1_score:
0.2689

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 5s 198ms/step - loss: 2.4399 -
f1_score: 0.2689 - val_loss: 2.2516 - val_f1_score: 0.3931
Epoch 68/500
28/28 [==============================] - 2s 63ms/step - loss: 2.4180 - f1_score:
0.2745 - val_loss: 2.3031 - val_f1_score: 0.3456
Epoch 69/500
28/28 [==============================] - 2s 63ms/step - loss: 2.4845 - f1_score:
0.2676 - val_loss: 2.2587 - val_f1_score: 0.3456
Epoch 70/500
28/28 [==============================] - 2s 69ms/step - loss: 2.4329 - f1_score:
0.2751 - val_loss: 2.2173 - val_f1_score: 0.3443
Epoch 71/500
28/28 [==============================] - 2s 66ms/step - loss: 2.3919 - f1_score:
0.2832 - val_loss: 2.2189 - val_f1_score: 0.3611
Epoch 72/500
```

```
28/28 [==============================] - 2s 64ms/step - loss: 2.3783 - f1_score:
0.2921 - val_loss: 2.1770 - val_f1_score: 0.3578
Epoch 73/500
28/28 [==============================] - 2s 65ms/step - loss: 2.3622 - f1_score:
0.2879 - val_loss: 2.1927 - val_f1_score: 0.3543
Epoch 74/500
28/28 [==============================] - 2s 65ms/step - loss: 2.3079 - f1_score:
0.3027 - val_loss: 2.2310 - val_f1_score: 0.3598
Epoch 75/500
28/28 [==============================] - 2s 66ms/step - loss: 2.3252 - f1_score:
0.3091 - val_loss: 2.1755 - val_f1_score: 0.3835
Epoch 76/500
28/28 [==============================] - 2s 68ms/step - loss: 2.2912 - f1_score:
0.3003 - val_loss: 2.1656 - val_f1_score: 0.3665
Epoch 77/500
28/28 [==============================] - 2s 65ms/step - loss: 2.2985 - f1_score:
0.3095 - val_loss: 2.2329 - val_f1_score: 0.3856
Epoch 78/500
28/28 [==============================] - 2s 66ms/step - loss: 2.2920 - f1_score:
0.2929 - val_loss: 2.1303 - val_f1_score: 0.3824
Epoch 79/500
28/28 [==============================] - ETA: 0s - loss: 2.2440 - f1_score:
0.3207

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 206ms/step - loss: 2.2440 -
f1_score: 0.3207 - val_loss: 2.1025 - val_f1_score: 0.3972
Epoch 80/500
28/28 [==============================] - 2s 64ms/step - loss: 2.2735 - f1_score:
0.3168 - val_loss: 2.1397 - val_f1_score: 0.3520
Epoch 81/500
28/28 [==============================] - 2s 66ms/step - loss: 2.2698 - f1_score:
0.3063 - val_loss: 2.0949 - val_f1_score: 0.3559
Epoch 82/500
28/28 [==============================] - 2s 65ms/step - loss: 2.2140 - f1_score:
0.3222 - val_loss: 2.0789 - val_f1_score: 0.3707
Epoch 83/500
28/28 [==============================] - 2s 65ms/step - loss: 2.2162 - f1_score:
0.3307 - val_loss: 2.0570 - val_f1_score: 0.3882
Epoch 84/500
28/28 [==============================] - ETA: 0s - loss: 2.1985 - f1_score:
0.3263
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 204ms/step - loss: 2.1985 -
f1_score: 0.3263 - val_loss: 2.0685 - val_f1_score: 0.4219
Epoch 85/500
28/28 [==============================] - 2s 64ms/step - loss: 2.1722 - f1_score:
0.3453 - val_loss: 2.0574 - val_f1_score: 0.4082
Epoch 86/500
28/28 [==============================] - 2s 65ms/step - loss: 2.2022 - f1_score:
0.3359 - val_loss: 2.0894 - val_f1_score: 0.3792
Epoch 87/500
28/28 [==============================] - 2s 66ms/step - loss: 2.1523 - f1_score:
0.3478 - val_loss: 2.0901 - val_f1_score: 0.3801
Epoch 88/500
28/28 [==============================] - ETA: 0s - loss: 2.1305 - f1_score:
0.3491

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 207ms/step - loss: 2.1305 -
f1_score: 0.3491 - val_loss: 2.0490 - val_f1_score: 0.4298
Epoch 89/500
28/28 [==============================] - 2s 64ms/step - loss: 2.1356 - f1_score:
0.3510 - val_loss: 2.0226 - val_f1_score: 0.4158
Epoch 90/500
28/28 [==============================] - 2s 65ms/step - loss: 2.1638 - f1_score:
0.3461 - val_loss: 2.0721 - val_f1_score: 0.4019
Epoch 91/500
28/28 [==============================] - ETA: 0s - loss: 2.1274 - f1_score:
0.3642

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 219ms/step - loss: 2.1274 -
f1_score: 0.3642 - val_loss: 1.9607 - val_f1_score: 0.4329
```

```
Epoch 92/500
28/28 [==============================] - ETA: 0s - loss: 2.1515 - f1_score:
0.3512

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 212ms/step - loss: 2.1515 -
f1_score: 0.3512 - val_loss: 1.9885 - val_f1_score: 0.4616
Epoch 93/500
28/28 [==============================] - 2s 64ms/step - loss: 2.0492 - f1_score:
0.3674 - val_loss: 1.9764 - val_f1_score: 0.4462
Epoch 94/500
28/28 [==============================] - 2s 64ms/step - loss: 2.1052 - f1_score:
0.3637 - val_loss: 1.9654 - val_f1_score: 0.4284
Epoch 95/500
28/28 [==============================] - 2s 66ms/step - loss: 2.0731 - f1_score:
0.3752 - val_loss: 2.0509 - val_f1_score: 0.4097
Epoch 96/500
28/28 [==============================] - 2s 65ms/step - loss: 2.0406 - f1_score:
0.3790 - val_loss: 1.9919 - val_f1_score: 0.3910
Epoch 97/500
28/28 [==============================] - 2s 67ms/step - loss: 2.0143 - f1_score:
0.3976 - val_loss: 2.0124 - val_f1_score: 0.4220
Epoch 98/500
28/28 [==============================] - 2s 65ms/step - loss: 2.0585 - f1_score:
0.3760 - val_loss: 1.9455 - val_f1_score: 0.4436
Epoch 99/500
28/28 [==============================] - 2s 66ms/step - loss: 2.0217 - f1_score:
0.3691 - val_loss: 1.9449 - val_f1_score: 0.4528
Epoch 100/500
28/28 [==============================] - 2s 66ms/step - loss: 2.0132 - f1_score:
0.3837 - val_loss: 1.9520 - val_f1_score: 0.4306
Epoch 101/500
28/28 [==============================] - 2s 69ms/step - loss: 2.0014 - f1_score:
0.3857 - val_loss: 1.9496 - val_f1_score: 0.3997
Epoch 102/500
28/28 [==============================] - 2s 70ms/step - loss: 1.9816 - f1_score:
0.3898 - val_loss: 1.9619 - val_f1_score: 0.4397
Epoch 103/500
28/28 [==============================] - 2s 67ms/step - loss: 1.9878 - f1_score:
0.3960 - val_loss: 2.0141 - val_f1_score: 0.3863
Epoch 104/500
28/28 [==============================] - 2s 68ms/step - loss: 1.9666 - f1_score:
0.3940 - val_loss: 1.9465 - val_f1_score: 0.4574
```

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Epoch 105/500
28/28 [==============================] - ETA: 0s - loss: 1.9515 - f1_score:
0.3920

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 224ms/step - loss: 1.9515 -
f1_score: 0.3920 - val_loss: 1.9048 - val_f1_score: 0.4675
Epoch 106/500
28/28 [==============================] - 2s 64ms/step - loss: 1.9463 - f1_score:
0.3938 - val_loss: 1.8639 - val_f1_score: 0.4671
Epoch 107/500
28/28 [==============================] - 2s 65ms/step - loss: 1.9384 - f1_score:
0.4059 - val_loss: 1.9221 - val_f1_score: 0.4355
Epoch 108/500
28/28 [==============================] - 2s 66ms/step - loss: 1.9680 - f1_score:
0.3885 - val_loss: 1.8816 - val_f1_score: 0.4451
Epoch 109/500
28/28 [==============================] - ETA: 0s - loss: 1.9410 - f1_score:
0.4202

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 202ms/step - loss: 1.9410 -
f1_score: 0.4202 - val_loss: 1.8965 - val_f1_score: 0.4689
Epoch 110/500
28/28 [==============================] - 2s 65ms/step - loss: 1.9679 - f1_score:
0.4039 - val_loss: 1.8939 - val_f1_score: 0.4541
Epoch 111/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8812 - f1_score:
0.4246 - val_loss: 1.8664 - val_f1_score: 0.4432
Epoch 112/500
28/28 [==============================] - 2s 65ms/step - loss: 1.9271 - f1_score:
0.4139 - val_loss: 1.8766 - val_f1_score: 0.4626
Epoch 113/500
28/28 [==============================] - ETA: 0s - loss: 1.9102 - f1_score:
0.4227

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
```

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3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 234ms/step - loss: 1.9102 -
f1_score: 0.4227 - val_loss: 1.9022 - val_f1_score: 0.4914
Epoch 114/500
28/28 [==============================] - 2s 64ms/step - loss: 1.8689 - f1_score:
0.4316 - val_loss: 1.9332 - val_f1_score: 0.4173
Epoch 115/500
28/28 [==============================] - 2s 65ms/step - loss: 1.8928 - f1_score:
0.4232 - val_loss: 1.8481 - val_f1_score: 0.4572
Epoch 116/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8668 - f1_score:
0.4153 - val_loss: 1.8792 - val_f1_score: 0.4621
Epoch 117/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8668 - f1_score:
0.4209 - val_loss: 1.9115 - val_f1_score: 0.4264
Epoch 118/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8697 - f1_score:
0.4213 - val_loss: 1.8723 - val_f1_score: 0.4711
Epoch 119/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8687 - f1_score:
0.4162 - val_loss: 1.8526 - val_f1_score: 0.4573
Epoch 120/500
28/28 [==============================] - 2s 66ms/step - loss: 1.8326 - f1_score:
0.4342 - val_loss: 1.8521 - val_f1_score: 0.4840
Epoch 121/500
28/28 [==============================] - 2s 70ms/step - loss: 1.8434 - f1_score:
0.4202 - val_loss: 1.9115 - val_f1_score: 0.4619
Epoch 122/500
28/28 [==============================] - 2s 67ms/step - loss: 1.8111 - f1_score:
0.4385 - val_loss: 1.8366 - val_f1_score: 0.4607
Epoch 123/500
28/28 [==============================] - 2s 67ms/step - loss: 1.8130 - f1_score:
0.4463 - val_loss: 1.8336 - val_f1_score: 0.4641
Epoch 124/500
28/28 [==============================] - 2s 66ms/step - loss: 1.7944 - f1_score:
0.4456 - val_loss: 1.8125 - val_f1_score: 0.4837
Epoch 125/500
28/28 [==============================] - ETA: 0s - loss: 1.8293 - f1_score:
0.4369

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets
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INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 204ms/step - loss: 1.8293 -
f1_score: 0.4369 - val_loss: 1.7891 - val_f1_score: 0.4931
Epoch 126/500
28/28 [==============================] - 2s 65ms/step - loss: 1.7662 - f1_score:
0.4403 - val_loss: 1.7982 - val_f1_score: 0.4907
Epoch 127/500
28/28 [==============================] - 2s 66ms/step - loss: 1.7911 - f1_score:
0.4448 - val_loss: 1.7923 - val_f1_score: 0.4673
Epoch 128/500
28/28 [==============================] - 2s 72ms/step - loss: 1.7596 - f1_score:
0.4611 - val_loss: 1.9302 - val_f1_score: 0.4701
Epoch 129/500
28/28 [==============================] - ETA: 0s - loss: 1.7799 - f1_score:
0.4407

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 214ms/step - loss: 1.7799 -
f1_score: 0.4407 - val_loss: 1.7995 - val_f1_score: 0.4985
Epoch 130/500
28/28 [==============================] - ETA: 0s - loss: 1.7739 - f1_score:
0.4422

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 13s 484ms/step - loss: 1.7739 -
f1_score: 0.4422 - val_loss: 1.7544 - val_f1_score: 0.5059
Epoch 131/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7987 - f1_score:
0.4491 - val_loss: 1.8301 - val_f1_score: 0.4896
Epoch 132/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7694 - f1_score:
0.4449 - val_loss: 1.8082 - val_f1_score: 0.4887
Epoch 133/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7722 - f1_score:
0.4467 - val_loss: 1.8437 - val_f1_score: 0.4639
Epoch 134/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7253 - f1_score:
```

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0.4645 - val_loss: 1.7979 - val_f1_score: 0.4971
Epoch 135/500
28/28 [==============================] - 2s 65ms/step - loss: 1.6902 - f1_score:
0.4653 - val_loss: 1.7423 - val_f1_score: 0.4941
Epoch 136/500
28/28 [==============================] - ETA: 0s - loss: 1.6895 - f1_score:
0.4807

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 226ms/step - loss: 1.6895 -
f1_score: 0.4807 - val_loss: 1.7280 - val_f1_score: 0.5222
Epoch 137/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7574 - f1_score:
0.4614 - val_loss: 1.7878 - val_f1_score: 0.4967
Epoch 138/500
28/28 [==============================] - 2s 64ms/step - loss: 1.7296 - f1_score:
0.4607 - val_loss: 1.8423 - val_f1_score: 0.4566
Epoch 139/500
28/28 [==============================] - 2s 65ms/step - loss: 1.6858 - f1_score:
0.4722 - val_loss: 1.7576 - val_f1_score: 0.4866
Epoch 140/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6382 - f1_score:
0.4842 - val_loss: 1.7744 - val_f1_score: 0.5205
Epoch 141/500
28/28 [==============================] - 2s 66ms/step - loss: 1.7079 - f1_score:
0.4601 - val_loss: 1.7741 - val_f1_score: 0.4880
Epoch 142/500
28/28 [==============================] - 2s 66ms/step - loss: 1.7067 - f1_score:
0.4677 - val_loss: 1.7609 - val_f1_score: 0.5024
Epoch 143/500
28/28 [==============================] - 2s 68ms/step - loss: 1.6287 - f1_score:
0.4919 - val_loss: 1.8637 - val_f1_score: 0.5062
Epoch 144/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6568 - f1_score:
0.4808 - val_loss: 1.7937 - val_f1_score: 0.4898
Epoch 145/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6752 - f1_score:
0.4867 - val_loss: 1.8442 - val_f1_score: 0.4839
Epoch 146/500
28/28 [==============================] - ETA: 0s - loss: 1.6469 - f1_score:
0.4722

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 218ms/step - loss: 1.6469 -
f1_score: 0.4722 - val_loss: 1.7702 - val_f1_score: 0.5328
Epoch 147/500
28/28 [==============================] - ETA: 0s - loss: 1.6673 - f1_score:
0.4728

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 207ms/step - loss: 1.6673 -
f1_score: 0.4728 - val_loss: 1.7426 - val_f1_score: 0.5359
Epoch 148/500
28/28 [==============================] - 2s 64ms/step - loss: 1.6345 - f1_score:
0.4855 - val_loss: 1.7475 - val_f1_score: 0.5355
Epoch 149/500
28/28 [==============================] - 2s 65ms/step - loss: 1.6332 - f1_score:
0.4860 - val_loss: 1.7610 - val_f1_score: 0.5023
Epoch 150/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6444 - f1_score:
0.4855 - val_loss: 1.7585 - val_f1_score: 0.5198
Epoch 151/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5963 - f1_score:
0.4967 - val_loss: 1.7224 - val_f1_score: 0.5075
Epoch 152/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6417 - f1_score:
0.4833 - val_loss: 1.8257 - val_f1_score: 0.4710
Epoch 153/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6010 - f1_score:
0.4982 - val_loss: 1.7204 - val_f1_score: 0.5252
Epoch 154/500
28/28 [==============================] - 2s 68ms/step - loss: 1.5859 - f1_score:
0.5055 - val_loss: 1.7300 - val_f1_score: 0.5135
Epoch 155/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6383 - f1_score:
0.4877 - val_loss: 1.6693 - val_f1_score: 0.5335
Epoch 156/500
28/28 [==============================] - 2s 66ms/step - loss: 1.6143 - f1_score:
0.4951 - val_loss: 1.7176 - val_f1_score: 0.5345
Epoch 157/500
```

```
28/28 [==============================] - 2s 67ms/step - loss: 1.6297 - f1_score:
0.4895 - val_loss: 1.8043 - val_f1_score: 0.4850
Epoch 158/500
28/28 [==============================] - 2s 67ms/step - loss: 1.6020 - f1_score:
0.5004 - val_loss: 1.7149 - val_f1_score: 0.5300
Epoch 159/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5616 - f1_score:
0.5193 - val_loss: 1.7353 - val_f1_score: 0.5122
Epoch 160/500
28/28 [==============================] - ETA: 0s - loss: 1.5853 - f1_score:
0.5064

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 227ms/step - loss: 1.5853 -
f1_score: 0.5064 - val_loss: 1.6758 - val_f1_score: 0.5372
Epoch 161/500
28/28 [==============================] - 2s 65ms/step - loss: 1.5900 - f1_score:
0.5013 - val_loss: 1.7414 - val_f1_score: 0.4837
Epoch 162/500
28/28 [==============================] - 2s 65ms/step - loss: 1.6175 - f1_score:
0.4946 - val_loss: 1.6607 - val_f1_score: 0.5309
Epoch 163/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5732 - f1_score:
0.5050 - val_loss: 1.7530 - val_f1_score: 0.4968
Epoch 164/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5687 - f1_score:
0.5014 - val_loss: 1.7052 - val_f1_score: 0.5172
Epoch 165/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5614 - f1_score:
0.5103 - val_loss: 1.7542 - val_f1_score: 0.4956
Epoch 166/500
28/28 [==============================] - 2s 69ms/step - loss: 1.5381 - f1_score:
0.5098 - val_loss: 1.7150 - val_f1_score: 0.5262
Epoch 167/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5423 - f1_score:
0.5197 - val_loss: 1.6884 - val_f1_score: 0.5287
Epoch 168/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5481 - f1_score:
0.5138 - val_loss: 1.6623 - val_f1_score: 0.5244
Epoch 169/500
28/28 [==============================] - 2s 71ms/step - loss: 1.5843 - f1_score:
0.5001 - val_loss: 1.7196 - val_f1_score: 0.5345
Epoch 170/500
```

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28/28 [==============================] - ETA: 0s - loss: 1.5403 - f1_score:
0.5163

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 209ms/step - loss: 1.5403 -
f1_score: 0.5163 - val_loss: 1.6107 - val_f1_score: 0.5613
Epoch 171/500
28/28 [==============================] - 2s 64ms/step - loss: 1.5535 - f1_score:
0.5191 - val_loss: 1.6147 - val_f1_score: 0.5421
Epoch 172/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5296 - f1_score:
0.5246 - val_loss: 1.7188 - val_f1_score: 0.5269
Epoch 173/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4641 - f1_score:
0.5450 - val_loss: 1.6718 - val_f1_score: 0.5216
Epoch 174/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4790 - f1_score:
0.5290 - val_loss: 1.7097 - val_f1_score: 0.5479
Epoch 175/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4827 - f1_score:
0.5439 - val_loss: 1.6273 - val_f1_score: 0.5557
Epoch 176/500
28/28 [==============================] - 2s 68ms/step - loss: 1.5101 - f1_score:
0.5202 - val_loss: 1.6854 - val_f1_score: 0.5240
Epoch 177/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5097 - f1_score:
0.5209 - val_loss: 1.7533 - val_f1_score: 0.5213
Epoch 178/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5230 - f1_score:
0.5218 - val_loss: 1.6974 - val_f1_score: 0.5174
Epoch 179/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5032 - f1_score:
0.5316 - val_loss: 1.5991 - val_f1_score: 0.5582
Epoch 180/500
28/28 [==============================] - 2s 68ms/step - loss: 1.4700 - f1_score:
0.5297 - val_loss: 1.7398 - val_f1_score: 0.5149
Epoch 181/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4494 - f1_score:
0.5519 - val_loss: 1.6931 - val_f1_score: 0.5135
Epoch 182/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4785 - f1_score:
0.5343 - val_loss: 1.5918 - val_f1_score: 0.5378
Epoch 183/500
```

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28/28 [==============================] - 2s 69ms/step - loss: 1.4954 - f1_score:
0.5310 - val_loss: 1.7063 - val_f1_score: 0.5052
Epoch 184/500
28/28 [==============================] - 2s 69ms/step - loss: 1.4824 - f1_score:
0.5401 - val_loss: 1.6496 - val_f1_score: 0.5444
Epoch 185/500
28/28 [==============================] - 2s 80ms/step - loss: 1.4603 - f1_score:
0.5385 - val_loss: 1.7479 - val_f1_score: 0.5068
Epoch 186/500
28/28 [==============================] - 2s 68ms/step - loss: 1.4782 - f1_score:
0.5427 - val_loss: 1.6305 - val_f1_score: 0.5297
Epoch 187/500
28/28 [==============================] - 2s 69ms/step - loss: 1.4513 - f1_score:
0.5481 - val_loss: 1.6285 - val_f1_score: 0.5609
Epoch 188/500
28/28 [==============================] - 2s 69ms/step - loss: 1.4590 - f1_score:
0.5439 - val_loss: 1.5878 - val_f1_score: 0.5503
Epoch 189/500
28/28 [==============================] - ETA: 0s - loss: 1.4943 - f1_score:
0.5314

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 234ms/step - loss: 1.4943 -
f1_score: 0.5314 - val_loss: 1.6069 - val_f1_score: 0.5642
Epoch 190/500
28/28 [==============================] - 2s 65ms/step - loss: 1.3962 - f1_score:
0.5547 - val_loss: 1.7095 - val_f1_score: 0.5325
Epoch 191/500
28/28 [==============================] - ETA: 0s - loss: 1.4330 - f1_score:
0.5368

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 232ms/step - loss: 1.4330 -
f1_score: 0.5368 - val_loss: 1.5782 - val_f1_score: 0.5759
Epoch 192/500
28/28 [==============================] - 2s 65ms/step - loss: 1.4203 - f1_score:
0.5467 - val_loss: 1.5874 - val_f1_score: 0.5618
Epoch 193/500
```

```
28/28 [==============================] - 2s 65ms/step - loss: 1.4487 - f1_score:
0.5420 - val_loss: 1.6118 - val_f1_score: 0.5664
Epoch 194/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4028 - f1_score:
0.5567 - val_loss: 1.6505 - val_f1_score: 0.5603
Epoch 195/500
28/28 [==============================] - 2s 70ms/step - loss: 1.3942 - f1_score:
0.5533 - val_loss: 1.8048 - val_f1_score: 0.4648
Epoch 196/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3599 - f1_score:
0.5746 - val_loss: 1.5696 - val_f1_score: 0.5613
Epoch 197/500
28/28 [==============================] - ETA: 0s - loss: 1.3981 - f1_score:
0.5598

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 207ms/step - loss: 1.3981 -
f1_score: 0.5598 - val_loss: 1.5565 - val_f1_score: 0.6037
Epoch 198/500
28/28 [==============================] - 2s 68ms/step - loss: 1.4189 - f1_score:
0.5441 - val_loss: 1.6110 - val_f1_score: 0.5524
Epoch 199/500
28/28 [==============================] - 2s 66ms/step - loss: 1.4005 - f1_score:
0.5634 - val_loss: 1.5798 - val_f1_score: 0.5382
Epoch 200/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3886 - f1_score:
0.5591 - val_loss: 1.6228 - val_f1_score: 0.5635
Epoch 201/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3993 - f1_score:
0.5498 - val_loss: 1.6543 - val_f1_score: 0.5401
Epoch 202/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4006 - f1_score:
0.5580 - val_loss: 1.6922 - val_f1_score: 0.5205
Epoch 203/500
28/28 [==============================] - 2s 67ms/step - loss: 1.3741 - f1_score:
0.5739 - val_loss: 1.5806 - val_f1_score: 0.5460
Epoch 204/500
28/28 [==============================] - 2s 67ms/step - loss: 1.3928 - f1_score:
0.5550 - val_loss: 1.5778 - val_f1_score: 0.5694
Epoch 205/500
28/28 [==============================] - 2s 67ms/step - loss: 1.3844 - f1_score:
0.5523 - val_loss: 1.5955 - val_f1_score: 0.5412
Epoch 206/500
```

```
28/28 [==============================] - 2s 67ms/step - loss: 1.3651 - f1_score:
0.5661 - val_loss: 1.5847 - val_f1_score: 0.5430
Epoch 207/500
28/28 [==============================] - 2s 72ms/step - loss: 1.3832 - f1_score:
0.5693 - val_loss: 1.5624 - val_f1_score: 0.5480
Epoch 208/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3482 - f1_score:
0.5720 - val_loss: 1.5389 - val_f1_score: 0.5726
Epoch 209/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3717 - f1_score:
0.5584 - val_loss: 1.6327 - val_f1_score: 0.5610
Epoch 210/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3881 - f1_score:
0.5621 - val_loss: 1.6854 - val_f1_score: 0.5421
Epoch 211/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3625 - f1_score:
0.5631 - val_loss: 1.6297 - val_f1_score: 0.5851
Epoch 212/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3686 - f1_score:
0.5509 - val_loss: 1.5056 - val_f1_score: 0.5780
Epoch 213/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3414 - f1_score:
0.5726 - val_loss: 1.5259 - val_f1_score: 0.5742
Epoch 214/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3303 - f1_score:
0.5731 - val_loss: 1.6090 - val_f1_score: 0.5211
Epoch 215/500
28/28 [==============================] - 2s 75ms/step - loss: 1.3364 - f1_score:
0.5794 - val_loss: 1.5448 - val_f1_score: 0.5584
Epoch 216/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3438 - f1_score:
0.5683 - val_loss: 1.5368 - val_f1_score: 0.5875
Epoch 217/500
28/28 [==============================] - 2s 70ms/step - loss: 1.3457 - f1_score:
0.5766 - val_loss: 1.5652 - val_f1_score: 0.5707
Epoch 218/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3150 - f1_score:
0.5902 - val_loss: 1.5472 - val_f1_score: 0.5705
Epoch 219/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3367 - f1_score:
0.5784 - val_loss: 1.5918 - val_f1_score: 0.5457
Epoch 220/500
28/28 [==============================] - 2s 70ms/step - loss: 1.3293 - f1_score:
0.5654 - val_loss: 1.6026 - val_f1_score: 0.5494
Epoch 221/500
28/28 [==============================] - ETA: 0s - loss: 1.3012 - f1_score:
0.5937
```

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WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
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INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

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28/28 [==============================] - 6s 236ms/step - loss: 1.3012 -
f1_score: 0.5937 - val_loss: 1.4795 - val_f1_score: 0.6202
Epoch 222/500
28/28 [==============================] - 2s 65ms/step - loss: 1.3292 - f1_score:
0.5833 - val_loss: 1.5300 - val_f1_score: 0.5763
Epoch 223/500
28/28 [==============================] - 2s 71ms/step - loss: 1.2402 - f1_score:
0.6044 - val_loss: 1.5755 - val_f1_score: 0.5933
Epoch 224/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3221 - f1_score:
0.5799 - val_loss: 1.5737 - val_f1_score: 0.5715
Epoch 225/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2633 - f1_score:
0.6018 - val_loss: 1.5193 - val_f1_score: 0.5868
Epoch 226/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2870 - f1_score:
0.5944 - val_loss: 1.5004 - val_f1_score: 0.5885
Epoch 227/500
28/28 [==============================] - 2s 67ms/step - loss: 1.2782 - f1_score:
0.5960 - val_loss: 1.5521 - val_f1_score: 0.6092
Epoch 228/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2904 - f1_score:
0.5768 - val_loss: 1.5302 - val_f1_score: 0.5578
Epoch 229/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2627 - f1_score:
0.5886 - val_loss: 1.4873 - val_f1_score: 0.5695
Epoch 230/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2790 - f1_score:
0.5909 - val_loss: 1.5590 - val_f1_score: 0.5768
Epoch 231/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2825 - f1_score:
0.5976 - val_loss: 1.4796 - val_f1_score: 0.5723
Epoch 232/500
28/28 [==============================] - 2s 69ms/step - loss: 1.3168 - f1_score:
0.5739 - val_loss: 1.4177 - val_f1_score: 0.6074
Epoch 233/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2368 - f1_score:
0.5972 - val_loss: 1.5221 - val_f1_score: 0.5851
Epoch 234/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2453 - f1_score:
0.6031 - val_loss: 1.5234 - val_f1_score: 0.5644
```

```
Epoch 235/500
28/28 [==============================] - 2s 70ms/step - loss: 1.2705 - f1_score:
0.5902 - val_loss: 1.4905 - val_f1_score: 0.5731
Epoch 236/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2324 - f1_score:
0.6139 - val_loss: 1.4419 - val_f1_score: 0.5973
Epoch 237/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2816 - f1_score:
0.5909 - val_loss: 1.4994 - val_f1_score: 0.5837
Epoch 238/500
28/28 [==============================] - 2s 73ms/step - loss: 1.2449 - f1_score:
0.5931 - val_loss: 1.5524 - val_f1_score: 0.5600
Epoch 239/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2732 - f1_score:
0.6044 - val_loss: 1.4432 - val_f1_score: 0.6060
Epoch 240/500
28/28 [==============================] - 2s 77ms/step - loss: 1.2488 - f1_score:
0.6066 - val_loss: 1.4709 - val_f1_score: 0.5764
Epoch 241/500
28/28 [==============================] - 2s 70ms/step - loss: 1.2095 - f1_score:
0.6045 - val_loss: 1.4874 - val_f1_score: 0.5767
Epoch 242/500
28/28 [==============================] - 2s 71ms/step - loss: 1.2144 - f1_score:
0.6087 - val_loss: 1.4465 - val_f1_score: 0.5913
Epoch 243/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2578 - f1_score:
0.6048 - val_loss: 1.5176 - val_f1_score: 0.5868
Epoch 244/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2577 - f1_score:
0.5880 - val_loss: 1.4734 - val_f1_score: 0.6059
Epoch 245/500
28/28 [==============================] - 2s 69ms/step - loss: 1.2482 - f1_score:
0.6010 - val_loss: 1.4629 - val_f1_score: 0.5834
Epoch 246/500
28/28 [==============================] - 2s 70ms/step - loss: 1.1849 - f1_score:
0.6223 - val_loss: 1.4705 - val_f1_score: 0.5961
Epoch 247/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1724 - f1_score:
0.6133 - val_loss: 1.6564 - val_f1_score: 0.5310
Epoch 248/500
28/28 [==============================] - 2s 70ms/step - loss: 1.2122 - f1_score:
0.6153 - val_loss: 1.4162 - val_f1_score: 0.6122
Epoch 249/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1798 - f1_score:
0.6197 - val_loss: 1.5112 - val_f1_score: 0.5637
Epoch 250/500
28/28 [==============================] - 2s 71ms/step - loss: 1.2040 - f1_score:
0.6237 - val_loss: 1.4662 - val_f1_score: 0.5745
```

```
Epoch 251/500
28/28 [==============================] - 3s 106ms/step - loss: 1.2260 -
f1_score: 0.6022 - val_loss: 1.5087 - val_f1_score: 0.5875
Epoch 252/500
28/28 [==============================] - 2s 74ms/step - loss: 1.2056 - f1_score:
0.6154 - val_loss: 1.4157 - val_f1_score: 0.5898
Epoch 253/500
28/28 [==============================] - ETA: 0s - loss: 1.1801 - f1_score:
0.6147

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

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28/28 [==============================] - 7s 254ms/step - loss: 1.1801 -
f1_score: 0.6147 - val_loss: 1.4145 - val_f1_score: 0.6301
Epoch 254/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1911 - f1_score:
0.6203 - val_loss: 1.5087 - val_f1_score: 0.5926
Epoch 255/500
28/28 [==============================] - 2s 66ms/step - loss: 1.2260 - f1_score:
0.6168 - val_loss: 1.5826 - val_f1_score: 0.5828
Epoch 256/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1653 - f1_score:
0.6277 - val_loss: 1.4742 - val_f1_score: 0.5794
Epoch 257/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1937 - f1_score:
0.6227 - val_loss: 1.4519 - val_f1_score: 0.5774
Epoch 258/500
28/28 [==============================] - 2s 68ms/step - loss: 1.2038 - f1_score:
0.6196 - val_loss: 1.3949 - val_f1_score: 0.6238
Epoch 259/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1832 - f1_score:
0.6135 - val_loss: 1.5623 - val_f1_score: 0.5544
Epoch 260/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1819 - f1_score:
0.6161 - val_loss: 1.5575 - val_f1_score: 0.5981
Epoch 261/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1473 - f1_score:
0.6300 - val_loss: 1.4135 - val_f1_score: 0.6141
Epoch 262/500
28/28 [==============================] - 2s 70ms/step - loss: 1.2249 - f1_score:
0.5980 - val_loss: 1.4152 - val_f1_score: 0.6005
Epoch 263/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1629 - f1_score:
0.6282 - val_loss: 1.3741 - val_f1_score: 0.6047
```

```
Epoch 264/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1329 - f1_score:
0.6437 - val_loss: 1.3925 - val_f1_score: 0.6009
Epoch 265/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1559 - f1_score:
0.6239 - val_loss: 1.5505 - val_f1_score: 0.5769
Epoch 266/500
28/28 [==============================] - ETA: 0s - loss: 1.1688 - f1_score:
0.6267

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
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INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

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28/28 [==============================] - 6s 232ms/step - loss: 1.1688 -
f1_score: 0.6267 - val_loss: 1.3834 - val_f1_score: 0.6322
Epoch 267/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1938 - f1_score:
0.6181 - val_loss: 1.4503 - val_f1_score: 0.6104
Epoch 268/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1741 - f1_score:
0.6198 - val_loss: 1.4062 - val_f1_score: 0.6197
Epoch 269/500
28/28 [==============================] - ETA: 0s - loss: 1.1141 - f1_score:
0.6406

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 220ms/step - loss: 1.1141 -
f1_score: 0.6406 - val_loss: 1.3498 - val_f1_score: 0.6400
Epoch 270/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1681 - f1_score:
0.6223 - val_loss: 1.5472 - val_f1_score: 0.6012
Epoch 271/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1326 - f1_score:
0.6289 - val_loss: 1.4059 - val_f1_score: 0.6280
Epoch 272/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1399 - f1_score:
0.6343 - val_loss: 1.4318 - val_f1_score: 0.5708
Epoch 273/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1480 - f1_score:
0.6282 - val_loss: 1.4852 - val_f1_score: 0.5960
```

```
Epoch 274/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0991 - f1_score:
0.6420 - val_loss: 1.3506 - val_f1_score: 0.6088
Epoch 275/500
28/28 [==============================] - ETA: 0s - loss: 1.1318 - f1_score:
0.6244

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

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28/28 [==============================] - 6s 217ms/step - loss: 1.1318 -
f1_score: 0.6244 - val_loss: 1.3530 - val_f1_score: 0.6624
Epoch 276/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1251 - f1_score:
0.6342 - val_loss: 1.4013 - val_f1_score: 0.6236
Epoch 277/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1171 - f1_score:
0.6495 - val_loss: 1.4824 - val_f1_score: 0.5960
Epoch 278/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1176 - f1_score:
0.6526 - val_loss: 1.3791 - val_f1_score: 0.6433
Epoch 279/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1264 - f1_score:
0.6340 - val_loss: 1.3702 - val_f1_score: 0.6525
Epoch 280/500
28/28 [==============================] - 2s 67ms/step - loss: 1.1036 - f1_score:
0.6443 - val_loss: 1.3640 - val_f1_score: 0.6429
Epoch 281/500
28/28 [==============================] - 2s 67ms/step - loss: 1.0789 - f1_score:
0.6412 - val_loss: 1.4458 - val_f1_score: 0.5853
Epoch 282/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0927 - f1_score:
0.6447 - val_loss: 1.4190 - val_f1_score: 0.6375
Epoch 283/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1505 - f1_score:
0.6269 - val_loss: 1.3866 - val_f1_score: 0.6429
Epoch 284/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1031 - f1_score:
0.6399 - val_loss: 1.4583 - val_f1_score: 0.6244
Epoch 285/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0807 - f1_score:
0.6590 - val_loss: 1.3685 - val_f1_score: 0.6243
Epoch 286/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1436 - f1_score:
0.6264 - val_loss: 1.3784 - val_f1_score: 0.6485
```

```
Epoch 287/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0921 - f1_score:
0.6370 - val_loss: 1.3347 - val_f1_score: 0.6312
Epoch 288/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0420 - f1_score:
0.6676 - val_loss: 1.3488 - val_f1_score: 0.6495
Epoch 289/500
28/28 [==============================] - 2s 70ms/step - loss: 1.1010 - f1_score:
0.6482 - val_loss: 1.3850 - val_f1_score: 0.6347
Epoch 290/500
28/28 [==============================] - 2s 70ms/step - loss: 1.1128 - f1_score:
0.6409 - val_loss: 1.4417 - val_f1_score: 0.5895
Epoch 291/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0967 - f1_score:
0.6426 - val_loss: 1.3407 - val_f1_score: 0.6393
Epoch 292/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0641 - f1_score:
0.6713 - val_loss: 1.3398 - val_f1_score: 0.6453
Epoch 293/500
28/28 [==============================] - 2s 71ms/step - loss: 1.0806 - f1_score:
0.6468 - val_loss: 1.4264 - val_f1_score: 0.6263
Epoch 294/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0786 - f1_score:
0.6472 - val_loss: 1.4013 - val_f1_score: 0.6192
Epoch 295/500
28/28 [==============================] - 2s 72ms/step - loss: 1.0829 - f1_score:
0.6657 - val_loss: 1.4033 - val_f1_score: 0.6414
Epoch 296/500
28/28 [==============================] - 2s 71ms/step - loss: 1.0354 - f1_score:
0.6574 - val_loss: 1.3463 - val_f1_score: 0.6402
Epoch 297/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0939 - f1_score:
0.6484 - val_loss: 1.3623 - val_f1_score: 0.6262
Epoch 298/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0388 - f1_score:
0.6599 - val_loss: 1.3915 - val_f1_score: 0.6185
Epoch 299/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0750 - f1_score:
0.6461 - val_loss: 1.5767 - val_f1_score: 0.5694
Epoch 300/500
28/28 [==============================] - 2s 71ms/step - loss: 1.0837 - f1_score:
0.6477 - val_loss: 1.4383 - val_f1_score: 0.5941
Epoch 301/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0675 - f1_score:
0.6536 - val_loss: 1.3244 - val_f1_score: 0.6485
Epoch 302/500
28/28 [==============================] - ETA: 0s - loss: 1.0138 - f1_score:
0.6627
```

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WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

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28/28 [==============================] - 7s 251ms/step - loss: 1.0138 -
f1_score: 0.6627 - val_loss: 1.3745 - val_f1_score: 0.6680
Epoch 303/500
28/28 [==============================] - 2s 66ms/step - loss: 1.0514 - f1_score:
0.6572 - val_loss: 1.3085 - val_f1_score: 0.6662
Epoch 304/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0473 - f1_score:
0.6562 - val_loss: 1.4105 - val_f1_score: 0.6403
Epoch 305/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0571 - f1_score:
0.6534 - val_loss: 1.4633 - val_f1_score: 0.5995
Epoch 306/500
28/28 [==============================] - 2s 67ms/step - loss: 1.0676 - f1_score:
0.6494 - val_loss: 1.4614 - val_f1_score: 0.6394
Epoch 307/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0600 - f1_score:
0.6610 - val_loss: 1.3377 - val_f1_score: 0.6411
Epoch 308/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0212 - f1_score:
0.6681 - val_loss: 1.3437 - val_f1_score: 0.6383
Epoch 309/500
28/28 [==============================] - 2s 72ms/step - loss: 1.0133 - f1_score:
0.6756 - val_loss: 1.4710 - val_f1_score: 0.6043
Epoch 310/500
28/28 [==============================] - ETA: 0s - loss: 1.0140 - f1_score:
0.6773

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 218ms/step - loss: 1.0140 -
f1_score: 0.6773 - val_loss: 1.2993 - val_f1_score: 0.6705
Epoch 311/500
28/28 [==============================] - 2s 79ms/step - loss: 1.0312 - f1_score:
0.6680 - val_loss: 1.4133 - val_f1_score: 0.6191
Epoch 312/500
28/28 [==============================] - ETA: 0s - loss: 1.0159 - f1_score:
0.6727
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 226ms/step - loss: 1.0159 -
f1_score: 0.6727 - val_loss: 1.3117 - val_f1_score: 0.6925
Epoch 313/500
28/28 [==============================] - 2s 65ms/step - loss: 1.0124 - f1_score:
0.6714 - val_loss: 1.3890 - val_f1_score: 0.6414
Epoch 314/500
28/28 [==============================] - 2s 67ms/step - loss: 1.0032 - f1_score:
0.6710 - val_loss: 1.3347 - val_f1_score: 0.6593
Epoch 315/500
28/28 [==============================] - 2s 66ms/step - loss: 1.0184 - f1_score:
0.6759 - val_loss: 1.3147 - val_f1_score: 0.6469
Epoch 316/500
28/28 [==============================] - 2s 72ms/step - loss: 0.9910 - f1_score:
0.6728 - val_loss: 1.2933 - val_f1_score: 0.6420
Epoch 317/500
28/28 [==============================] - 2s 67ms/step - loss: 1.0118 - f1_score:
0.6777 - val_loss: 1.4097 - val_f1_score: 0.6037
Epoch 318/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0096 - f1_score:
0.6686 - val_loss: 1.3216 - val_f1_score: 0.6539
Epoch 319/500
28/28 [==============================] - 2s 68ms/step - loss: 0.9888 - f1_score:
0.6667 - val_loss: 1.5432 - val_f1_score: 0.5764
Epoch 320/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0196 - f1_score:
0.6697 - val_loss: 1.5007 - val_f1_score: 0.6147
Epoch 321/500
28/28 [==============================] - 2s 68ms/step - loss: 0.9836 - f1_score:
0.6791 - val_loss: 1.3435 - val_f1_score: 0.6492
Epoch 322/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9822 - f1_score:
0.6806 - val_loss: 1.2729 - val_f1_score: 0.6470
Epoch 323/500
28/28 [==============================] - 2s 68ms/step - loss: 1.0282 - f1_score:
0.6673 - val_loss: 1.2789 - val_f1_score: 0.6477
Epoch 324/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9646 - f1_score:
0.6823 - val_loss: 1.2631 - val_f1_score: 0.6705
Epoch 325/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0168 - f1_score:
0.6609 - val_loss: 1.2878 - val_f1_score: 0.6323
```

```
Epoch 326/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0049 - f1_score:
0.6874 - val_loss: 1.2779 - val_f1_score: 0.6444
Epoch 327/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9736 - f1_score:
0.6792 - val_loss: 1.3007 - val_f1_score: 0.6406
Epoch 328/500
28/28 [==============================] - 2s 71ms/step - loss: 1.0106 - f1_score:
0.6655 - val_loss: 1.3183 - val_f1_score: 0.6354
Epoch 329/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9880 - f1_score:
0.6924 - val_loss: 1.3604 - val_f1_score: 0.6250
Epoch 330/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9863 - f1_score:
0.6740 - val_loss: 1.3407 - val_f1_score: 0.6604
Epoch 331/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9762 - f1_score:
0.6865 - val_loss: 1.3813 - val_f1_score: 0.6055
Epoch 332/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9839 - f1_score:
0.6754 - val_loss: 1.2934 - val_f1_score: 0.6239
Epoch 333/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9399 - f1_score:
0.6959 - val_loss: 1.3893 - val_f1_score: 0.6085
Epoch 334/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9558 - f1_score:
0.6858 - val_loss: 1.3853 - val_f1_score: 0.6382
Epoch 335/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9366 - f1_score:
0.6763 - val_loss: 1.3576 - val_f1_score: 0.6718
Epoch 336/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9432 - f1_score:
0.6909 - val_loss: 1.3452 - val_f1_score: 0.6451
Epoch 337/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9316 - f1_score:
0.6858 - val_loss: 1.2917 - val_f1_score: 0.6466
Epoch 338/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8969 - f1_score:
0.7160 - val_loss: 1.3878 - val_f1_score: 0.6372
Epoch 339/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9757 - f1_score:
0.6819 - val_loss: 1.2952 - val_f1_score: 0.6493
Epoch 340/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9550 - f1_score:
0.6909 - val_loss: 1.2634 - val_f1_score: 0.6696
Epoch 341/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9711 - f1_score:
0.6853 - val_loss: 1.4181 - val_f1_score: 0.6450
```

```
Epoch 342/500
28/28 [==============================] - ETA: 0s - loss: 0.9501 - f1_score:
0.6943

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 226ms/step - loss: 0.9501 -
f1_score: 0.6943 - val_loss: 1.2586 - val_f1_score: 0.6963
Epoch 343/500
28/28 [==============================] - 2s 66ms/step - loss: 0.9615 - f1_score:
0.6862 - val_loss: 1.2421 - val_f1_score: 0.6576
Epoch 344/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9847 - f1_score:
0.6795 - val_loss: 1.2849 - val_f1_score: 0.6309
Epoch 345/500
28/28 [==============================] - 2s 67ms/step - loss: 0.9347 - f1_score:
0.6840 - val_loss: 1.2657 - val_f1_score: 0.6522
Epoch 346/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9075 - f1_score:
0.6997 - val_loss: 1.2648 - val_f1_score: 0.6844
Epoch 347/500
28/28 [==============================] - 2s 68ms/step - loss: 0.9228 - f1_score:
0.6916 - val_loss: 1.2880 - val_f1_score: 0.6579
Epoch 348/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9305 - f1_score:
0.6970 - val_loss: 1.2902 - val_f1_score: 0.6451
Epoch 349/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9286 - f1_score:
0.6993 - val_loss: 1.2579 - val_f1_score: 0.6464
Epoch 350/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9767 - f1_score:
0.6772 - val_loss: 1.2966 - val_f1_score: 0.6112
Epoch 351/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9262 - f1_score:
0.6919 - val_loss: 1.3012 - val_f1_score: 0.6482
Epoch 352/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9713 - f1_score:
0.6830 - val_loss: 1.3114 - val_f1_score: 0.6555
Epoch 353/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9442 - f1_score:
0.6938 - val_loss: 1.3313 - val_f1_score: 0.6179
Epoch 354/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9240 - f1_score:
0.6944 - val_loss: 1.2526 - val_f1_score: 0.6507
```

```
Epoch 355/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9416 - f1_score:
0.6826 - val_loss: 1.2632 - val_f1_score: 0.6383
Epoch 356/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9285 - f1_score:
0.6877 - val_loss: 1.2299 - val_f1_score: 0.6845
Epoch 357/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9277 - f1_score:
0.6908 - val_loss: 1.2210 - val_f1_score: 0.6644
Epoch 358/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8607 - f1_score:
0.7217 - val_loss: 1.2552 - val_f1_score: 0.6623
Epoch 359/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9352 - f1_score:
0.6897 - val_loss: 1.3105 - val_f1_score: 0.6174
Epoch 360/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9226 - f1_score:
0.7007 - val_loss: 1.2289 - val_f1_score: 0.6407
Epoch 361/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8967 - f1_score:
0.6995 - val_loss: 1.2431 - val_f1_score: 0.6552
Epoch 362/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8911 - f1_score:
0.7097 - val_loss: 1.3005 - val_f1_score: 0.6356
Epoch 363/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8983 - f1_score:
0.7017 - val_loss: 1.2571 - val_f1_score: 0.6597
Epoch 364/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9049 - f1_score:
0.6998 - val_loss: 1.4066 - val_f1_score: 0.6319
Epoch 365/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8932 - f1_score:
0.7041 - val_loss: 1.3601 - val_f1_score: 0.6580
Epoch 366/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9127 - f1_score:
0.6957 - val_loss: 1.2755 - val_f1_score: 0.6304
Epoch 367/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8828 - f1_score:
0.7046 - val_loss: 1.2862 - val_f1_score: 0.6650
Epoch 368/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9181 - f1_score:
0.6883 - val_loss: 1.2569 - val_f1_score: 0.6658
Epoch 369/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9025 - f1_score:
0.7033 - val_loss: 1.2344 - val_f1_score: 0.6738
Epoch 370/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9373 - f1_score:
0.6952 - val_loss: 1.2674 - val_f1_score: 0.6384
```

```
Epoch 371/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9121 - f1_score:
0.6973 - val_loss: 1.2436 - val_f1_score: 0.6583
Epoch 372/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9000 - f1_score:
0.7041 - val_loss: 1.4677 - val_f1_score: 0.5772
Epoch 373/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9107 - f1_score:
0.7048 - val_loss: 1.3385 - val_f1_score: 0.6388
Epoch 374/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9135 - f1_score:
0.6890 - val_loss: 1.2977 - val_f1_score: 0.6786
Epoch 375/500
28/28 [==============================] - 2s 77ms/step - loss: 0.9258 - f1_score:
0.6994 - val_loss: 1.2761 - val_f1_score: 0.6482
Epoch 376/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9071 - f1_score:
0.7046 - val_loss: 1.2244 - val_f1_score: 0.6722
Epoch 377/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8630 - f1_score:
0.7209 - val_loss: 1.2121 - val_f1_score: 0.6632
Epoch 378/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8489 - f1_score:
0.7188 - val_loss: 1.2508 - val_f1_score: 0.6445
Epoch 379/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8680 - f1_score:
0.7191 - val_loss: 1.2413 - val_f1_score: 0.6597
Epoch 380/500
28/28 [==============================] - 2s 86ms/step - loss: 0.8943 - f1_score:
0.7097 - val_loss: 1.2045 - val_f1_score: 0.6490
Epoch 381/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8695 - f1_score:
0.7155 - val_loss: 1.2437 - val_f1_score: 0.6873
Epoch 382/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8616 - f1_score:
0.7178 - val_loss: 1.2654 - val_f1_score: 0.6459
Epoch 383/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8590 - f1_score:
0.7157 - val_loss: 1.3701 - val_f1_score: 0.6351
Epoch 384/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8788 - f1_score:
0.7094 - val_loss: 1.3803 - val_f1_score: 0.6182
Epoch 385/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8636 - f1_score:
0.7199 - val_loss: 1.2993 - val_f1_score: 0.6611
Epoch 386/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8559 - f1_score:
0.7249 - val_loss: 1.2270 - val_f1_score: 0.6719
```

```
Epoch 387/500
28/28 [==============================] - 2s 69ms/step - loss: 0.9368 - f1_score:
0.6920 - val_loss: 1.2551 - val_f1_score: 0.6564
Epoch 388/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8429 - f1_score:
0.7273 - val_loss: 1.2642 - val_f1_score: 0.6515
Epoch 389/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8755 - f1_score:
0.7143 - val_loss: 1.2051 - val_f1_score: 0.6587
Epoch 390/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8549 - f1_score:
0.7207 - val_loss: 1.2364 - val_f1_score: 0.6578
Epoch 391/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8489 - f1_score:
0.7235 - val_loss: 1.1979 - val_f1_score: 0.6932
Epoch 392/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8651 - f1_score:
0.7121 - val_loss: 1.3831 - val_f1_score: 0.6278
Epoch 393/500
28/28 [==============================] - 2s 77ms/step - loss: 0.8742 - f1_score:
0.7149 - val_loss: 1.2784 - val_f1_score: 0.6385
Epoch 394/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8562 - f1_score:
0.7211 - val_loss: 1.3090 - val_f1_score: 0.6223
Epoch 395/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8451 - f1_score:
0.7279 - val_loss: 1.3576 - val_f1_score: 0.6400
Epoch 396/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8603 - f1_score:
0.7127 - val_loss: 1.2571 - val_f1_score: 0.6731
Epoch 397/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8511 - f1_score:
0.7187 - val_loss: 1.2029 - val_f1_score: 0.6738
Epoch 398/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8488 - f1_score:
0.7326 - val_loss: 1.2871 - val_f1_score: 0.6795
Epoch 399/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8625 - f1_score:
0.7187 - val_loss: 1.2521 - val_f1_score: 0.6866
Epoch 400/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8319 - f1_score:
0.7299 - val_loss: 1.2239 - val_f1_score: 0.6607
Epoch 401/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8718 - f1_score:
0.7165 - val_loss: 1.2718 - val_f1_score: 0.6768
Epoch 402/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8706 - f1_score:
0.7182 - val_loss: 1.1802 - val_f1_score: 0.6746
```

```
Epoch 403/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8036 - f1_score:
0.7206 - val_loss: 1.2047 - val_f1_score: 0.6804
Epoch 404/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8510 - f1_score:
0.7126 - val_loss: 1.1943 - val_f1_score: 0.6603
Epoch 405/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8569 - f1_score:
0.7127 - val_loss: 1.2560 - val_f1_score: 0.6295
Epoch 406/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8455 - f1_score:
0.7262 - val_loss: 1.1527 - val_f1_score: 0.6872
Epoch 407/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8081 - f1_score:
0.7406 - val_loss: 1.2378 - val_f1_score: 0.6645
Epoch 408/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8272 - f1_score:
0.7292 - val_loss: 1.3930 - val_f1_score: 0.6505
Epoch 409/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8090 - f1_score:
0.7320 - val_loss: 1.2163 - val_f1_score: 0.6700
Epoch 410/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8388 - f1_score:
0.7236 - val_loss: 1.2972 - val_f1_score: 0.6265
Epoch 411/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8267 - f1_score:
0.7142 - val_loss: 1.2110 - val_f1_score: 0.6501
Epoch 412/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7986 - f1_score:
0.7435 - val_loss: 1.2139 - val_f1_score: 0.6833
Epoch 413/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8107 - f1_score:
0.7411 - val_loss: 1.2286 - val_f1_score: 0.6747
Epoch 414/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8335 - f1_score:
0.7348 - val_loss: 1.3908 - val_f1_score: 0.6038
Epoch 415/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8217 - f1_score:
0.7328 - val_loss: 1.2805 - val_f1_score: 0.6510
Epoch 416/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8029 - f1_score:
0.7351 - val_loss: 1.2142 - val_f1_score: 0.6715
Epoch 417/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7821 - f1_score:
0.7474 - val_loss: 1.2016 - val_f1_score: 0.6867
Epoch 418/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8197 - f1_score:
0.7453 - val_loss: 1.2561 - val_f1_score: 0.6795
```

```
Epoch 419/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8350 - f1_score:
0.7249 - val_loss: 1.2207 - val_f1_score: 0.6754
Epoch 420/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8145 - f1_score:
0.7350 - val_loss: 1.1673 - val_f1_score: 0.6779
Epoch 421/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8346 - f1_score:
0.7251 - val_loss: 1.3023 - val_f1_score: 0.6889
Epoch 422/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7955 - f1_score:
0.7438 - val_loss: 1.2664 - val_f1_score: 0.6554
Epoch 423/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8202 - f1_score:
0.7278 - val_loss: 1.2342 - val_f1_score: 0.6635
Epoch 424/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8329 - f1_score:
0.7223 - val_loss: 1.2881 - val_f1_score: 0.6761
Epoch 425/500
28/28 [==============================] - 2s 79ms/step - loss: 0.8011 - f1_score:
0.7338 - val_loss: 1.2925 - val_f1_score: 0.6169
Epoch 426/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7825 - f1_score:
0.7381 - val_loss: 1.2814 - val_f1_score: 0.6778
Epoch 427/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8283 - f1_score:
0.7319 - val_loss: 1.1990 - val_f1_score: 0.6286
Epoch 428/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7868 - f1_score:
0.7409 - val_loss: 1.1896 - val_f1_score: 0.6781
Epoch 429/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7757 - f1_score:
0.7420 - val_loss: 1.1806 - val_f1_score: 0.6830
Epoch 430/500
28/28 [==============================] - 2s 73ms/step - loss: 0.7828 - f1_score:
0.7429 - val_loss: 1.3110 - val_f1_score: 0.6474
Epoch 431/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7933 - f1_score:
0.7404 - val_loss: 1.2144 - val_f1_score: 0.6846
Epoch 432/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8045 - f1_score:
0.7344 - val_loss: 1.2349 - val_f1_score: 0.6587
Epoch 433/500
28/28 [==============================] - 2s 72ms/step - loss: 0.8048 - f1_score:
0.7353 - val_loss: 1.1869 - val_f1_score: 0.6706
Epoch 434/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7838 - f1_score:
0.7502 - val_loss: 1.2874 - val_f1_score: 0.6452
```

```
Epoch 435/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8252 - f1_score:
0.7283 - val_loss: 1.2673 - val_f1_score: 0.6440
Epoch 436/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7492 - f1_score:
0.7554 - val_loss: 1.2668 - val_f1_score: 0.6614
Epoch 437/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7792 - f1_score:
0.7310 - val_loss: 1.3156 - val_f1_score: 0.6301
Epoch 438/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7697 - f1_score:
0.7511 - val_loss: 1.2173 - val_f1_score: 0.6777
Epoch 439/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7700 - f1_score:
0.7455 - val_loss: 1.2782 - val_f1_score: 0.6696
Epoch 440/500
28/28 [==============================] - ETA: 0s - loss: 0.7857 - f1_score:
0.7330

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 7s 245ms/step - loss: 0.7857 -
f1_score: 0.7330 - val_loss: 1.1228 - val_f1_score: 0.7034
Epoch 441/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7859 - f1_score:
0.7463 - val_loss: 1.3763 - val_f1_score: 0.6518
Epoch 442/500
28/28 [==============================] - 2s 67ms/step - loss: 0.8131 - f1_score:
0.7400 - val_loss: 1.3391 - val_f1_score: 0.6700
Epoch 443/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7822 - f1_score:
0.7448 - val_loss: 1.1882 - val_f1_score: 0.6787
Epoch 444/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7748 - f1_score:
0.7468 - val_loss: 1.3705 - val_f1_score: 0.6233
Epoch 445/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8256 - f1_score:
0.7185 - val_loss: 1.2170 - val_f1_score: 0.6558
Epoch 446/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7677 - f1_score:
0.7452 - val_loss: 1.2371 - val_f1_score: 0.6744
Epoch 447/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7750 - f1_score:
0.7418 - val_loss: 1.2011 - val_f1_score: 0.6795
```

```
Epoch 448/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7675 - f1_score:
0.7377 - val_loss: 1.2288 - val_f1_score: 0.6641
Epoch 449/500
28/28 [==============================] - ETA: 0s - loss: 0.7491 - f1_score:
0.7509

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing
3 of 3). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

INFO:tensorflow:Assets written to: 3 1D CNN Trial 718/assets

28/28 [==============================] - 6s 231ms/step - loss: 0.7491 -
f1_score: 0.7509 - val_loss: 1.1519 - val_f1_score: 0.7068
Epoch 450/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7638 - f1_score:
0.7460 - val_loss: 1.1637 - val_f1_score: 0.6755
Epoch 451/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7587 - f1_score:
0.7460 - val_loss: 1.1990 - val_f1_score: 0.6681
Epoch 452/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7557 - f1_score:
0.7546 - val_loss: 1.1912 - val_f1_score: 0.6618
Epoch 453/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7579 - f1_score:
0.7497 - val_loss: 1.2229 - val_f1_score: 0.6906
Epoch 454/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7878 - f1_score:
0.7437 - val_loss: 1.2215 - val_f1_score: 0.6581
Epoch 455/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7309 - f1_score:
0.7581 - val_loss: 1.1353 - val_f1_score: 0.6905
Epoch 456/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7324 - f1_score:
0.7564 - val_loss: 1.2404 - val_f1_score: 0.6715
Epoch 457/500
28/28 [==============================] - 2s 73ms/step - loss: 0.7576 - f1_score:
0.7453 - val_loss: 1.2670 - val_f1_score: 0.6453
Epoch 458/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7222 - f1_score:
0.7555 - val_loss: 1.2494 - val_f1_score: 0.6548
Epoch 459/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7739 - f1_score:
0.7478 - val_loss: 1.2296 - val_f1_score: 0.6538
Epoch 460/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7317 - f1_score:
0.7545 - val_loss: 1.1415 - val_f1_score: 0.6781
```

```
Epoch 461/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7692 - f1_score:
0.7467 - val_loss: 1.1787 - val_f1_score: 0.6852
Epoch 462/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7526 - f1_score:
0.7497 - val_loss: 1.1669 - val_f1_score: 0.6805
Epoch 463/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7347 - f1_score:
0.7587 - val_loss: 1.1564 - val_f1_score: 0.6741
Epoch 464/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7795 - f1_score:
0.7329 - val_loss: 1.3093 - val_f1_score: 0.6478
Epoch 465/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7210 - f1_score:
0.7572 - val_loss: 1.1823 - val_f1_score: 0.6774
Epoch 466/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7357 - f1_score:
0.7494 - val_loss: 1.1541 - val_f1_score: 0.6636
Epoch 467/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7275 - f1_score:
0.7527 - val_loss: 1.2729 - val_f1_score: 0.6608
Epoch 468/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7289 - f1_score:
0.7585 - val_loss: 1.1866 - val_f1_score: 0.6916
Epoch 469/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7318 - f1_score:
0.7543 - val_loss: 1.2938 - val_f1_score: 0.6271
Epoch 470/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7343 - f1_score:
0.7530 - val_loss: 1.2795 - val_f1_score: 0.6735
Epoch 471/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7186 - f1_score:
0.7620 - val_loss: 1.1500 - val_f1_score: 0.6633
Epoch 472/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7539 - f1_score:
0.7504 - val_loss: 1.3190 - val_f1_score: 0.6834
Epoch 473/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7044 - f1_score:
0.7668 - val_loss: 1.1390 - val_f1_score: 0.6927
Epoch 474/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7325 - f1_score:
0.7551 - val_loss: 1.3141 - val_f1_score: 0.6132
Epoch 475/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7154 - f1_score:
0.7556 - val_loss: 1.1390 - val_f1_score: 0.6814
Epoch 476/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7357 - f1_score:
0.7506 - val_loss: 1.1992 - val_f1_score: 0.6814
```

```
Epoch 477/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7262 - f1_score:
0.7704 - val_loss: 1.2282 - val_f1_score: 0.6600
Epoch 478/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7491 - f1_score:
0.7504 - val_loss: 1.1607 - val_f1_score: 0.6771
Epoch 479/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7243 - f1_score:
0.7498 - val_loss: 1.2151 - val_f1_score: 0.6778
Epoch 480/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7323 - f1_score:
0.7564 - val_loss: 1.1975 - val_f1_score: 0.6615
Epoch 481/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7668 - f1_score:
0.7468 - val_loss: 1.2615 - val_f1_score: 0.6844
Epoch 482/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7190 - f1_score:
0.7611 - val_loss: 1.1574 - val_f1_score: 0.6756
Epoch 483/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6829 - f1_score:
0.7761 - val_loss: 1.3945 - val_f1_score: 0.6536
Epoch 484/500
28/28 [==============================] - 2s 79ms/step - loss: 0.7431 - f1_score:
0.7536 - val_loss: 1.2824 - val_f1_score: 0.6338
Epoch 485/500
28/28 [==============================] - 2s 73ms/step - loss: 0.6932 - f1_score:
0.7578 - val_loss: 1.2787 - val_f1_score: 0.6611
Epoch 486/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7305 - f1_score:
0.7537 - val_loss: 1.1614 - val_f1_score: 0.6910
Epoch 487/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7389 - f1_score:
0.7616 - val_loss: 1.3857 - val_f1_score: 0.6561
Epoch 488/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7105 - f1_score:
0.7647 - val_loss: 1.2946 - val_f1_score: 0.6367
Epoch 489/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7521 - f1_score:
0.7516 - val_loss: 1.1693 - val_f1_score: 0.6925
Epoch 490/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7623 - f1_score:
0.7544 - val_loss: 1.1771 - val_f1_score: 0.6669
Epoch 491/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6770 - f1_score:
0.7682 - val_loss: 1.1138 - val_f1_score: 0.6746
Epoch 492/500
28/28 [==============================] - 2s 73ms/step - loss: 0.7004 - f1_score:
0.7670 - val_loss: 1.2139 - val_f1_score: 0.6461
```

```
Epoch 493/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7399 - f1_score:
0.7532 - val_loss: 1.1788 - val_f1_score: 0.6636
Epoch 494/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6843 - f1_score:
0.7734 - val_loss: 1.2379 - val_f1_score: 0.6776
Epoch 495/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6870 - f1_score:
0.7715 - val_loss: 1.3014 - val_f1_score: 0.6551
Epoch 496/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6780 - f1_score:
0.7764 - val_loss: 1.1346 - val_f1_score: 0.6817
Epoch 497/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7203 - f1_score:
0.7568 - val_loss: 1.2437 - val_f1_score: 0.6797
Epoch 498/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6994 - f1_score:
0.7673 - val_loss: 1.2779 - val_f1_score: 0.6702
Epoch 499/500
28/28 [==============================] - 2s 72ms/step - loss: 0.7132 - f1_score:
0.7707 - val_loss: 1.2053 - val_f1_score: 0.6701
Epoch 500/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6961 - f1_score:
0.7711 - val_loss: 1.1857 - val_f1_score: 0.6803
```

[128]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 13ms/step
              precision    recall  f1-score   support

         AXE      0.778     0.875     0.824         8
    BACKPACK      0.625     0.833     0.714         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.714     0.500     0.588        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.500     0.667         8
   BREAKFAST      0.625     0.833     0.714         6
      CANCER      0.727     1.000     0.842         8
   CHRISTMAS      1.000     0.333     0.500         6
    CONFUSED      0.600     1.000     0.750         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.286     0.333     0.308         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      1.000     0.250     0.400         8
```

```
     DEVELOP      0.333     0.500     0.400         6
      DINNER      0.750     0.750     0.750         8
         DOG      1.000     1.000     1.000         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.667     0.500     0.571         4
         EAT      0.667     1.000     0.800         6
        EDIT      1.000     0.833     0.909         6
    ELEVATOR      0.250     0.375     0.300         8
        FINE      0.250     0.500     0.333         4
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      0.875     0.875     0.875         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.571     0.667     0.615         6
 HURDLE/TRIP      1.000     0.500     0.667         4
     JEWELRY      0.667     0.500     0.571         4
      KNIGHT      0.667     0.500     0.571         4
        LOCK      0.556     0.625     0.588         8
       LUNCH      0.800     0.500     0.615         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.429     0.500     0.462         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.636     0.875     0.737         8
        NOON      0.800     1.000     0.889         8
       PARTY      0.600     0.750     0.667         8
     PATIENT      0.667     0.333     0.444         6
       RAZOR      0.333     0.250     0.286         4
       RIVER      0.800     0.667     0.727         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.600     0.600     0.600        10
        SINK      0.500     0.167     0.250         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.667     1.000     0.800         4
       TWINS      0.625     0.625     0.625         8
     WHATFOR      0.778     0.700     0.737        10

    accuracy                          0.691       324
   macro avg      0.725     0.685     0.680       324
weighted avg      0.730     0.691     0.686       324
```

[129]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '3 1D CNN Trial 718/history.csv'
with open(hist_csv_file, mode='w') as f:
```

```
    hist_df.to_csv(f)
```

[130]:
```
hist_df = pd.read_csv('3 1D CNN Trial 718/history.csv', index_col=0)
hist_df.tail()
```

[130]:

	loss	f1_score	val_loss	val_f1_score
495	0.678017	0.776367	1.134617	0.681710
496	0.720257	0.756820	1.243725	0.679700
497	0.699408	0.767313	1.277877	0.670225
498	0.713163	0.770704	1.205303	0.670083
499	0.696090	0.771102	1.185654	0.680261

[131]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[132]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[133]:
```
reconstructed_model = tf.keras.models.load_model("3 1D CNN Trial 718")
```

[134]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_3 (Conv1D)           (None, 126, 175)          349300

 max_pooling1d_3 (MaxPooling  (None, 63, 175)          0
 1D)

 conv1d_4 (Conv1D)           (None, 61, 50)            26300

 max_pooling1d_4 (MaxPooling  (None, 30, 50)           0
 1D)
```

```
 conv1d_5 (Conv1D)           (None, 29, 75)            7575

 max_pooling1d_5 (MaxPooling  (None, 14, 75)           0
 1D)

 dropout_2 (Dropout)         (None, 14, 75)            0

 flatten_1 (Flatten)         (None, 1050)              0

 dense_2 (Dense)             (None, 120)               126120

 dropout_3 (Dropout)         (None, 120)               0

 dense_3 (Dense)             (None, 50)                6050

=================================================================
Total params: 515,345
Trainable params: 515,345
Non-trainable params: 0
_________________________________________________________________
```

[135]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[135]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 126, 175)
MaxPooling1D
input: (None, 126, 175)
output: (None, 63, 175)
Conv1D
input: (None, 63, 175)
output: (None, 61, 50)
MaxPooling1D
input: (None, 61, 50)
output: (None, 30, 50)
Conv1D
input: (None, 30, 50)
output: (None, 29, 75)
MaxPooling1D
input: (None, 29, 75)
output: (None, 14, 75)
Dropout
input: (None, 14, 75)
output: (None, 14, 75)
Flatten
input: (None, 14, 75)
output: (None, 1050)
Dense
input: (None, 1050)
output: (None, 120)
Dropout
input: (None, 120)
output: (None, 120)
Dense
input: (None, 120)
output: (None, 50)

[136]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[136]:

Conv1D
MaxPooling1D
Dropout
Flatten
Dense

[137]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 14ms/step - loss: 1.1519 - f1_score:
0.7068
```

[137]:
```
[1.1518529653549194, 0.7067626118659973]
```

[138]:
```
reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)
```

```
28/28 [==============================] - 1s 27ms/step - loss: 0.1865 - f1_score:
0.9680
```

[138]:
```
[0.18647992610931396, 0.967958390712738]
```

[139]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 12ms/step
              precision    recall  f1-score   support

         AXE      0.889     1.000     0.941         8
    BACKPACK      0.667     1.000     0.800         6
  BASKETBALL      0.667     1.000     0.800        10
         BEE      0.429     0.600     0.500        10
        BELT      1.000     1.000     1.000         4
        BITE      0.667     0.750     0.706         8
   BREAKFAST      0.600     0.500     0.545         6
      CANCER      1.000     1.000     1.000         8
   CHRISTMAS      0.500     0.333     0.400         6
    CONFUSED      0.667     0.667     0.667         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.300     0.500     0.375         6
      DECIDE      1.000     0.333     0.500         6
      DEMAND      0.600     0.375     0.462         8
     DEVELOP      0.333     0.500     0.400         6
      DINNER      1.000     0.750     0.857         8
         DOG      0.857     1.000     0.923         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.667     0.500     0.571         4
         EAT      0.750     1.000     0.857         6
        EDIT      1.000     1.000     1.000         6
    ELEVATOR      0.500     0.750     0.600         8
        FINE      0.500     0.500     0.500         4
```

```
       FLOAT      0.500     0.500     0.500         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      1.000     0.750     0.857         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.667     0.800         6
 HURDLE/TRIP      0.500     0.250     0.333         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.750     0.375     0.500         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.500     0.667     0.571         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.750     0.857         8
       MOVIE      0.750     0.750     0.750         8
        NOON      0.800     1.000     0.889         8
       PARTY      0.600     0.750     0.667         8
     PATIENT      0.800     0.667     0.727         6
       RAZOR      0.667     0.500     0.571         4
       RIVER      1.000     0.667     0.800         6
ROCKINGCHAIR      0.667     1.000     0.800         8
       SHAVE      0.750     0.600     0.667        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.333     0.500     0.400         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.833     0.625     0.714         8
     WHATFOR      0.700     0.700     0.700        10

    accuracy                          0.716       324
   macro avg      0.749     0.706     0.707       324
weighted avg      0.752     0.716     0.714       324
```

3.7 Hyperparameter Tuning 1 1D CNN Layer + 1 GRU

[119]:
```
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_2511190/3109640001.py:2: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
```

```python
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='elu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[5, 10, 15, 20],
                       default=20,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
                values=[5, 10, 15, 20],
                default=20,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(
            GRU(units=hp.Int('units_1',
                             min_value=50,
```

```
                            max_value=200,
                            step=25,
                            default=100),
                return_sequences=False,
                kernel_regularizer=regularizers.l2(
                    hp.Float('regularizer',
                            min_value=1e-4,
                            max_value=1e-2,
                            sampling='LOG',
                            default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))
        model.add(
            Dense(units=hp.Int('units_2',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=80),
                  activation=act_function))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.00062198175395800846)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

[121]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
```

```
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='1_1D_CNN+1_GRU',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN+1_GRU/tuner0.json
```

[122]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 10
dense_activation (Choice)
{'default': 'elu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 20, 'conditions': [], 'values': [5, 10, 15, 20], 'ordered': True}
pool_1 (Choice)
{'default': 20, 'conditions': [], 'values': [5, 10, 15, 20], 'ordered': True}
dropout_1 (Float)
{'default': 0.8, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0006219817539580085, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[123]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[125]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 19m 34s]
val_f1_score: 0.5111344456672668

Best val_f1_score So Far: 0.7555990815162659
Total elapsed time: 04h 49m 53s
INFO:tensorflow:Oracle triggered exit
```

[126]:
```
best_model = tuner.get_best_models(num_models=10)[0]
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
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object: (root).optimizer._u_product
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object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
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```
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```

```
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
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```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```

```
object: (root).optimizer._variables.8
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object: (root).optimizer._variables.9
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```

```
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```

```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

[127]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 121, 200)          798200

 max_pooling1d (MaxPooling1D  (None, 24, 200)          0
 )

 dropout (Dropout)           (None, 24, 200)           0

 gru (GRU)                   (None, 125)               122625

 dropout_1 (Dropout)         (None, 125)               0

 dense (Dense)               (None, 110)               13860

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 940,235
Trainable params: 940,235
Non-trainable params: 0
_________________________________________________________________
```

[128]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[128]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 121, 200)
MaxPooling1D
input:
(None, 121, 200)
output:
(None, 24, 200)
Dropout
input:
(None, 24, 200)
output:
(None, 24, 200)
GRU
input:
(None, 24, 200)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[129]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN+1_GRU
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0714 summary
Hyperparameters:
dense_activation: elu
filters_1: 200
kernel_1: 10
pool_1: 5
dropout_1: 0.65
units_1: 125
regularizer: 0.0034365682734906543
dropout_2: 0.1
units_2: 110
learning_rate: 0.00015386971155916857
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0711
Score: 0.7555990815162659

Trial 0598 summary
Hyperparameters:
dense_activation: elu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.4
units_1: 175
regularizer: 0.002613956776855358
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0008380093243360302
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0593
Score: 0.7111110687255859
```

```
Trial 0593 summary
Hyperparameters:
dense_activation: elu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.4
units_1: 175
regularizer: 0.002613956776855358
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0008380093243360302
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0586
Score: 0.6994518935680389

Trial 0722 summary
Hyperparameters:
dense_activation: selu
filters_1: 150
kernel_1: 15
pool_1: 10
dropout_1: 0.55
units_1: 150
regularizer: 0.00043122634871936203
dropout_2: 0.7000000000000001
units_2: 110
learning_rate: 0.00021882052801027956
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.6933612823486328

Trial 0599 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 5
pool_1: 15
dropout_1: 0.6000000000000001
units_1: 175
regularizer: 0.000328831566908209
dropout_2: 0.2
units_2: 110
```

```
learning_rate: 0.00043395415818833083
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0595
Score: 0.6831835508346558

Trial 0427 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 15
pool_1: 20
dropout_1: 0.15000000000000002
units_1: 200
regularizer: 0.0008286694843864185
dropout_2: 0.35000000000000003
units_2: 80
learning_rate: 0.00013125030310243128
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0425
Score: 0.6808184087276459

Trial 0671 summary
Hyperparameters:
dense_activation: selu
filters_1: 150
kernel_1: 5
pool_1: 20
dropout_1: 0.5
units_1: 175
regularizer: 0.002400263349609699
dropout_2: 0.65
units_2: 100
learning_rate: 0.00046877017234707473
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0667
Score: 0.6805973649024963

Trial 0595 summary
Hyperparameters:
```

```
dense_activation: mish
filters_1: 175
kernel_1: 5
pool_1: 15
dropout_1: 0.6000000000000001
units_1: 175
regularizer: 0.000328831566908209
dropout_2: 0.2
units_2: 110
learning_rate: 0.00043395415818833083
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0580
Score: 0.6790770292282104

Trial 0664 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 5
pool_1: 15
dropout_1: 0.4
units_1: 200
regularizer: 0.005387318024861541
dropout_2: 0.30000000000000004
units_2: 70
learning_rate: 0.0004933580644287955
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0648
Score: 0.6691314280033112

Trial 0717 summary
Hyperparameters:
dense_activation: selu
filters_1: 100
kernel_1: 20
pool_1: 15
dropout_1: 0.55
units_1: 150
regularizer: 0.0024305409582891496
dropout_2: 0.5
units_2: 100
learning_rate: 0.00010335966296352788
```

```
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0705
Score: 0.6648110449314117
```

[130]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 15ms/step - loss: 1.1833 - f1_score:
0.7556
```

[131]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 14ms/step - loss: 0.1752 - f1_score:
0.9928
```

[133]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 11ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.625     0.500     0.556        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.500     0.667         8
   BREAKFAST      0.545     1.000     0.706         6
      CANCER      0.571     1.000     0.727         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      1.000     1.000     1.000         6
        DARK      0.667     1.000     0.800         4
        DEAF      0.333     0.333     0.333         6
      DECIDE      0.833     0.833     0.833         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      1.000     1.000     1.000         8
         DOG      0.714     0.833     0.769         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.500     0.500     0.500         4
         EAT      1.000     1.000     1.000         6
        EDIT      1.000     0.833     0.909         6
    ELEVATOR      0.300     0.375     0.333         8
        FINE      1.000     0.750     0.857         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      0.500     0.750     0.600         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.500     0.667         6
 HURDLE/TRIP      1.000     0.500     0.667         4
     JEWELRY      1.000     0.750     0.857         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.556     0.625     0.588         8
       LUNCH      0.800     0.500     0.615         8
       MAPLE      1.000     0.750     0.857         4
        MEAT      0.600     1.000     0.750         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.727     1.000     0.842         8
        NOON      0.800     1.000     0.889         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.500     0.667     0.571         6
       RAZOR      1.000     0.750     0.857         4
       RIVER      0.500     0.667     0.571         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      1.000     0.700     0.824        10
        SINK      0.667     0.333     0.444         6
     SQUEEZE      0.667     0.500     0.571         4
        THEY      0.667     1.000     0.800         4
       TWINS      0.727     1.000     0.842         8
     WHATFOR      1.000     0.400     0.571        10

    accuracy                          0.759       324
   macro avg      0.805     0.756     0.756       324
weighted avg      0.802     0.759     0.755       324
```

[134]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[135]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1DCNN + 1 GRU/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[139]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
```

```
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - 8s 116ms/step - loss: 4.8754 -
f1_score: 0.0170 - val_loss: 4.7783 - val_f1_score: 0.0040
Epoch 2/500
28/28 [==============================] - 2s 89ms/step - loss: 4.8321 - f1_score:
0.0160 - val_loss: 4.7571 - val_f1_score: 4.8780e-04
Epoch 3/500
28/28 [==============================] - 2s 89ms/step - loss: 4.7829 - f1_score:
0.0199 - val_loss: 4.7014 - val_f1_score: 0.0017
Epoch 4/500
28/28 [==============================] - 2s 89ms/step - loss: 4.7313 - f1_score:
0.0134 - val_loss: 4.6746 - val_f1_score: 0.0010
Epoch 5/500
28/28 [==============================] - 3s 91ms/step - loss: 4.6865 - f1_score:
0.0133 - val_loss: 4.6513 - val_f1_score: 9.8160e-04
Epoch 6/500
28/28 [==============================] - 3s 92ms/step - loss: 4.6553 - f1_score:
0.0161 - val_loss: 4.5905 - val_f1_score: 0.0012
Epoch 7/500
28/28 [==============================] - 3s 92ms/step - loss: 4.6279 - f1_score:
0.0145 - val_loss: 4.5603 - val_f1_score: 0.0082
Epoch 8/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5874 - f1_score:
0.0177 - val_loss: 4.5487 - val_f1_score: 0.0022
Epoch 9/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5648 - f1_score:
0.0172 - val_loss: 4.5149 - val_f1_score: 0.0010
Epoch 10/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5271 - f1_score:
0.0198 - val_loss: 4.4820 - val_f1_score: 0.0123
Epoch 11/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4971 - f1_score:
0.0178 - val_loss: 4.4558 - val_f1_score: 0.0083
Epoch 12/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4614 - f1_score:
0.0270 - val_loss: 4.4531 - val_f1_score: 0.0063
Epoch 13/500
28/28 [==============================] - 3s 94ms/step - loss: 4.4383 - f1_score:
0.0252 - val_loss: 4.3983 - val_f1_score: 0.0141
Epoch 14/500
28/28 [==============================] - 3s 94ms/step - loss: 4.4048 - f1_score:
0.0241 - val_loss: 4.3693 - val_f1_score: 0.0149
Epoch 15/500
```

```
28/28 [==============================] - 3s 94ms/step - loss: 4.3665 - f1_score:
0.0284 - val_loss: 4.3272 - val_f1_score: 0.0102
Epoch 16/500
28/28 [==============================] - 3s 94ms/step - loss: 4.3058 - f1_score:
0.0347 - val_loss: 4.2318 - val_f1_score: 0.0101
Epoch 17/500
28/28 [==============================] - 3s 94ms/step - loss: 4.2318 - f1_score:
0.0349 - val_loss: 4.1535 - val_f1_score: 0.0249
Epoch 18/500
28/28 [==============================] - 3s 94ms/step - loss: 4.1401 - f1_score:
0.0411 - val_loss: 4.0525 - val_f1_score: 0.0160
Epoch 19/500
28/28 [==============================] - 3s 94ms/step - loss: 4.0487 - f1_score:
0.0412 - val_loss: 3.9484 - val_f1_score: 0.0419
Epoch 20/500
28/28 [==============================] - 3s 94ms/step - loss: 3.9608 - f1_score:
0.0443 - val_loss: 3.8510 - val_f1_score: 0.0410
Epoch 21/500
28/28 [==============================] - 3s 94ms/step - loss: 3.8698 - f1_score:
0.0546 - val_loss: 3.7463 - val_f1_score: 0.0414
Epoch 22/500
28/28 [==============================] - 3s 94ms/step - loss: 3.7629 - f1_score:
0.0719 - val_loss: 3.6519 - val_f1_score: 0.0475
Epoch 23/500
28/28 [==============================] - 3s 95ms/step - loss: 3.6892 - f1_score:
0.0835 - val_loss: 3.5411 - val_f1_score: 0.0882
Epoch 24/500
28/28 [==============================] - 3s 96ms/step - loss: 3.5873 - f1_score:
0.0942 - val_loss: 3.4716 - val_f1_score: 0.0687
Epoch 25/500
28/28 [==============================] - 3s 94ms/step - loss: 3.5154 - f1_score:
0.1073 - val_loss: 3.3956 - val_f1_score: 0.0780
Epoch 26/500
28/28 [==============================] - 3s 94ms/step - loss: 3.4368 - f1_score:
0.1234 - val_loss: 3.3198 - val_f1_score: 0.1084
Epoch 27/500
28/28 [==============================] - 3s 95ms/step - loss: 3.3627 - f1_score:
0.1306 - val_loss: 3.2811 - val_f1_score: 0.1098
Epoch 28/500
28/28 [==============================] - 3s 95ms/step - loss: 3.2835 - f1_score:
0.1580 - val_loss: 3.1900 - val_f1_score: 0.1317
Epoch 29/500
28/28 [==============================] - 3s 95ms/step - loss: 3.2096 - f1_score:
0.1635 - val_loss: 3.0931 - val_f1_score: 0.1552
Epoch 30/500
28/28 [==============================] - 3s 95ms/step - loss: 3.1427 - f1_score:
0.1777 - val_loss: 3.0164 - val_f1_score: 0.1509
Epoch 31/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 3.0654 - f1_score:
0.1906 - val_loss: 3.0509 - val_f1_score: 0.1503
Epoch 32/500
28/28 [==============================] - 3s 95ms/step - loss: 3.0207 - f1_score:
0.1958 - val_loss: 2.9052 - val_f1_score: 0.1800
Epoch 33/500
28/28 [==============================] - 3s 96ms/step - loss: 2.9391 - f1_score:
0.2271 - val_loss: 2.8805 - val_f1_score: 0.2352
Epoch 34/500
28/28 [==============================] - 3s 95ms/step - loss: 2.9025 - f1_score:
0.2287 - val_loss: 2.8096 - val_f1_score: 0.2122
Epoch 35/500
28/28 [==============================] - 3s 95ms/step - loss: 2.8417 - f1_score:
0.2381 - val_loss: 2.8436 - val_f1_score: 0.2029
Epoch 36/500
28/28 [==============================] - 3s 95ms/step - loss: 2.7971 - f1_score:
0.2563 - val_loss: 2.7282 - val_f1_score: 0.2361
Epoch 37/500
28/28 [==============================] - 3s 94ms/step - loss: 2.7559 - f1_score:
0.2672 - val_loss: 2.7826 - val_f1_score: 0.2412
Epoch 38/500
28/28 [==============================] - 3s 95ms/step - loss: 2.7210 - f1_score:
0.2686 - val_loss: 2.6538 - val_f1_score: 0.2833
Epoch 39/500
28/28 [==============================] - 3s 94ms/step - loss: 2.6595 - f1_score:
0.2840 - val_loss: 2.6823 - val_f1_score: 0.2643
Epoch 40/500
28/28 [==============================] - 3s 96ms/step - loss: 2.6247 - f1_score:
0.2919 - val_loss: 2.5926 - val_f1_score: 0.2850
Epoch 41/500
28/28 [==============================] - 3s 97ms/step - loss: 2.5894 - f1_score:
0.3051 - val_loss: 2.5214 - val_f1_score: 0.3311
Epoch 42/500
28/28 [==============================] - 3s 95ms/step - loss: 2.5311 - f1_score:
0.3229 - val_loss: 2.5051 - val_f1_score: 0.3247
Epoch 43/500
28/28 [==============================] - 3s 95ms/step - loss: 2.4957 - f1_score:
0.3357 - val_loss: 2.4908 - val_f1_score: 0.3343
Epoch 44/500
28/28 [==============================] - 3s 95ms/step - loss: 2.4643 - f1_score:
0.3385 - val_loss: 2.4375 - val_f1_score: 0.3470
Epoch 45/500
28/28 [==============================] - 3s 94ms/step - loss: 2.4234 - f1_score:
0.3372 - val_loss: 2.3914 - val_f1_score: 0.3765
Epoch 46/500
28/28 [==============================] - 3s 95ms/step - loss: 2.3741 - f1_score:
0.3656 - val_loss: 2.3879 - val_f1_score: 0.3601
Epoch 47/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 2.3420 - f1_score:
0.3733 - val_loss: 2.3319 - val_f1_score: 0.3711
Epoch 48/500
28/28 [==============================] - 3s 95ms/step - loss: 2.3077 - f1_score:
0.3773 - val_loss: 2.3147 - val_f1_score: 0.3867
Epoch 49/500
28/28 [==============================] - 3s 98ms/step - loss: 2.2641 - f1_score:
0.3840 - val_loss: 2.2923 - val_f1_score: 0.3559
Epoch 50/500
28/28 [==============================] - 3s 96ms/step - loss: 2.2287 - f1_score:
0.3952 - val_loss: 2.2161 - val_f1_score: 0.4126
Epoch 51/500
28/28 [==============================] - 3s 95ms/step - loss: 2.1940 - f1_score:
0.4003 - val_loss: 2.2372 - val_f1_score: 0.4133
Epoch 52/500
28/28 [==============================] - 3s 96ms/step - loss: 2.1626 - f1_score:
0.4137 - val_loss: 2.2233 - val_f1_score: 0.4154
Epoch 53/500
28/28 [==============================] - 3s 95ms/step - loss: 2.1047 - f1_score:
0.4331 - val_loss: 2.1567 - val_f1_score: 0.4259
Epoch 54/500
28/28 [==============================] - 3s 95ms/step - loss: 2.0884 - f1_score:
0.4395 - val_loss: 2.1432 - val_f1_score: 0.4269
Epoch 55/500
28/28 [==============================] - 3s 97ms/step - loss: 2.0623 - f1_score:
0.4408 - val_loss: 2.1276 - val_f1_score: 0.4480
Epoch 56/500
28/28 [==============================] - 3s 95ms/step - loss: 2.0284 - f1_score:
0.4509 - val_loss: 2.1424 - val_f1_score: 0.4134
Epoch 57/500
28/28 [==============================] - 3s 95ms/step - loss: 1.9909 - f1_score:
0.4594 - val_loss: 2.0706 - val_f1_score: 0.4614
Epoch 58/500
28/28 [==============================] - 3s 96ms/step - loss: 1.9531 - f1_score:
0.4799 - val_loss: 2.0727 - val_f1_score: 0.4633
Epoch 59/500
28/28 [==============================] - 3s 95ms/step - loss: 1.9263 - f1_score:
0.4853 - val_loss: 2.0275 - val_f1_score: 0.4611
Epoch 60/500
28/28 [==============================] - 3s 95ms/step - loss: 1.8807 - f1_score:
0.4852 - val_loss: 2.0393 - val_f1_score: 0.4603
Epoch 61/500
28/28 [==============================] - 3s 95ms/step - loss: 1.8595 - f1_score:
0.4984 - val_loss: 1.9622 - val_f1_score: 0.4850
Epoch 62/500
28/28 [==============================] - 3s 95ms/step - loss: 1.8206 - f1_score:
0.5208 - val_loss: 1.9954 - val_f1_score: 0.4669
Epoch 63/500
```

```
28/28 [==============================] - 3s 94ms/step - loss: 1.8147 - f1_score:
0.5108 - val_loss: 1.9593 - val_f1_score: 0.4445
Epoch 64/500
28/28 [==============================] - 3s 95ms/step - loss: 1.7875 - f1_score:
0.5181 - val_loss: 2.0338 - val_f1_score: 0.4215
Epoch 65/500
28/28 [==============================] - 3s 96ms/step - loss: 1.7465 - f1_score:
0.5301 - val_loss: 1.9391 - val_f1_score: 0.4730
Epoch 66/500
28/28 [==============================] - 3s 95ms/step - loss: 1.7035 - f1_score:
0.5497 - val_loss: 1.8956 - val_f1_score: 0.4746
Epoch 67/500
28/28 [==============================] - 3s 95ms/step - loss: 1.6899 - f1_score:
0.5427 - val_loss: 1.8736 - val_f1_score: 0.5036
Epoch 68/500
28/28 [==============================] - 3s 98ms/step - loss: 1.6670 - f1_score:
0.5513 - val_loss: 1.8829 - val_f1_score: 0.4737
Epoch 69/500
28/28 [==============================] - 3s 95ms/step - loss: 1.6361 - f1_score:
0.5678 - val_loss: 1.8304 - val_f1_score: 0.5232
Epoch 70/500
28/28 [==============================] - 3s 95ms/step - loss: 1.6156 - f1_score:
0.5651 - val_loss: 1.8513 - val_f1_score: 0.5110
Epoch 71/500
28/28 [==============================] - 3s 100ms/step - loss: 1.5911 -
f1_score: 0.5935 - val_loss: 1.7742 - val_f1_score: 0.5235
Epoch 72/500
28/28 [==============================] - 3s 95ms/step - loss: 1.5746 - f1_score:
0.5747 - val_loss: 1.8494 - val_f1_score: 0.4912
Epoch 73/500
28/28 [==============================] - 3s 95ms/step - loss: 1.5326 - f1_score:
0.5898 - val_loss: 1.7840 - val_f1_score: 0.5290
Epoch 74/500
28/28 [==============================] - 3s 96ms/step - loss: 1.5220 - f1_score:
0.5979 - val_loss: 1.7846 - val_f1_score: 0.5281
Epoch 75/500
28/28 [==============================] - 3s 95ms/step - loss: 1.4892 - f1_score:
0.6044 - val_loss: 1.7476 - val_f1_score: 0.5009
Epoch 76/500
28/28 [==============================] - 3s 96ms/step - loss: 1.4655 - f1_score:
0.6106 - val_loss: 1.7114 - val_f1_score: 0.5301
Epoch 77/500
28/28 [==============================] - 3s 95ms/step - loss: 1.4373 - f1_score:
0.6245 - val_loss: 1.6835 - val_f1_score: 0.5391
Epoch 78/500
28/28 [==============================] - 3s 95ms/step - loss: 1.4247 - f1_score:
0.6246 - val_loss: 1.6314 - val_f1_score: 0.5412
Epoch 79/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 1.3864 - f1_score:
0.6377 - val_loss: 1.6355 - val_f1_score: 0.5414
Epoch 80/500
28/28 [==============================] - 3s 96ms/step - loss: 1.3755 - f1_score:
0.6424 - val_loss: 1.6148 - val_f1_score: 0.5604
Epoch 81/500
28/28 [==============================] - 3s 94ms/step - loss: 1.3439 - f1_score:
0.6496 - val_loss: 1.6599 - val_f1_score: 0.5511
Epoch 82/500
28/28 [==============================] - 3s 95ms/step - loss: 1.3168 - f1_score:
0.6658 - val_loss: 1.6204 - val_f1_score: 0.5550
Epoch 83/500
28/28 [==============================] - 3s 95ms/step - loss: 1.3264 - f1_score:
0.6423 - val_loss: 1.5657 - val_f1_score: 0.5763
Epoch 84/500
28/28 [==============================] - 3s 95ms/step - loss: 1.2879 - f1_score:
0.6656 - val_loss: 1.5935 - val_f1_score: 0.5470
Epoch 85/500
28/28 [==============================] - 3s 95ms/step - loss: 1.2586 - f1_score:
0.6788 - val_loss: 1.5924 - val_f1_score: 0.5885
Epoch 86/500
28/28 [==============================] - 3s 95ms/step - loss: 1.2565 - f1_score:
0.6811 - val_loss: 1.6332 - val_f1_score: 0.5693
Epoch 87/500
28/28 [==============================] - 3s 95ms/step - loss: 1.2503 - f1_score:
0.6729 - val_loss: 1.5135 - val_f1_score: 0.5599
Epoch 88/500
28/28 [==============================] - 3s 95ms/step - loss: 1.2123 - f1_score:
0.6961 - val_loss: 1.5891 - val_f1_score: 0.5837
Epoch 89/500
28/28 [==============================] - 3s 97ms/step - loss: 1.1904 - f1_score:
0.6939 - val_loss: 1.4841 - val_f1_score: 0.6316
Epoch 90/500
28/28 [==============================] - 3s 95ms/step - loss: 1.1705 - f1_score:
0.6995 - val_loss: 1.5246 - val_f1_score: 0.5849
Epoch 91/500
28/28 [==============================] - 3s 95ms/step - loss: 1.1537 - f1_score:
0.6956 - val_loss: 1.5009 - val_f1_score: 0.6170
Epoch 92/500
28/28 [==============================] - 3s 94ms/step - loss: 1.1667 - f1_score:
0.7005 - val_loss: 1.4985 - val_f1_score: 0.5898
Epoch 93/500
28/28 [==============================] - 3s 96ms/step - loss: 1.1345 - f1_score:
0.7116 - val_loss: 1.4431 - val_f1_score: 0.6065
Epoch 94/500
28/28 [==============================] - 3s 96ms/step - loss: 1.1118 - f1_score:
0.7138 - val_loss: 1.4281 - val_f1_score: 0.6188
Epoch 95/500
```

```
28/28 [==============================] - 3s 96ms/step - loss: 1.0984 - f1_score:
0.7236 - val_loss: 1.5334 - val_f1_score: 0.5732
Epoch 96/500
28/28 [==============================] - 3s 94ms/step - loss: 1.0948 - f1_score:
0.7125 - val_loss: 1.4263 - val_f1_score: 0.6622
Epoch 97/500
28/28 [==============================] - 3s 97ms/step - loss: 1.0809 - f1_score:
0.7268 - val_loss: 1.3978 - val_f1_score: 0.6411
Epoch 98/500
28/28 [==============================] - 3s 97ms/step - loss: 1.0756 - f1_score:
0.7180 - val_loss: 1.4731 - val_f1_score: 0.6186
Epoch 99/500
28/28 [==============================] - 3s 95ms/step - loss: 1.0373 - f1_score:
0.7330 - val_loss: 1.4193 - val_f1_score: 0.6655
Epoch 100/500
28/28 [==============================] - 3s 95ms/step - loss: 1.0278 - f1_score:
0.7372 - val_loss: 1.4266 - val_f1_score: 0.6105
Epoch 101/500
28/28 [==============================] - 3s 98ms/step - loss: 1.0229 - f1_score:
0.7369 - val_loss: 1.3648 - val_f1_score: 0.6501
Epoch 102/500
28/28 [==============================] - 3s 102ms/step - loss: 1.0106 -
f1_score: 0.7389 - val_loss: 1.4220 - val_f1_score: 0.6342
Epoch 103/500
28/28 [==============================] - 3s 99ms/step - loss: 0.9963 - f1_score:
0.7408 - val_loss: 1.3381 - val_f1_score: 0.6902
Epoch 104/500
28/28 [==============================] - 3s 98ms/step - loss: 0.9964 - f1_score:
0.7499 - val_loss: 1.3863 - val_f1_score: 0.6272
Epoch 105/500
28/28 [==============================] - 3s 96ms/step - loss: 0.9599 - f1_score:
0.7538 - val_loss: 1.3401 - val_f1_score: 0.6702
Epoch 106/500
28/28 [==============================] - 3s 95ms/step - loss: 0.9460 - f1_score:
0.7567 - val_loss: 1.3539 - val_f1_score: 0.6685
Epoch 107/500
28/28 [==============================] - 3s 95ms/step - loss: 0.9497 - f1_score:
0.7618 - val_loss: 1.3295 - val_f1_score: 0.6631
Epoch 108/500
28/28 [==============================] - 3s 96ms/step - loss: 0.9370 - f1_score:
0.7641 - val_loss: 1.3498 - val_f1_score: 0.6576
Epoch 109/500
28/28 [==============================] - 3s 95ms/step - loss: 0.9179 - f1_score:
0.7655 - val_loss: 1.3150 - val_f1_score: 0.6766
Epoch 110/500
28/28 [==============================] - 3s 95ms/step - loss: 0.9235 - f1_score:
0.7669 - val_loss: 1.3413 - val_f1_score: 0.6541
Epoch 111/500
```

```
28/28 [==============================] - 3s 96ms/step - loss: 0.8978 - f1_score:
0.7687 - val_loss: 1.2806 - val_f1_score: 0.6723
Epoch 112/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8931 - f1_score:
0.7657 - val_loss: 1.3580 - val_f1_score: 0.6687
Epoch 113/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8935 - f1_score:
0.7685 - val_loss: 1.3482 - val_f1_score: 0.6377
Epoch 114/500
28/28 [==============================] - 3s 96ms/step - loss: 0.8668 - f1_score:
0.7762 - val_loss: 1.3175 - val_f1_score: 0.6702
Epoch 115/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8547 - f1_score:
0.7931 - val_loss: 1.3761 - val_f1_score: 0.6478
Epoch 116/500
28/28 [==============================] - 3s 96ms/step - loss: 0.8432 - f1_score:
0.7826 - val_loss: 1.2900 - val_f1_score: 0.6622
Epoch 117/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8451 - f1_score:
0.7910 - val_loss: 1.2816 - val_f1_score: 0.6986
Epoch 118/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8004 - f1_score:
0.8026 - val_loss: 1.3125 - val_f1_score: 0.6752
Epoch 119/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8207 - f1_score:
0.7931 - val_loss: 1.2863 - val_f1_score: 0.6779
Epoch 120/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7991 - f1_score:
0.7960 - val_loss: 1.3129 - val_f1_score: 0.6689
Epoch 121/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7835 - f1_score:
0.8032 - val_loss: 1.3099 - val_f1_score: 0.6548
Epoch 122/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7799 - f1_score:
0.8044 - val_loss: 1.2240 - val_f1_score: 0.6970
Epoch 123/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7780 - f1_score:
0.8014 - val_loss: 1.3102 - val_f1_score: 0.6673
Epoch 124/500
28/28 [==============================] - 3s 97ms/step - loss: 0.7677 - f1_score:
0.8109 - val_loss: 1.2982 - val_f1_score: 0.6993
Epoch 125/500
28/28 [==============================] - 3s 96ms/step - loss: 0.7365 - f1_score:
0.8247 - val_loss: 1.2734 - val_f1_score: 0.6888
Epoch 126/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7438 - f1_score:
0.8250 - val_loss: 1.2473 - val_f1_score: 0.6918
Epoch 127/500
```

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28/28 [==============================] - 3s 96ms/step - loss: 0.7325 - f1_score:
0.8150 - val_loss: 1.2335 - val_f1_score: 0.7167
Epoch 128/500
28/28 [==============================] - 3s 96ms/step - loss: 0.7307 - f1_score:
0.8158 - val_loss: 1.2809 - val_f1_score: 0.7147
Epoch 129/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7343 - f1_score:
0.8224 - val_loss: 1.2093 - val_f1_score: 0.7187
Epoch 130/500
28/28 [==============================] - 3s 100ms/step - loss: 0.7047 -
f1_score: 0.8247 - val_loss: 1.2593 - val_f1_score: 0.7044
Epoch 131/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6827 - f1_score:
0.8362 - val_loss: 1.2696 - val_f1_score: 0.6846
Epoch 132/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7008 - f1_score:
0.8253 - val_loss: 1.2879 - val_f1_score: 0.6753
Epoch 133/500
28/28 [==============================] - 3s 96ms/step - loss: 0.6833 - f1_score:
0.8277 - val_loss: 1.2538 - val_f1_score: 0.7207
Epoch 134/500
28/28 [==============================] - 3s 94ms/step - loss: 0.6829 - f1_score:
0.8313 - val_loss: 1.2681 - val_f1_score: 0.6880
Epoch 135/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6625 - f1_score:
0.8452 - val_loss: 1.3173 - val_f1_score: 0.6837
Epoch 136/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6571 - f1_score:
0.8397 - val_loss: 1.2659 - val_f1_score: 0.7021
Epoch 137/500
28/28 [==============================] - 3s 96ms/step - loss: 0.6569 - f1_score:
0.8381 - val_loss: 1.2693 - val_f1_score: 0.6889
Epoch 138/500
28/28 [==============================] - 3s 96ms/step - loss: 0.6379 - f1_score:
0.8429 - val_loss: 1.2402 - val_f1_score: 0.6934
Epoch 139/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6545 - f1_score:
0.8335 - val_loss: 1.2756 - val_f1_score: 0.6898
Epoch 140/500
28/28 [==============================] - ETA: 0s - loss: 0.6458 - f1_score:
0.8391

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
```

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INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 11s 410ms/step - loss: 0.6458 -
f1_score: 0.8391 - val_loss: 1.2540 - val_f1_score: 0.7325
Epoch 141/500
28/28 [==============================] - 3s 92ms/step - loss: 0.6265 - f1_score:
0.8530 - val_loss: 1.2280 - val_f1_score: 0.7211
Epoch 142/500
28/28 [==============================] - 3s 92ms/step - loss: 0.6123 - f1_score:
0.8548 - val_loss: 1.2046 - val_f1_score: 0.7156
Epoch 143/500
28/28 [==============================] - 3s 93ms/step - loss: 0.6045 - f1_score:
0.8506 - val_loss: 1.2689 - val_f1_score: 0.7089
Epoch 144/500
28/28 [==============================] - ETA: 0s - loss: 0.6073 - f1_score:
0.8446

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 20s 721ms/step - loss: 0.6073 -
f1_score: 0.8446 - val_loss: 1.2252 - val_f1_score: 0.7341
Epoch 145/500
28/28 [==============================] - 2s 89ms/step - loss: 0.5927 - f1_score:
0.8584 - val_loss: 1.2341 - val_f1_score: 0.7126
Epoch 146/500
28/28 [==============================] - 3s 91ms/step - loss: 0.5843 - f1_score:
0.8604 - val_loss: 1.2315 - val_f1_score: 0.7309
Epoch 147/500
28/28 [==============================] - 3s 91ms/step - loss: 0.5981 - f1_score:
0.8511 - val_loss: 1.2813 - val_f1_score: 0.7230
Epoch 148/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5689 - f1_score:
0.8627 - val_loss: 1.2607 - val_f1_score: 0.6924
Epoch 149/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5764 - f1_score:
0.8627 - val_loss: 1.2997 - val_f1_score: 0.7133
Epoch 150/500
28/28 [==============================] - ETA: 0s - loss: 0.5595 - f1_score:
0.8701

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 375ms/step - loss: 0.5595 -
f1_score: 0.8701 - val_loss: 1.1762 - val_f1_score: 0.7452
Epoch 151/500
28/28 [==============================] - 3s 90ms/step - loss: 0.5641 - f1_score:
0.8598 - val_loss: 1.2248 - val_f1_score: 0.7034
Epoch 152/500
28/28 [==============================] - 3s 91ms/step - loss: 0.5628 - f1_score:
0.8636 - val_loss: 1.2137 - val_f1_score: 0.7283
Epoch 153/500
28/28 [==============================] - 3s 93ms/step - loss: 0.5495 - f1_score:
0.8650 - val_loss: 1.1652 - val_f1_score: 0.7284
Epoch 154/500
28/28 [==============================] - 3s 94ms/step - loss: 0.5318 - f1_score:
0.8770 - val_loss: 1.2373 - val_f1_score: 0.7197
Epoch 155/500
28/28 [==============================] - ETA: 0s - loss: 0.5279 - f1_score:
0.8794

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 15s 554ms/step - loss: 0.5279 -
f1_score: 0.8794 - val_loss: 1.2332 - val_f1_score: 0.7586
Epoch 156/500
28/28 [==============================] - 2s 89ms/step - loss: 0.5263 - f1_score:
0.8710 - val_loss: 1.2273 - val_f1_score: 0.7364
Epoch 157/500
28/28 [==============================] - 3s 91ms/step - loss: 0.5213 - f1_score:
0.8725 - val_loss: 1.2792 - val_f1_score: 0.7255
Epoch 158/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5025 - f1_score:
0.8920 - val_loss: 1.1806 - val_f1_score: 0.7355
Epoch 159/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5187 - f1_score:
0.8761 - val_loss: 1.2087 - val_f1_score: 0.7443
Epoch 160/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5010 - f1_score:
0.8840 - val_loss: 1.2334 - val_f1_score: 0.7374
Epoch 161/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5120 - f1_score:
0.8711 - val_loss: 1.1864 - val_f1_score: 0.7518
```

```
Epoch 162/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5121 - f1_score:
0.8783 - val_loss: 1.2235 - val_f1_score: 0.7406
Epoch 163/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4968 - f1_score:
0.8831 - val_loss: 1.1686 - val_f1_score: 0.7225
Epoch 164/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4878 - f1_score:
0.8901 - val_loss: 1.2755 - val_f1_score: 0.7030
Epoch 165/500
28/28 [==============================] - ETA: 0s - loss: 0.4685 - f1_score:
0.8950

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 383ms/step - loss: 0.4685 -
f1_score: 0.8950 - val_loss: 1.2458 - val_f1_score: 0.7626
Epoch 166/500
28/28 [==============================] - 3s 89ms/step - loss: 0.4676 - f1_score:
0.8985 - val_loss: 1.2624 - val_f1_score: 0.7143
Epoch 167/500
28/28 [==============================] - 3s 91ms/step - loss: 0.4739 - f1_score:
0.8898 - val_loss: 1.2561 - val_f1_score: 0.7155
Epoch 168/500
28/28 [==============================] - 3s 92ms/step - loss: 0.4588 - f1_score:
0.8986 - val_loss: 1.2502 - val_f1_score: 0.7150
Epoch 169/500
28/28 [==============================] - 3s 92ms/step - loss: 0.4637 - f1_score:
0.8945 - val_loss: 1.2004 - val_f1_score: 0.7350
Epoch 170/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4600 - f1_score:
0.8878 - val_loss: 1.2627 - val_f1_score: 0.6911
Epoch 171/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4346 - f1_score:
0.9018 - val_loss: 1.2015 - val_f1_score: 0.7246
Epoch 172/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4342 - f1_score:
0.9037 - val_loss: 1.3066 - val_f1_score: 0.7081
Epoch 173/500
28/28 [==============================] - 3s 92ms/step - loss: 0.4554 - f1_score:
0.8909 - val_loss: 1.1783 - val_f1_score: 0.7209
Epoch 174/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4479 - f1_score:
```

```
0.8941 - val_loss: 1.2511 - val_f1_score: 0.7345
Epoch 175/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4524 - f1_score:
0.8938 - val_loss: 1.1963 - val_f1_score: 0.7200
Epoch 176/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4257 - f1_score:
0.9041 - val_loss: 1.2366 - val_f1_score: 0.7432
Epoch 177/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4231 - f1_score:
0.9046 - val_loss: 1.2323 - val_f1_score: 0.7168
Epoch 178/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4112 - f1_score:
0.9071 - val_loss: 1.2317 - val_f1_score: 0.7287
Epoch 179/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4098 - f1_score:
0.9112 - val_loss: 1.2886 - val_f1_score: 0.7259
Epoch 180/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3967 - f1_score:
0.9035 - val_loss: 1.1964 - val_f1_score: 0.7518
Epoch 181/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4041 - f1_score:
0.9006 - val_loss: 1.2043 - val_f1_score: 0.7261
Epoch 182/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3999 - f1_score:
0.9126 - val_loss: 1.2300 - val_f1_score: 0.7230
Epoch 183/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4194 - f1_score:
0.9017 - val_loss: 1.2363 - val_f1_score: 0.7516
Epoch 184/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4047 - f1_score:
0.9064 - val_loss: 1.2676 - val_f1_score: 0.7308
Epoch 185/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3947 - f1_score:
0.9155 - val_loss: 1.2398 - val_f1_score: 0.7181
Epoch 186/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3944 - f1_score:
0.9168 - val_loss: 1.2052 - val_f1_score: 0.7450
Epoch 187/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3878 - f1_score:
0.9165 - val_loss: 1.1611 - val_f1_score: 0.7383
Epoch 188/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3661 - f1_score:
0.9217 - val_loss: 1.2110 - val_f1_score: 0.7529
Epoch 189/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3953 - f1_score:
0.9099 - val_loss: 1.2310 - val_f1_score: 0.7204
Epoch 190/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3763 - f1_score:
```

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0.9180 - val_loss: 1.2261 - val_f1_score: 0.7187
Epoch 191/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3563 - f1_score:
0.9296 - val_loss: 1.2137 - val_f1_score: 0.7592
Epoch 192/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3729 - f1_score:
0.9200 - val_loss: 1.2006 - val_f1_score: 0.7469
Epoch 193/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3626 - f1_score:
0.9200 - val_loss: 1.2332 - val_f1_score: 0.7561
Epoch 194/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3505 - f1_score:
0.9253 - val_loss: 1.1724 - val_f1_score: 0.7391
Epoch 195/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3703 - f1_score:
0.9207 - val_loss: 1.2540 - val_f1_score: 0.7210
Epoch 196/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3406 - f1_score:
0.9309 - val_loss: 1.3025 - val_f1_score: 0.7063
Epoch 197/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3466 - f1_score:
0.9269 - val_loss: 1.1794 - val_f1_score: 0.7375
Epoch 198/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3499 - f1_score:
0.9224 - val_loss: 1.2336 - val_f1_score: 0.7261
Epoch 199/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3460 - f1_score:
0.9300 - val_loss: 1.2599 - val_f1_score: 0.7049
Epoch 200/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3415 - f1_score:
0.9312 - val_loss: 1.3304 - val_f1_score: 0.7183
Epoch 201/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3595 - f1_score:
0.9203 - val_loss: 1.2709 - val_f1_score: 0.7252
Epoch 202/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3418 - f1_score:
0.9263 - val_loss: 1.2760 - val_f1_score: 0.6859
Epoch 203/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3309 - f1_score:
0.9322 - val_loss: 1.2230 - val_f1_score: 0.7401
Epoch 204/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3229 - f1_score:
0.9373 - val_loss: 1.2616 - val_f1_score: 0.7350
Epoch 205/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3294 - f1_score:
0.9329 - val_loss: 1.3138 - val_f1_score: 0.7289
Epoch 206/500
28/28 [==============================] - 3s 94ms/step - loss: 0.3329 - f1_score:
```

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0.9318 - val_loss: 1.2164 - val_f1_score: 0.7420
Epoch 207/500
28/28 [==============================] - ETA: 0s - loss: 0.3128 - f1_score:
0.9419

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_4_layer_call_fn, gru_cell_4_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [==============================] - 11s 407ms/step - loss: 0.3128 -
f1_score: 0.9419 - val_loss: 1.1852 - val_f1_score: 0.7679
Epoch 208/500
28/28 [==============================] - 3s 90ms/step - loss: 0.3150 - f1_score:
0.9359 - val_loss: 1.3395 - val_f1_score: 0.7050
Epoch 209/500
28/28 [==============================] - 3s 91ms/step - loss: 0.3027 - f1_score:
0.9436 - val_loss: 1.3657 - val_f1_score: 0.6965
Epoch 210/500
28/28 [==============================] - 3s 92ms/step - loss: 0.3267 - f1_score:
0.9340 - val_loss: 1.2864 - val_f1_score: 0.7252
Epoch 211/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3116 - f1_score:
0.9312 - val_loss: 1.2950 - val_f1_score: 0.7130
Epoch 212/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3078 - f1_score:
0.9371 - val_loss: 1.2660 - val_f1_score: 0.7409
Epoch 213/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3053 - f1_score:
0.9391 - val_loss: 1.2976 - val_f1_score: 0.7433
Epoch 214/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3003 - f1_score:
0.9385 - val_loss: 1.2488 - val_f1_score: 0.7464
Epoch 215/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2996 - f1_score:
0.9446 - val_loss: 1.2737 - val_f1_score: 0.7192
Epoch 216/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2966 - f1_score:
0.9398 - val_loss: 1.3852 - val_f1_score: 0.6910
Epoch 217/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2958 - f1_score:
0.9466 - val_loss: 1.3044 - val_f1_score: 0.7470
Epoch 218/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2872 - f1_score:
0.9461 - val_loss: 1.3300 - val_f1_score: 0.7436
Epoch 219/500
```

```
28/28 [==============================] - 3s 94ms/step - loss: 0.2885 - f1_score:
0.9422 - val_loss: 1.2303 - val_f1_score: 0.7545
Epoch 220/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2856 - f1_score:
0.9449 - val_loss: 1.3461 - val_f1_score: 0.7390
Epoch 221/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2947 - f1_score:
0.9426 - val_loss: 1.3317 - val_f1_score: 0.7316
Epoch 222/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2851 - f1_score:
0.9516 - val_loss: 1.2791 - val_f1_score: 0.7427
Epoch 223/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2871 - f1_score:
0.9409 - val_loss: 1.1884 - val_f1_score: 0.7615
Epoch 224/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2799 - f1_score:
0.9444 - val_loss: 1.2905 - val_f1_score: 0.7485
Epoch 225/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2579 - f1_score:
0.9579 - val_loss: 1.2386 - val_f1_score: 0.7446
Epoch 226/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2712 - f1_score:
0.9517 - val_loss: 1.3074 - val_f1_score: 0.7425
Epoch 227/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2625 - f1_score:
0.9508 - val_loss: 1.2723 - val_f1_score: 0.7468
Epoch 228/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2715 - f1_score:
0.9469 - val_loss: 1.4269 - val_f1_score: 0.6955
Epoch 229/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2777 - f1_score:
0.9441 - val_loss: 1.3980 - val_f1_score: 0.7073
Epoch 230/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2794 - f1_score:
0.9432 - val_loss: 1.2292 - val_f1_score: 0.7554
Epoch 231/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2477 - f1_score:
0.9553 - val_loss: 1.3204 - val_f1_score: 0.7530
Epoch 232/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2514 - f1_score:
0.9573 - val_loss: 1.3015 - val_f1_score: 0.7640
Epoch 233/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2567 - f1_score:
0.9516 - val_loss: 1.2897 - val_f1_score: 0.7361
Epoch 234/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2517 - f1_score:
0.9535 - val_loss: 1.3658 - val_f1_score: 0.6888
Epoch 235/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 0.2458 - f1_score:
0.9576 - val_loss: 1.3764 - val_f1_score: 0.6899
Epoch 236/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2462 - f1_score:
0.9514 - val_loss: 1.3558 - val_f1_score: 0.7141
Epoch 237/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2376 - f1_score:
0.9599 - val_loss: 1.3344 - val_f1_score: 0.7409
Epoch 238/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2490 - f1_score:
0.9577 - val_loss: 1.3371 - val_f1_score: 0.7323
Epoch 239/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2376 - f1_score:
0.9583 - val_loss: 1.3601 - val_f1_score: 0.7369
Epoch 240/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2321 - f1_score:
0.9586 - val_loss: 1.2952 - val_f1_score: 0.7494
Epoch 241/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2380 - f1_score:
0.9578 - val_loss: 1.3563 - val_f1_score: 0.7285
Epoch 242/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2407 - f1_score:
0.9515 - val_loss: 1.3081 - val_f1_score: 0.7435
Epoch 243/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2393 - f1_score:
0.9550 - val_loss: 1.3919 - val_f1_score: 0.7321
Epoch 244/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2328 - f1_score:
0.9594 - val_loss: 1.3077 - val_f1_score: 0.7244
Epoch 245/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2327 - f1_score:
0.9588 - val_loss: 1.2667 - val_f1_score: 0.7409
Epoch 246/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2257 - f1_score:
0.9605 - val_loss: 1.3433 - val_f1_score: 0.7505
Epoch 247/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2459 - f1_score:
0.9587 - val_loss: 1.3030 - val_f1_score: 0.7482
Epoch 248/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2316 - f1_score:
0.9598 - val_loss: 1.3450 - val_f1_score: 0.7432
Epoch 249/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2106 - f1_score:
0.9689 - val_loss: 1.3715 - val_f1_score: 0.6894
Epoch 250/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2283 - f1_score:
0.9623 - val_loss: 1.3706 - val_f1_score: 0.7213
Epoch 251/500
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28/28 [==============================] - 3s 95ms/step - loss: 0.2242 - f1_score:
0.9571 - val_loss: 1.3881 - val_f1_score: 0.7081
Epoch 252/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2210 - f1_score:
0.9601 - val_loss: 1.3361 - val_f1_score: 0.7240
Epoch 253/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2162 - f1_score:
0.9643 - val_loss: 1.3411 - val_f1_score: 0.7483
Epoch 254/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2248 - f1_score:
0.9600 - val_loss: 1.3591 - val_f1_score: 0.7147
Epoch 255/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2275 - f1_score:
0.9567 - val_loss: 1.3570 - val_f1_score: 0.7174
Epoch 256/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2124 - f1_score:
0.9609 - val_loss: 1.4022 - val_f1_score: 0.7278
Epoch 257/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2255 - f1_score:
0.9546 - val_loss: 1.3457 - val_f1_score: 0.7422
Epoch 258/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2236 - f1_score:
0.9543 - val_loss: 1.3329 - val_f1_score: 0.7229
Epoch 259/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2133 - f1_score:
0.9614 - val_loss: 1.2869 - val_f1_score: 0.7381
Epoch 260/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2191 - f1_score:
0.9569 - val_loss: 1.2755 - val_f1_score: 0.7484
Epoch 261/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2115 - f1_score:
0.9653 - val_loss: 1.4519 - val_f1_score: 0.6880
Epoch 262/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2122 - f1_score:
0.9631 - val_loss: 1.2950 - val_f1_score: 0.7533
Epoch 263/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2184 - f1_score:
0.9611 - val_loss: 1.2917 - val_f1_score: 0.7211
Epoch 264/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2186 - f1_score:
0.9555 - val_loss: 1.2867 - val_f1_score: 0.7443
Epoch 265/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2089 - f1_score:
0.9649 - val_loss: 1.3429 - val_f1_score: 0.7440
Epoch 266/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1893 - f1_score:
0.9730 - val_loss: 1.3364 - val_f1_score: 0.7308
Epoch 267/500
```

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28/28 [==============================] - 3s 94ms/step - loss: 0.1934 - f1_score:
0.9666 - val_loss: 1.4209 - val_f1_score: 0.7139
Epoch 268/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2134 - f1_score:
0.9584 - val_loss: 1.3442 - val_f1_score: 0.7114
Epoch 269/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2028 - f1_score:
0.9642 - val_loss: 1.2705 - val_f1_score: 0.7401
Epoch 270/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2134 - f1_score:
0.9631 - val_loss: 1.3733 - val_f1_score: 0.7327
Epoch 271/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1991 - f1_score:
0.9644 - val_loss: 1.4452 - val_f1_score: 0.7176
Epoch 272/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1968 - f1_score:
0.9664 - val_loss: 1.2827 - val_f1_score: 0.7278
Epoch 273/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1912 - f1_score:
0.9696 - val_loss: 1.3644 - val_f1_score: 0.7420
Epoch 274/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1902 - f1_score:
0.9670 - val_loss: 1.3481 - val_f1_score: 0.7152
Epoch 275/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1903 - f1_score:
0.9698 - val_loss: 1.4052 - val_f1_score: 0.7229
Epoch 276/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1979 - f1_score:
0.9668 - val_loss: 1.4137 - val_f1_score: 0.7158
Epoch 277/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1827 - f1_score:
0.9744 - val_loss: 1.3967 - val_f1_score: 0.7354
Epoch 278/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1923 - f1_score:
0.9636 - val_loss: 1.3495 - val_f1_score: 0.7394
Epoch 279/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1840 - f1_score:
0.9696 - val_loss: 1.3701 - val_f1_score: 0.7394
Epoch 280/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1864 - f1_score:
0.9703 - val_loss: 1.3779 - val_f1_score: 0.7419
Epoch 281/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1821 - f1_score:
0.9716 - val_loss: 1.3472 - val_f1_score: 0.7422
Epoch 282/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2028 - f1_score:
0.9627 - val_loss: 1.4774 - val_f1_score: 0.6893
Epoch 283/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.1944 - f1_score:
0.9628 - val_loss: 1.4946 - val_f1_score: 0.6905
Epoch 284/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1888 - f1_score:
0.9692 - val_loss: 1.4037 - val_f1_score: 0.7276
Epoch 285/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1939 - f1_score:
0.9619 - val_loss: 1.3832 - val_f1_score: 0.7446
Epoch 286/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1845 - f1_score:
0.9657 - val_loss: 1.5553 - val_f1_score: 0.6830
Epoch 287/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1792 - f1_score:
0.9746 - val_loss: 1.3962 - val_f1_score: 0.7203
Epoch 288/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1891 - f1_score:
0.9686 - val_loss: 1.3327 - val_f1_score: 0.7490
Epoch 289/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1756 - f1_score:
0.9720 - val_loss: 1.3007 - val_f1_score: 0.7422
Epoch 290/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1786 - f1_score:
0.9701 - val_loss: 1.4288 - val_f1_score: 0.7237
Epoch 291/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1896 - f1_score:
0.9637 - val_loss: 1.3647 - val_f1_score: 0.7508
Epoch 292/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1834 - f1_score:
0.9701 - val_loss: 1.3308 - val_f1_score: 0.7294
Epoch 293/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1801 - f1_score:
0.9697 - val_loss: 1.3541 - val_f1_score: 0.7460
Epoch 294/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1717 - f1_score:
0.9715 - val_loss: 1.3822 - val_f1_score: 0.7434
Epoch 295/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1872 - f1_score:
0.9666 - val_loss: 1.3971 - val_f1_score: 0.7326
Epoch 296/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1646 - f1_score:
0.9736 - val_loss: 1.3291 - val_f1_score: 0.7479
Epoch 297/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1637 - f1_score:
0.9783 - val_loss: 1.3324 - val_f1_score: 0.7345
Epoch 298/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1717 - f1_score:
0.9750 - val_loss: 1.4605 - val_f1_score: 0.7053
Epoch 299/500
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28/28 [==============================] - 3s 95ms/step - loss: 0.1589 - f1_score:
0.9748 - val_loss: 1.3836 - val_f1_score: 0.7080
Epoch 300/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1693 - f1_score:
0.9700 - val_loss: 1.3510 - val_f1_score: 0.7448
Epoch 301/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1739 - f1_score:
0.9697 - val_loss: 1.4090 - val_f1_score: 0.7490
Epoch 302/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1749 - f1_score:
0.9678 - val_loss: 1.4359 - val_f1_score: 0.7285
Epoch 303/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1640 - f1_score:
0.9724 - val_loss: 1.3868 - val_f1_score: 0.7349
Epoch 304/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1602 - f1_score:
0.9740 - val_loss: 1.4464 - val_f1_score: 0.7126
Epoch 305/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1579 - f1_score:
0.9737 - val_loss: 1.3851 - val_f1_score: 0.7364
Epoch 306/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1670 - f1_score:
0.9702 - val_loss: 1.3692 - val_f1_score: 0.7526
Epoch 307/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1566 - f1_score:
0.9733 - val_loss: 1.3632 - val_f1_score: 0.7379
Epoch 308/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1662 - f1_score:
0.9727 - val_loss: 1.6027 - val_f1_score: 0.7055
Epoch 309/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1584 - f1_score:
0.9758 - val_loss: 1.3748 - val_f1_score: 0.7379
Epoch 310/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1547 - f1_score:
0.9752 - val_loss: 1.5226 - val_f1_score: 0.7085
Epoch 311/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1684 - f1_score:
0.9699 - val_loss: 1.3588 - val_f1_score: 0.7364
Epoch 312/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1572 - f1_score:
0.9771 - val_loss: 1.4357 - val_f1_score: 0.6990
Epoch 313/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1509 - f1_score:
0.9777 - val_loss: 1.5382 - val_f1_score: 0.7091
Epoch 314/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1491 - f1_score:
0.9767 - val_loss: 1.3825 - val_f1_score: 0.7208
Epoch 315/500
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28/28 [==============================] - 3s 95ms/step - loss: 0.1471 - f1_score:
0.9752 - val_loss: 1.4507 - val_f1_score: 0.7351
Epoch 316/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1422 - f1_score:
0.9815 - val_loss: 1.5264 - val_f1_score: 0.7194
Epoch 317/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1590 - f1_score:
0.9709 - val_loss: 1.4156 - val_f1_score: 0.7170
Epoch 318/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1536 - f1_score:
0.9738 - val_loss: 1.4536 - val_f1_score: 0.7268
Epoch 319/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1592 - f1_score:
0.9738 - val_loss: 1.5156 - val_f1_score: 0.7236
Epoch 320/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1534 - f1_score:
0.9763 - val_loss: 1.5545 - val_f1_score: 0.6816
Epoch 321/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1532 - f1_score:
0.9768 - val_loss: 1.4065 - val_f1_score: 0.7406
Epoch 322/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1558 - f1_score:
0.9711 - val_loss: 1.5721 - val_f1_score: 0.6840
Epoch 323/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1581 - f1_score:
0.9754 - val_loss: 1.5725 - val_f1_score: 0.6922
Epoch 324/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1494 - f1_score:
0.9740 - val_loss: 1.4584 - val_f1_score: 0.7107
Epoch 325/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1593 - f1_score:
0.9733 - val_loss: 1.5596 - val_f1_score: 0.6731
Epoch 326/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1525 - f1_score:
0.9729 - val_loss: 1.3781 - val_f1_score: 0.7258
Epoch 327/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1540 - f1_score:
0.9723 - val_loss: 1.4309 - val_f1_score: 0.7143
Epoch 328/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1578 - f1_score:
0.9722 - val_loss: 1.5431 - val_f1_score: 0.6894
Epoch 329/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1375 - f1_score:
0.9778 - val_loss: 1.4339 - val_f1_score: 0.7232
Epoch 330/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1476 - f1_score:
0.9775 - val_loss: 1.5384 - val_f1_score: 0.7192
Epoch 331/500
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28/28 [==============================] - 3s 95ms/step - loss: 0.1641 - f1_score:
0.9706 - val_loss: 1.6264 - val_f1_score: 0.7124
Epoch 332/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1515 - f1_score:
0.9729 - val_loss: 1.4176 - val_f1_score: 0.7258
Epoch 333/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1491 - f1_score:
0.9797 - val_loss: 1.4570 - val_f1_score: 0.7238
Epoch 334/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1438 - f1_score:
0.9773 - val_loss: 1.5142 - val_f1_score: 0.7218
Epoch 335/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1521 - f1_score:
0.9744 - val_loss: 1.5105 - val_f1_score: 0.7194
Epoch 336/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1336 - f1_score:
0.9780 - val_loss: 1.5596 - val_f1_score: 0.7038
Epoch 337/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1335 - f1_score:
0.9784 - val_loss: 1.4495 - val_f1_score: 0.7369
Epoch 338/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1322 - f1_score:
0.9802 - val_loss: 1.4279 - val_f1_score: 0.7074
Epoch 339/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1365 - f1_score:
0.9792 - val_loss: 1.5398 - val_f1_score: 0.7178
Epoch 340/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1317 - f1_score:
0.9813 - val_loss: 1.4733 - val_f1_score: 0.7084
Epoch 341/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1322 - f1_score:
0.9799 - val_loss: 1.4186 - val_f1_score: 0.7052
Epoch 342/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1270 - f1_score:
0.9842 - val_loss: 1.4261 - val_f1_score: 0.7229
Epoch 343/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1379 - f1_score:
0.9753 - val_loss: 1.4902 - val_f1_score: 0.7215
Epoch 344/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1349 - f1_score:
0.9815 - val_loss: 1.5227 - val_f1_score: 0.7184
Epoch 345/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1410 - f1_score:
0.9775 - val_loss: 1.4237 - val_f1_score: 0.7139
Epoch 346/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1328 - f1_score:
0.9802 - val_loss: 1.4792 - val_f1_score: 0.7083
Epoch 347/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.1250 - f1_score:
0.9841 - val_loss: 1.5028 - val_f1_score: 0.7163
Epoch 348/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1340 - f1_score:
0.9768 - val_loss: 1.4350 - val_f1_score: 0.7087
Epoch 349/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1350 - f1_score:
0.9772 - val_loss: 1.5055 - val_f1_score: 0.7007
Epoch 350/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1243 - f1_score:
0.9820 - val_loss: 1.5107 - val_f1_score: 0.7211
Epoch 351/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1313 - f1_score:
0.9810 - val_loss: 1.4481 - val_f1_score: 0.7448
Epoch 352/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1263 - f1_score:
0.9816 - val_loss: 1.4473 - val_f1_score: 0.6993
Epoch 353/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1258 - f1_score:
0.9830 - val_loss: 1.5006 - val_f1_score: 0.7108
Epoch 354/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1262 - f1_score:
0.9793 - val_loss: 1.4291 - val_f1_score: 0.7033
Epoch 355/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1521 - f1_score:
0.9696 - val_loss: 1.6036 - val_f1_score: 0.6780
Epoch 356/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1440 - f1_score:
0.9745 - val_loss: 1.5266 - val_f1_score: 0.6915
Epoch 357/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1346 - f1_score:
0.9790 - val_loss: 1.5601 - val_f1_score: 0.6913
Epoch 358/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1289 - f1_score:
0.9782 - val_loss: 1.5192 - val_f1_score: 0.7388
Epoch 359/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1322 - f1_score:
0.9793 - val_loss: 1.4951 - val_f1_score: 0.7073
Epoch 360/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1270 - f1_score:
0.9815 - val_loss: 1.6249 - val_f1_score: 0.6695
Epoch 361/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1171 - f1_score:
0.9875 - val_loss: 1.4463 - val_f1_score: 0.7397
Epoch 362/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1128 - f1_score:
0.9881 - val_loss: 1.5591 - val_f1_score: 0.7244
Epoch 363/500
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28/28 [==============================] - 3s 94ms/step - loss: 0.1110 - f1_score:
0.9845 - val_loss: 1.4747 - val_f1_score: 0.7376
Epoch 364/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1096 - f1_score:
0.9878 - val_loss: 1.5100 - val_f1_score: 0.7224
Epoch 365/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1243 - f1_score:
0.9786 - val_loss: 1.4259 - val_f1_score: 0.7296
Epoch 366/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1238 - f1_score:
0.9839 - val_loss: 1.4883 - val_f1_score: 0.7089
Epoch 367/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1374 - f1_score:
0.9748 - val_loss: 1.3946 - val_f1_score: 0.7136
Epoch 368/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1271 - f1_score:
0.9753 - val_loss: 1.4779 - val_f1_score: 0.6960
Epoch 369/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1274 - f1_score:
0.9808 - val_loss: 1.5194 - val_f1_score: 0.7241
Epoch 370/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1291 - f1_score:
0.9776 - val_loss: 1.4920 - val_f1_score: 0.7300
Epoch 371/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1149 - f1_score:
0.9841 - val_loss: 1.4058 - val_f1_score: 0.7028
Epoch 372/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1205 - f1_score:
0.9801 - val_loss: 1.4163 - val_f1_score: 0.7482
Epoch 373/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1320 - f1_score:
0.9761 - val_loss: 1.4192 - val_f1_score: 0.7191
Epoch 374/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1241 - f1_score:
0.9800 - val_loss: 1.5480 - val_f1_score: 0.7048
Epoch 375/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1584 - f1_score:
0.9688 - val_loss: 1.5246 - val_f1_score: 0.7047
Epoch 376/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1196 - f1_score:
0.9815 - val_loss: 1.5791 - val_f1_score: 0.6892
Epoch 377/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1222 - f1_score:
0.9803 - val_loss: 1.4801 - val_f1_score: 0.7202
Epoch 378/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1093 - f1_score:
0.9867 - val_loss: 1.4339 - val_f1_score: 0.7161
Epoch 379/500
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28/28 [==============================] - 3s 95ms/step - loss: 0.1045 - f1_score:
0.9860 - val_loss: 1.4921 - val_f1_score: 0.7220
Epoch 380/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1204 - f1_score:
0.9799 - val_loss: 1.4972 - val_f1_score: 0.7182
Epoch 381/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1203 - f1_score:
0.9819 - val_loss: 1.5162 - val_f1_score: 0.7136
Epoch 382/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1268 - f1_score:
0.9774 - val_loss: 1.5175 - val_f1_score: 0.7205
Epoch 383/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1306 - f1_score:
0.9770 - val_loss: 1.7108 - val_f1_score: 0.6754
Epoch 384/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1192 - f1_score:
0.9795 - val_loss: 1.5128 - val_f1_score: 0.7365
Epoch 385/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1217 - f1_score:
0.9790 - val_loss: 1.6003 - val_f1_score: 0.6947
Epoch 386/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1243 - f1_score:
0.9765 - val_loss: 1.5309 - val_f1_score: 0.6948
Epoch 387/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1092 - f1_score:
0.9881 - val_loss: 1.4837 - val_f1_score: 0.7332
Epoch 388/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1049 - f1_score:
0.9855 - val_loss: 1.5008 - val_f1_score: 0.7027
Epoch 389/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1219 - f1_score:
0.9789 - val_loss: 1.5139 - val_f1_score: 0.7320
Epoch 390/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1196 - f1_score:
0.9798 - val_loss: 1.5510 - val_f1_score: 0.7044
Epoch 391/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1187 - f1_score:
0.9776 - val_loss: 1.5452 - val_f1_score: 0.7041
Epoch 392/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1080 - f1_score:
0.9853 - val_loss: 1.5799 - val_f1_score: 0.6937
Epoch 393/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1128 - f1_score:
0.9800 - val_loss: 1.4763 - val_f1_score: 0.7280
Epoch 394/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1066 - f1_score:
0.9869 - val_loss: 1.5021 - val_f1_score: 0.7279
Epoch 395/500
```

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28/28 [==============================] - 3s 94ms/step - loss: 0.1098 - f1_score:
0.9832 - val_loss: 1.5819 - val_f1_score: 0.7030
Epoch 396/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1223 - f1_score:
0.9771 - val_loss: 1.4663 - val_f1_score: 0.7110
Epoch 397/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1134 - f1_score:
0.9828 - val_loss: 1.5056 - val_f1_score: 0.7325
Epoch 398/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1058 - f1_score:
0.9843 - val_loss: 1.5238 - val_f1_score: 0.7395
Epoch 399/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1084 - f1_score:
0.9834 - val_loss: 1.5224 - val_f1_score: 0.7025
Epoch 400/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1408 - f1_score:
0.9734 - val_loss: 1.4970 - val_f1_score: 0.6969
Epoch 401/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1254 - f1_score:
0.9753 - val_loss: 1.6439 - val_f1_score: 0.7097
Epoch 402/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1093 - f1_score:
0.9811 - val_loss: 1.4612 - val_f1_score: 0.7046
Epoch 403/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1196 - f1_score:
0.9810 - val_loss: 1.5634 - val_f1_score: 0.7164
Epoch 404/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1044 - f1_score:
0.9848 - val_loss: 1.5160 - val_f1_score: 0.7428
Epoch 405/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1035 - f1_score:
0.9847 - val_loss: 1.6163 - val_f1_score: 0.6891
Epoch 406/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1239 - f1_score:
0.9758 - val_loss: 1.4003 - val_f1_score: 0.7298
Epoch 407/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1125 - f1_score:
0.9796 - val_loss: 1.5808 - val_f1_score: 0.7058
Epoch 408/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1171 - f1_score:
0.9805 - val_loss: 1.4872 - val_f1_score: 0.7176
Epoch 409/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1163 - f1_score:
0.9772 - val_loss: 1.5405 - val_f1_score: 0.7181
Epoch 410/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1021 - f1_score:
0.9861 - val_loss: 1.4125 - val_f1_score: 0.7308
Epoch 411/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.1075 - f1_score:
0.9853 - val_loss: 1.5520 - val_f1_score: 0.7188
Epoch 412/500
28/28 [==============================] - 3s 94ms/step - loss: 0.0999 - f1_score:
0.9858 - val_loss: 1.4511 - val_f1_score: 0.7284
Epoch 413/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1049 - f1_score:
0.9847 - val_loss: 1.5401 - val_f1_score: 0.7041
Epoch 414/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1149 - f1_score:
0.9792 - val_loss: 1.6348 - val_f1_score: 0.7011
Epoch 415/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1072 - f1_score:
0.9841 - val_loss: 1.4173 - val_f1_score: 0.7218
Epoch 416/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0945 - f1_score:
0.9892 - val_loss: 1.5862 - val_f1_score: 0.7172
Epoch 417/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1026 - f1_score:
0.9848 - val_loss: 1.4732 - val_f1_score: 0.7202
Epoch 418/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1140 - f1_score:
0.9820 - val_loss: 1.5151 - val_f1_score: 0.7317
Epoch 419/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0929 - f1_score:
0.9899 - val_loss: 1.5263 - val_f1_score: 0.7312
Epoch 420/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0937 - f1_score:
0.9892 - val_loss: 1.3951 - val_f1_score: 0.7511
Epoch 421/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1151 - f1_score:
0.9796 - val_loss: 1.4483 - val_f1_score: 0.7422
Epoch 422/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1095 - f1_score:
0.9789 - val_loss: 1.4505 - val_f1_score: 0.7312
Epoch 423/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1010 - f1_score:
0.9844 - val_loss: 1.5078 - val_f1_score: 0.7311
Epoch 424/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0960 - f1_score:
0.9851 - val_loss: 1.4603 - val_f1_score: 0.7363
Epoch 425/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0901 - f1_score:
0.9890 - val_loss: 1.6114 - val_f1_score: 0.7060
Epoch 426/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0886 - f1_score:
0.9907 - val_loss: 1.6222 - val_f1_score: 0.7024
Epoch 427/500
```

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28/28 [==============================] - 3s 97ms/step - loss: 0.0909 - f1_score:
0.9859 - val_loss: 1.5679 - val_f1_score: 0.7146
Epoch 428/500
28/28 [==============================] - 3s 94ms/step - loss: 0.0924 - f1_score:
0.9875 - val_loss: 1.6326 - val_f1_score: 0.6977
Epoch 429/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1023 - f1_score:
0.9799 - val_loss: 1.4651 - val_f1_score: 0.7440
Epoch 430/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1044 - f1_score:
0.9832 - val_loss: 1.5487 - val_f1_score: 0.7076
Epoch 431/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1276 - f1_score:
0.9718 - val_loss: 1.4605 - val_f1_score: 0.7166
Epoch 432/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1195 - f1_score:
0.9746 - val_loss: 1.4912 - val_f1_score: 0.7310
Epoch 433/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1125 - f1_score:
0.9803 - val_loss: 1.5143 - val_f1_score: 0.7219
Epoch 434/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1131 - f1_score:
0.9799 - val_loss: 1.6343 - val_f1_score: 0.7428
Epoch 435/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1247 - f1_score:
0.9778 - val_loss: 1.5312 - val_f1_score: 0.7410
Epoch 436/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1209 - f1_score:
0.9774 - val_loss: 1.8115 - val_f1_score: 0.6875
Epoch 437/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1071 - f1_score:
0.9840 - val_loss: 1.6899 - val_f1_score: 0.6823
Epoch 438/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1052 - f1_score:
0.9847 - val_loss: 1.5622 - val_f1_score: 0.6955
Epoch 439/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1032 - f1_score:
0.9798 - val_loss: 1.5610 - val_f1_score: 0.6990
Epoch 440/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0996 - f1_score:
0.9859 - val_loss: 1.6430 - val_f1_score: 0.6936
Epoch 441/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1026 - f1_score:
0.9825 - val_loss: 1.6960 - val_f1_score: 0.6386
Epoch 442/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1057 - f1_score:
0.9813 - val_loss: 1.5725 - val_f1_score: 0.7200
Epoch 443/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.1021 - f1_score:
0.9845 - val_loss: 1.7416 - val_f1_score: 0.6768
Epoch 444/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1064 - f1_score:
0.9837 - val_loss: 1.6188 - val_f1_score: 0.7076
Epoch 445/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0936 - f1_score:
0.9862 - val_loss: 1.6087 - val_f1_score: 0.7200
Epoch 446/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0976 - f1_score:
0.9859 - val_loss: 1.5733 - val_f1_score: 0.7135
Epoch 447/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0993 - f1_score:
0.9848 - val_loss: 1.4669 - val_f1_score: 0.7274
Epoch 448/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0960 - f1_score:
0.9851 - val_loss: 1.4896 - val_f1_score: 0.7298
Epoch 449/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0818 - f1_score:
0.9912 - val_loss: 1.6793 - val_f1_score: 0.7003
Epoch 450/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0909 - f1_score:
0.9869 - val_loss: 1.6421 - val_f1_score: 0.6963
Epoch 451/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0927 - f1_score:
0.9871 - val_loss: 1.5877 - val_f1_score: 0.7001
Epoch 452/500
28/28 [==============================] - 3s 94ms/step - loss: 0.0764 - f1_score:
0.9932 - val_loss: 1.4667 - val_f1_score: 0.7345
Epoch 453/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0783 - f1_score:
0.9912 - val_loss: 1.6196 - val_f1_score: 0.7123
Epoch 454/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0892 - f1_score:
0.9878 - val_loss: 1.7029 - val_f1_score: 0.6997
Epoch 455/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0927 - f1_score:
0.9862 - val_loss: 1.4943 - val_f1_score: 0.7147
Epoch 456/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1018 - f1_score:
0.9845 - val_loss: 1.7805 - val_f1_score: 0.6757
Epoch 457/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1123 - f1_score:
0.9808 - val_loss: 1.6367 - val_f1_score: 0.7070
Epoch 458/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1119 - f1_score:
0.9782 - val_loss: 1.4942 - val_f1_score: 0.7152
Epoch 459/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.0953 - f1_score:
0.9871 - val_loss: 1.7182 - val_f1_score: 0.7190
Epoch 460/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0919 - f1_score:
0.9865 - val_loss: 1.6198 - val_f1_score: 0.6922
Epoch 461/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0892 - f1_score:
0.9889 - val_loss: 1.6098 - val_f1_score: 0.7069
Epoch 462/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0839 - f1_score:
0.9904 - val_loss: 1.5397 - val_f1_score: 0.7282
Epoch 463/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0879 - f1_score:
0.9870 - val_loss: 1.7719 - val_f1_score: 0.6983
Epoch 464/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0801 - f1_score:
0.9916 - val_loss: 1.6058 - val_f1_score: 0.7260
Epoch 465/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0890 - f1_score:
0.9856 - val_loss: 1.5849 - val_f1_score: 0.7232
Epoch 466/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0963 - f1_score:
0.9847 - val_loss: 1.7123 - val_f1_score: 0.6807
Epoch 467/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0964 - f1_score:
0.9832 - val_loss: 1.5153 - val_f1_score: 0.7366
Epoch 468/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0977 - f1_score:
0.9820 - val_loss: 1.7063 - val_f1_score: 0.6996
Epoch 469/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0952 - f1_score:
0.9850 - val_loss: 1.7119 - val_f1_score: 0.6731
Epoch 470/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1105 - f1_score:
0.9789 - val_loss: 1.6175 - val_f1_score: 0.7123
Epoch 471/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0825 - f1_score:
0.9886 - val_loss: 1.5057 - val_f1_score: 0.7146
Epoch 472/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0860 - f1_score:
0.9893 - val_loss: 1.6256 - val_f1_score: 0.6905
Epoch 473/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0868 - f1_score:
0.9874 - val_loss: 1.6535 - val_f1_score: 0.7051
Epoch 474/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0989 - f1_score:
0.9820 - val_loss: 1.6698 - val_f1_score: 0.7095
Epoch 475/500
```

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28/28 [==============================] - 3s 95ms/step - loss: 0.0895 - f1_score:
0.9872 - val_loss: 1.5071 - val_f1_score: 0.7135
Epoch 476/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1000 - f1_score:
0.9831 - val_loss: 1.6482 - val_f1_score: 0.7081
Epoch 477/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0963 - f1_score:
0.9815 - val_loss: 1.4868 - val_f1_score: 0.7439
Epoch 478/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0956 - f1_score:
0.9829 - val_loss: 1.6749 - val_f1_score: 0.7026
Epoch 479/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0968 - f1_score:
0.9835 - val_loss: 1.4926 - val_f1_score: 0.7214
Epoch 480/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0932 - f1_score:
0.9848 - val_loss: 1.5883 - val_f1_score: 0.7064
Epoch 481/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0970 - f1_score:
0.9836 - val_loss: 1.5398 - val_f1_score: 0.7375
Epoch 482/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1000 - f1_score:
0.9809 - val_loss: 1.4767 - val_f1_score: 0.7175
Epoch 483/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0880 - f1_score:
0.9860 - val_loss: 1.5103 - val_f1_score: 0.7254
Epoch 484/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1002 - f1_score:
0.9798 - val_loss: 1.4846 - val_f1_score: 0.7256
Epoch 485/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0911 - f1_score:
0.9847 - val_loss: 1.4483 - val_f1_score: 0.7261
Epoch 486/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0965 - f1_score:
0.9797 - val_loss: 1.6058 - val_f1_score: 0.7222
Epoch 487/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0872 - f1_score:
0.9852 - val_loss: 1.6515 - val_f1_score: 0.7216
Epoch 488/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0870 - f1_score:
0.9859 - val_loss: 1.4708 - val_f1_score: 0.7385
Epoch 489/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0911 - f1_score:
0.9858 - val_loss: 1.5484 - val_f1_score: 0.7152
Epoch 490/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0787 - f1_score:
0.9916 - val_loss: 1.4969 - val_f1_score: 0.7359
Epoch 491/500
```

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28/28 [==============================] - 3s 97ms/step - loss: 0.0960 - f1_score:
0.9875 - val_loss: 1.5232 - val_f1_score: 0.7350
Epoch 492/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0934 - f1_score:
0.9810 - val_loss: 1.6443 - val_f1_score: 0.7043
Epoch 493/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0788 - f1_score:
0.9902 - val_loss: 1.4690 - val_f1_score: 0.7273
Epoch 494/500
28/28 [==============================] - 3s 94ms/step - loss: 0.0915 - f1_score:
0.9852 - val_loss: 1.7000 - val_f1_score: 0.6735
Epoch 495/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1065 - f1_score:
0.9801 - val_loss: 1.6182 - val_f1_score: 0.7010
Epoch 496/500
28/28 [==============================] - 3s 94ms/step - loss: 0.0997 - f1_score:
0.9826 - val_loss: 1.9312 - val_f1_score: 0.6735
Epoch 497/500
28/28 [==============================] - 3s 95ms/step - loss: 0.0830 - f1_score:
0.9905 - val_loss: 1.6879 - val_f1_score: 0.6940
Epoch 498/500
28/28 [==============================] - 3s 96ms/step - loss: 0.0906 - f1_score:
0.9864 - val_loss: 1.8039 - val_f1_score: 0.6636
Epoch 499/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1070 - f1_score:
0.9771 - val_loss: 1.5641 - val_f1_score: 0.7118
Epoch 500/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1070 - f1_score:
0.9793 - val_loss: 1.6971 - val_f1_score: 0.6722
```

[140]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 11ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.571     0.667     0.615         6
  BASKETBALL      1.000     0.900     0.947        10
         BEE      0.556     0.500     0.526        10
        BELT      0.500     1.000     0.667         4
        BITE      1.000     0.125     0.222         8
   BREAKFAST      0.571     0.667     0.615         6
      CANCER      0.778     0.875     0.824         8
   CHRISTMAS      0.857     1.000     0.923         6
```

CONFUSED	0.857	1.000	0.923	6
DARK	0.800	1.000	0.889	4
DEAF	0.182	0.333	0.235	6
DECIDE	1.000	0.833	0.909	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.500	0.333	0.400	6
DINNER	0.444	0.500	0.471	8
DOG	0.667	1.000	0.800	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	0.250	0.250	0.250	4
EAT	0.750	1.000	0.857	6
EDIT	1.000	0.833	0.909	6
ELEVATOR	0.600	0.750	0.667	8
FINE	1.000	0.250	0.400	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	0.571	0.667	0.615	6
GUESS	0.636	0.875	0.737	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	0.800	0.667	0.727	6
HURDLE/TRIP	0.400	0.500	0.444	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.545	0.750	0.632	8
LUNCH	0.571	0.500	0.533	8
MAPLE	1.000	0.500	0.667	4
MEAT	0.500	0.333	0.400	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.571	1.000	0.727	8
NOON	0.800	1.000	0.889	8
PARTY	0.857	0.750	0.800	8
PATIENT	1.000	0.667	0.800	6
RAZOR	0.571	1.000	0.727	4
RIVER	0.571	0.667	0.615	6
ROCKINGCHAIR	1.000	0.750	0.857	8
SHAVE	0.889	0.800	0.842	10
SINK	0.400	0.333	0.364	6
SQUEEZE	0.500	0.500	0.500	4
THEY	0.333	0.500	0.400	4
TWINS	0.625	0.625	0.625	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.691	324
macro avg	0.723	0.682	0.672	324
weighted avg	0.740	0.691	0.686	324

[141]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1DCNN + 1 GRU/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[131]:
```
hist_df = pd.read_csv('1 1DCNN + 1 GRU/history.csv', index_col=0)
hist_df.tail()
```

[131]:

	loss	f1_score	val_loss	val_f1_score
495	0.099662	0.982627	1.931195	0.673482
496	0.082953	0.990497	1.687911	0.694009
497	0.090602	0.986427	1.803858	0.663592
498	0.106971	0.977117	1.564104	0.711779
499	0.106982	0.979273	1.697142	0.672247

[132]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[133]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[134]:
```
reconstructed_model = tf.keras.models.load_model("1 1DCNN + 1 GRU")
```

[145]:
```
reconstructed_model.summary()
```

```
Model: "sequential_4"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_4 (Conv1D)           (None, 121, 200)          798200

 max_pooling1d_4 (MaxPooling  (None, 24, 200)          0
 1D)

 dropout_8 (Dropout)         (None, 24, 200)           0

 gru_4 (GRU)                 (None, 125)               122625
```

```
 dropout_9 (Dropout)         (None, 125)               0

 dense_8 (Dense)             (None, 110)               13860

 dense_9 (Dense)             (None, 50)                5550

=================================================================
Total params: 940,235
Trainable params: 940,235
Non-trainable params: 0
_________________________________________________________________
```

[146]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[146]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 121, 200)
MaxPooling1D
input: (None, 121, 200)
output: (None, 24, 200)
Dropout
input: (None, 24, 200)
output: (None, 24, 200)
GRU
input: (None, 24, 200)
output: (None, 125)
Dropout
input: (None, 125)
output: (None, 125)
Dense
input: (None, 125)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[135]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[135]:

Conv1D
MaxPooling1D
Dropout
GRU
Dense

[147]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 12ms/step - loss: 1.1852 - f1_score:
0.7679
```

[147]:
```
[1.185200810432434, 0.7678741216659546]
```

[149]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 15ms/step - loss: 0.1628 - f1_score:
0.9936
```

[149]:
```
[0.16277065873146057, 0.9936215877532959]
```

[150]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 11ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.571     0.667     0.615         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      1.000     0.800     0.889        10
        BELT      0.571     1.000     0.727         4
        BITE      0.857     0.750     0.800         8
   BREAKFAST      0.750     1.000     0.857         6
      CANCER      0.800     1.000     0.889         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.857     1.000     0.923         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.167     0.333     0.222         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      0.889     1.000     0.941         8
         DOG      0.750     1.000     0.857         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.000     0.000     0.000         4
         EAT      1.000     1.000     1.000         6
        EDIT      1.000     1.000     1.000         6
    ELEVATOR      0.545     0.750     0.632         8
        FINE      1.000     0.500     0.667         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.545     0.750     0.632         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      1.000     0.333     0.500         6
 HURDLE/TRIP      0.333     0.500     0.400         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.625     0.625     0.625         8
       LUNCH      0.800     0.500     0.615         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.667     0.667     0.667         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.875     0.933         8
       MOVIE      0.615     1.000     0.762         8
        NOON      0.889     1.000     0.941         8
       PARTY      1.000     0.625     0.769         8
     PATIENT      1.000     0.667     0.800         6
       RAZOR      1.000     1.000     1.000         4
       RIVER      0.500     0.833     0.625         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.889     0.800     0.842        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.667     0.500     0.571         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.667     1.000     0.800         8
     WHATFOR      1.000     0.500     0.667        10

    accuracy                          0.784       324
   macro avg      0.818     0.769     0.768       324
weighted avg      0.825     0.784     0.781       324
```

[119]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1DCNN + 1 GRU Mish/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[127]:
```
act_function = 'mish'

model = Sequential()
model.add(
    Conv1D(filters=200,
           kernel_size=10,
           activation=act_function,
           input_shape=(130, 399)))
```

```
model.add(MaxPooling1D(pool_size=5))
model.add(Dropout(.65))
model.add(
    GRU(units=125,
        return_sequences=False,
        kernel_regularizer=regularizers.l2(.0034365682734906543)))
model.add(Dropout(.1))
model.add(Dense(units=110, activation=act_function))
model.add(Dense(50, activation='softmax'))

model.compile(tf.optimizers.experimental.Nadam(.00015386971155916857),
              loss='categorical_crossentropy',
              metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
model.summary()
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_1 (Conv1D)           (None, 121, 200)          798200

 max_pooling1d_1 (MaxPooling  (None, 24, 200)          0
 1D)

 dropout_2 (Dropout)         (None, 24, 200)           0

 gru_1 (GRU)                 (None, 125)               122625

 dropout_3 (Dropout)         (None, 125)               0

 dense_2 (Dense)             (None, 110)               13860

 dense_3 (Dense)             (None, 50)                5550

=================================================================
Total params: 940,235
Trainable params: 940,235
Non-trainable params: 0
_________________________________________________________________
Epoch 1/500
28/28 [==============================] - 7s 114ms/step - loss: 4.8374 -
```

```
f1_score: 0.0182 - val_loss: 4.7789 - val_f1_score: 0.0011
Epoch 2/500
28/28 [==============================] - 3s 91ms/step - loss: 4.7644 - f1_score:
0.0156 - val_loss: 4.7232 - val_f1_score: 0.0018
Epoch 3/500
28/28 [==============================] - 3s 92ms/step - loss: 4.6969 - f1_score:
0.0171 - val_loss: 4.6586 - val_f1_score: 0.0026
Epoch 4/500
28/28 [==============================] - 3s 93ms/step - loss: 4.6419 - f1_score:
0.0102 - val_loss: 4.6086 - val_f1_score: 5.8182e-04
Epoch 5/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5892 - f1_score:
0.0107 - val_loss: 4.5647 - val_f1_score: 0.0011
Epoch 6/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5415 - f1_score:
0.0162 - val_loss: 4.5190 - val_f1_score: 0.0037
Epoch 7/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4980 - f1_score:
0.0145 - val_loss: 4.4722 - val_f1_score: 0.0015
Epoch 8/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4625 - f1_score:
0.0124 - val_loss: 4.4411 - val_f1_score: 0.0011
Epoch 9/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4171 - f1_score:
0.0130 - val_loss: 4.4070 - val_f1_score: 0.0082
Epoch 10/500
28/28 [==============================] - 3s 93ms/step - loss: 4.3804 - f1_score:
0.0168 - val_loss: 4.3741 - val_f1_score: 0.0105
Epoch 11/500
28/28 [==============================] - 3s 95ms/step - loss: 4.3466 - f1_score:
0.0152 - val_loss: 4.3427 - val_f1_score: 0.0038
Epoch 12/500
28/28 [==============================] - 3s 95ms/step - loss: 4.3140 - f1_score:
0.0200 - val_loss: 4.3190 - val_f1_score: 0.0040
Epoch 13/500
28/28 [==============================] - 3s 95ms/step - loss: 4.2915 - f1_score:
0.0194 - val_loss: 4.2977 - val_f1_score: 0.0020
Epoch 14/500
28/28 [==============================] - 3s 95ms/step - loss: 4.2600 - f1_score:
0.0129 - val_loss: 4.2674 - val_f1_score: 0.0071
Epoch 15/500
28/28 [==============================] - 3s 96ms/step - loss: 4.2320 - f1_score:
0.0158 - val_loss: 4.2546 - val_f1_score: 9.6970e-04
Epoch 16/500
28/28 [==============================] - 3s 95ms/step - loss: 4.2069 - f1_score:
0.0170 - val_loss: 4.2207 - val_f1_score: 0.0109
Epoch 17/500
28/28 [==============================] - 3s 96ms/step - loss: 4.1740 - f1_score:
```

```
0.0209 - val_loss: 4.1946 - val_f1_score: 0.0166
Epoch 18/500
28/28 [==============================] - 3s 96ms/step - loss: 4.1428 - f1_score:
0.0203 - val_loss: 4.1709 - val_f1_score: 0.0029
Epoch 19/500
28/28 [==============================] - 3s 96ms/step - loss: 4.0916 - f1_score:
0.0320 - val_loss: 4.0861 - val_f1_score: 0.0212
Epoch 20/500
28/28 [==============================] - 3s 96ms/step - loss: 4.0087 - f1_score:
0.0341 - val_loss: 3.9731 - val_f1_score: 0.0063
Epoch 21/500
28/28 [==============================] - 3s 96ms/step - loss: 3.8907 - f1_score:
0.0249 - val_loss: 3.8727 - val_f1_score: 0.0053
Epoch 22/500
28/28 [==============================] - 3s 97ms/step - loss: 3.7906 - f1_score:
0.0345 - val_loss: 3.7372 - val_f1_score: 0.0178
Epoch 23/500
28/28 [==============================] - 3s 96ms/step - loss: 3.6965 - f1_score:
0.0405 - val_loss: 3.6285 - val_f1_score: 0.0187
Epoch 24/500
28/28 [==============================] - 3s 98ms/step - loss: 3.6123 - f1_score:
0.0437 - val_loss: 3.5077 - val_f1_score: 0.0313
Epoch 25/500
28/28 [==============================] - 3s 98ms/step - loss: 3.5069 - f1_score:
0.0585 - val_loss: 3.3918 - val_f1_score: 0.0328
Epoch 26/500
28/28 [==============================] - 3s 103ms/step - loss: 3.4039 -
f1_score: 0.0624 - val_loss: 3.2890 - val_f1_score: 0.0548
Epoch 27/500
28/28 [==============================] - 3s 98ms/step - loss: 3.3244 - f1_score:
0.0718 - val_loss: 3.2588 - val_f1_score: 0.0705
Epoch 28/500
28/28 [==============================] - 3s 97ms/step - loss: 3.2481 - f1_score:
0.0890 - val_loss: 3.1607 - val_f1_score: 0.0734
Epoch 29/500
28/28 [==============================] - 3s 99ms/step - loss: 3.1648 - f1_score:
0.0947 - val_loss: 3.0488 - val_f1_score: 0.0858
Epoch 30/500
28/28 [==============================] - 3s 96ms/step - loss: 3.0726 - f1_score:
0.1204 - val_loss: 2.9546 - val_f1_score: 0.0969
Epoch 31/500
28/28 [==============================] - 3s 97ms/step - loss: 3.0281 - f1_score:
0.1238 - val_loss: 3.0696 - val_f1_score: 0.0678
Epoch 32/500
28/28 [==============================] - 3s 96ms/step - loss: 2.9542 - f1_score:
0.1374 - val_loss: 2.8571 - val_f1_score: 0.1157
Epoch 33/500
28/28 [==============================] - 3s 96ms/step - loss: 2.8751 - f1_score:
```

```
0.1498 - val_loss: 2.7892 - val_f1_score: 0.1344
Epoch 34/500
28/28 [==============================] - 3s 96ms/step - loss: 2.8196 - f1_score:
0.1628 - val_loss: 2.7460 - val_f1_score: 0.1609
Epoch 35/500
28/28 [==============================] - 3s 97ms/step - loss: 2.7847 - f1_score:
0.1607 - val_loss: 2.7262 - val_f1_score: 0.1514
Epoch 36/500
28/28 [==============================] - 3s 96ms/step - loss: 2.7264 - f1_score:
0.1784 - val_loss: 2.6554 - val_f1_score: 0.1757
Epoch 37/500
28/28 [==============================] - 3s 105ms/step - loss: 2.6818 -
f1_score: 0.1880 - val_loss: 2.7182 - val_f1_score: 0.1442
Epoch 38/500
28/28 [==============================] - 3s 113ms/step - loss: 2.6646 -
f1_score: 0.1848 - val_loss: 2.6015 - val_f1_score: 0.2179
Epoch 39/500
28/28 [==============================] - 3s 104ms/step - loss: 2.6150 -
f1_score: 0.2130 - val_loss: 2.6388 - val_f1_score: 0.1730
Epoch 40/500
28/28 [==============================] - 3s 99ms/step - loss: 2.5703 - f1_score:
0.1993 - val_loss: 2.5220 - val_f1_score: 0.2153
Epoch 41/500
28/28 [==============================] - 3s 99ms/step - loss: 2.5335 - f1_score:
0.2241 - val_loss: 2.5067 - val_f1_score: 0.2220
Epoch 42/500
28/28 [==============================] - 3s 99ms/step - loss: 2.5121 - f1_score:
0.2362 - val_loss: 2.4687 - val_f1_score: 0.2461
Epoch 43/500
28/28 [==============================] - 3s 99ms/step - loss: 2.4589 - f1_score:
0.2385 - val_loss: 2.4651 - val_f1_score: 0.2354
Epoch 44/500
28/28 [==============================] - 3s 99ms/step - loss: 2.4503 - f1_score:
0.2407 - val_loss: 2.4956 - val_f1_score: 0.2366
Epoch 45/500
28/28 [==============================] - 3s 110ms/step - loss: 2.4273 -
f1_score: 0.2601 - val_loss: 2.4319 - val_f1_score: 0.2785
Epoch 46/500
28/28 [==============================] - 3s 115ms/step - loss: 2.3893 -
f1_score: 0.2651 - val_loss: 2.4804 - val_f1_score: 0.2168
Epoch 47/500
28/28 [==============================] - 3s 107ms/step - loss: 2.3553 -
f1_score: 0.2705 - val_loss: 2.3358 - val_f1_score: 0.2723
Epoch 48/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3548 -
f1_score: 0.2682 - val_loss: 2.4195 - val_f1_score: 0.2487
Epoch 49/500
28/28 [==============================] - 3s 107ms/step - loss: 2.3243 -
```

```
f1_score: 0.2783 - val_loss: 2.3518 - val_f1_score: 0.2448
Epoch 50/500
28/28 [==============================] - 3s 107ms/step - loss: 2.2921 -
f1_score: 0.2994 - val_loss: 2.3693 - val_f1_score: 0.2617
Epoch 51/500
28/28 [==============================] - 3s 108ms/step - loss: 2.2796 -
f1_score: 0.2930 - val_loss: 2.3380 - val_f1_score: 0.2459
Epoch 52/500
28/28 [==============================] - 3s 108ms/step - loss: 2.2574 -
f1_score: 0.3024 - val_loss: 2.2672 - val_f1_score: 0.2932
Epoch 53/500
28/28 [==============================] - 3s 107ms/step - loss: 2.2215 -
f1_score: 0.3164 - val_loss: 2.2792 - val_f1_score: 0.2760
Epoch 54/500
28/28 [==============================] - 3s 107ms/step - loss: 2.2109 -
f1_score: 0.3095 - val_loss: 2.3084 - val_f1_score: 0.2707
Epoch 55/500
28/28 [==============================] - 3s 107ms/step - loss: 2.1780 -
f1_score: 0.3285 - val_loss: 2.2468 - val_f1_score: 0.2974
Epoch 56/500
28/28 [==============================] - 3s 107ms/step - loss: 2.1648 -
f1_score: 0.3160 - val_loss: 2.2236 - val_f1_score: 0.2843
Epoch 57/500
28/28 [==============================] - 3s 106ms/step - loss: 2.1457 -
f1_score: 0.3209 - val_loss: 2.2366 - val_f1_score: 0.2866
Epoch 58/500
28/28 [==============================] - 3s 107ms/step - loss: 2.0948 -
f1_score: 0.3404 - val_loss: 2.2554 - val_f1_score: 0.3009
Epoch 59/500
28/28 [==============================] - 3s 107ms/step - loss: 2.1004 -
f1_score: 0.3345 - val_loss: 2.1821 - val_f1_score: 0.3224
Epoch 60/500
28/28 [==============================] - 3s 107ms/step - loss: 2.0622 -
f1_score: 0.3578 - val_loss: 2.1588 - val_f1_score: 0.2937
Epoch 61/500
28/28 [==============================] - 3s 113ms/step - loss: 2.0423 -
f1_score: 0.3625 - val_loss: 2.1239 - val_f1_score: 0.3264
Epoch 62/500
28/28 [==============================] - 3s 108ms/step - loss: 2.0237 -
f1_score: 0.3629 - val_loss: 2.1687 - val_f1_score: 0.3266
Epoch 63/500
28/28 [==============================] - 3s 105ms/step - loss: 2.0217 -
f1_score: 0.3536 - val_loss: 2.1217 - val_f1_score: 0.3175
Epoch 64/500
28/28 [==============================] - 3s 106ms/step - loss: 2.0127 -
f1_score: 0.3626 - val_loss: 2.0972 - val_f1_score: 0.3251
Epoch 65/500
28/28 [==============================] - 3s 106ms/step - loss: 1.9813 -
```

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f1_score: 0.3717 - val_loss: 2.0772 - val_f1_score: 0.3523
Epoch 66/500
28/28 [==============================] - 3s 113ms/step - loss: 1.9412 -
f1_score: 0.3880 - val_loss: 2.1828 - val_f1_score: 0.3058
Epoch 67/500
28/28 [==============================] - 3s 106ms/step - loss: 1.9523 -
f1_score: 0.3854 - val_loss: 2.0571 - val_f1_score: 0.3312
Epoch 68/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9244 -
f1_score: 0.3944 - val_loss: 2.0566 - val_f1_score: 0.3454
Epoch 69/500
28/28 [==============================] - 3s 107ms/step - loss: 1.9134 -
f1_score: 0.3851 - val_loss: 2.0246 - val_f1_score: 0.3826
Epoch 70/500
28/28 [==============================] - 3s 107ms/step - loss: 1.8910 -
f1_score: 0.4008 - val_loss: 1.9995 - val_f1_score: 0.3641
Epoch 71/500
28/28 [==============================] - 3s 109ms/step - loss: 1.8645 -
f1_score: 0.4163 - val_loss: 1.9870 - val_f1_score: 0.3796
Epoch 72/500
28/28 [==============================] - 3s 107ms/step - loss: 1.8457 -
f1_score: 0.4204 - val_loss: 2.0988 - val_f1_score: 0.3546
Epoch 73/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8471 -
f1_score: 0.4124 - val_loss: 2.0084 - val_f1_score: 0.3657
Epoch 74/500
28/28 [==============================] - 3s 108ms/step - loss: 1.8046 -
f1_score: 0.4290 - val_loss: 2.0094 - val_f1_score: 0.3697
Epoch 75/500
28/28 [==============================] - 3s 107ms/step - loss: 1.8069 -
f1_score: 0.4290 - val_loss: 1.9850 - val_f1_score: 0.3859
Epoch 76/500
28/28 [==============================] - 3s 116ms/step - loss: 1.8078 -
f1_score: 0.4349 - val_loss: 2.0939 - val_f1_score: 0.3430
Epoch 77/500
28/28 [==============================] - 3s 121ms/step - loss: 1.7643 -
f1_score: 0.4444 - val_loss: 1.9440 - val_f1_score: 0.4209
Epoch 78/500
28/28 [==============================] - 3s 109ms/step - loss: 1.7593 -
f1_score: 0.4546 - val_loss: 1.8830 - val_f1_score: 0.4309
Epoch 79/500
28/28 [==============================] - 3s 107ms/step - loss: 1.7365 -
f1_score: 0.4595 - val_loss: 1.8897 - val_f1_score: 0.4189
Epoch 80/500
28/28 [==============================] - 3s 108ms/step - loss: 1.7512 -
f1_score: 0.4484 - val_loss: 2.0107 - val_f1_score: 0.3757
Epoch 81/500
28/28 [==============================] - 3s 109ms/step - loss: 1.7302 -
```

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f1_score: 0.4493 - val_loss: 1.9354 - val_f1_score: 0.3948
Epoch 82/500
28/28 [==============================] - 3s 109ms/step - loss: 1.6959 -
f1_score: 0.4629 - val_loss: 1.9078 - val_f1_score: 0.4228
Epoch 83/500
28/28 [==============================] - 3s 111ms/step - loss: 1.7013 -
f1_score: 0.4698 - val_loss: 1.8489 - val_f1_score: 0.4508
Epoch 84/500
28/28 [==============================] - 3s 110ms/step - loss: 1.6842 -
f1_score: 0.4651 - val_loss: 1.9308 - val_f1_score: 0.3873
Epoch 85/500
28/28 [==============================] - 3s 110ms/step - loss: 1.6448 -
f1_score: 0.4848 - val_loss: 1.8576 - val_f1_score: 0.4342
Epoch 86/500
28/28 [==============================] - 3s 109ms/step - loss: 1.6496 -
f1_score: 0.4822 - val_loss: 1.9154 - val_f1_score: 0.4293
Epoch 87/500
28/28 [==============================] - 3s 111ms/step - loss: 1.6504 -
f1_score: 0.4743 - val_loss: 1.8492 - val_f1_score: 0.4592
Epoch 88/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6392 -
f1_score: 0.4857 - val_loss: 1.8956 - val_f1_score: 0.4424
Epoch 89/500
28/28 [==============================] - 3s 108ms/step - loss: 1.6162 -
f1_score: 0.4919 - val_loss: 1.8148 - val_f1_score: 0.4359
Epoch 90/500
28/28 [==============================] - 3s 107ms/step - loss: 1.6113 -
f1_score: 0.4896 - val_loss: 1.8196 - val_f1_score: 0.4621
Epoch 91/500
28/28 [==============================] - 3s 120ms/step - loss: 1.5958 -
f1_score: 0.4879 - val_loss: 1.7830 - val_f1_score: 0.4837
Epoch 92/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5854 -
f1_score: 0.5116 - val_loss: 1.8676 - val_f1_score: 0.4390
Epoch 93/500
28/28 [==============================] - 3s 108ms/step - loss: 1.5715 -
f1_score: 0.5032 - val_loss: 1.8411 - val_f1_score: 0.4565
Epoch 94/500
28/28 [==============================] - 3s 111ms/step - loss: 1.5582 -
f1_score: 0.5113 - val_loss: 1.8116 - val_f1_score: 0.4687
Epoch 95/500
28/28 [==============================] - 3s 108ms/step - loss: 1.5390 -
f1_score: 0.5224 - val_loss: 1.8783 - val_f1_score: 0.4463
Epoch 96/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5393 -
f1_score: 0.5089 - val_loss: 1.8380 - val_f1_score: 0.4676
Epoch 97/500
28/28 [==============================] - 3s 108ms/step - loss: 1.5259 -
```

```
f1_score: 0.5224 - val_loss: 1.7895 - val_f1_score: 0.4393
Epoch 98/500
28/28 [==============================] - 3s 121ms/step - loss: 1.5273 -
f1_score: 0.5199 - val_loss: 1.8028 - val_f1_score: 0.4548
Epoch 99/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5032 -
f1_score: 0.5297 - val_loss: 1.7457 - val_f1_score: 0.4618
Epoch 100/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4903 -
f1_score: 0.5278 - val_loss: 1.7994 - val_f1_score: 0.4883
Epoch 101/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4654 -
f1_score: 0.5424 - val_loss: 1.7782 - val_f1_score: 0.4746
Epoch 102/500
28/28 [==============================] - 3s 110ms/step - loss: 1.4757 -
f1_score: 0.5441 - val_loss: 1.8310 - val_f1_score: 0.4618
Epoch 103/500
28/28 [==============================] - 3s 108ms/step - loss: 1.4716 -
f1_score: 0.5346 - val_loss: 1.7827 - val_f1_score: 0.4606
Epoch 104/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4490 -
f1_score: 0.5504 - val_loss: 1.7255 - val_f1_score: 0.4858
Epoch 105/500
28/28 [==============================] - 3s 110ms/step - loss: 1.4430 -
f1_score: 0.5614 - val_loss: 1.7217 - val_f1_score: 0.5091
Epoch 106/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4168 -
f1_score: 0.5595 - val_loss: 1.7483 - val_f1_score: 0.4750
Epoch 107/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4074 -
f1_score: 0.5612 - val_loss: 1.6665 - val_f1_score: 0.5092
Epoch 108/500
28/28 [==============================] - 3s 125ms/step - loss: 1.3936 -
f1_score: 0.5673 - val_loss: 1.7648 - val_f1_score: 0.4862
Epoch 109/500
28/28 [==============================] - 4s 133ms/step - loss: 1.3964 -
f1_score: 0.5649 - val_loss: 1.7837 - val_f1_score: 0.4817
Epoch 110/500
28/28 [==============================] - 3s 117ms/step - loss: 1.4171 -
f1_score: 0.5555 - val_loss: 1.7419 - val_f1_score: 0.4980
Epoch 111/500
28/28 [==============================] - 3s 113ms/step - loss: 1.3875 -
f1_score: 0.5594 - val_loss: 1.6135 - val_f1_score: 0.4951
Epoch 112/500
28/28 [==============================] - 4s 128ms/step - loss: 1.3531 -
f1_score: 0.5829 - val_loss: 1.7003 - val_f1_score: 0.5197
Epoch 113/500
28/28 [==============================] - 3s 109ms/step - loss: 1.3790 -
```

```
f1_score: 0.5656 - val_loss: 1.7383 - val_f1_score: 0.4817
Epoch 114/500
28/28 [==============================] - 3s 123ms/step - loss: 1.3491 -
f1_score: 0.5838 - val_loss: 1.6888 - val_f1_score: 0.4911
Epoch 115/500
28/28 [==============================] - 3s 112ms/step - loss: 1.3423 -
f1_score: 0.5831 - val_loss: 1.7048 - val_f1_score: 0.4940
Epoch 116/500
28/28 [==============================] - 3s 121ms/step - loss: 1.3292 -
f1_score: 0.5810 - val_loss: 1.6303 - val_f1_score: 0.4917
Epoch 117/500
28/28 [==============================] - 3s 119ms/step - loss: 1.3577 -
f1_score: 0.5766 - val_loss: 1.6902 - val_f1_score: 0.5097
Epoch 118/500
28/28 [==============================] - 3s 123ms/step - loss: 1.3053 -
f1_score: 0.5984 - val_loss: 1.6598 - val_f1_score: 0.5295
Epoch 119/500
28/28 [==============================] - 3s 119ms/step - loss: 1.3121 -
f1_score: 0.5806 - val_loss: 1.7075 - val_f1_score: 0.4870
Epoch 120/500
28/28 [==============================] - 3s 116ms/step - loss: 1.2890 -
f1_score: 0.5937 - val_loss: 1.6259 - val_f1_score: 0.5309
Epoch 121/500
28/28 [==============================] - 3s 113ms/step - loss: 1.2844 -
f1_score: 0.5971 - val_loss: 1.5789 - val_f1_score: 0.5237
Epoch 122/500
28/28 [==============================] - 3s 117ms/step - loss: 1.2763 -
f1_score: 0.6150 - val_loss: 1.6219 - val_f1_score: 0.5426
Epoch 123/500
28/28 [==============================] - 3s 119ms/step - loss: 1.2841 -
f1_score: 0.6005 - val_loss: 1.6280 - val_f1_score: 0.5275
Epoch 124/500
28/28 [==============================] - 3s 109ms/step - loss: 1.2626 -
f1_score: 0.6100 - val_loss: 1.6133 - val_f1_score: 0.5413
Epoch 125/500
28/28 [==============================] - 3s 102ms/step - loss: 1.2336 -
f1_score: 0.6117 - val_loss: 1.6015 - val_f1_score: 0.5527
Epoch 126/500
28/28 [==============================] - 3s 104ms/step - loss: 1.2444 -
f1_score: 0.6183 - val_loss: 1.5706 - val_f1_score: 0.5460
Epoch 127/500
28/28 [==============================] - 3s 100ms/step - loss: 1.2419 -
f1_score: 0.6167 - val_loss: 1.5416 - val_f1_score: 0.5395
Epoch 128/500
28/28 [==============================] - 3s 101ms/step - loss: 1.2340 -
f1_score: 0.6213 - val_loss: 1.6122 - val_f1_score: 0.5373
Epoch 129/500
28/28 [==============================] - 3s 100ms/step - loss: 1.2163 -
```

```
f1_score: 0.6208 - val_loss: 1.6107 - val_f1_score: 0.5383
Epoch 130/500
28/28 [==============================] - 3s 100ms/step - loss: 1.1747 -
f1_score: 0.6376 - val_loss: 1.5302 - val_f1_score: 0.5607
Epoch 131/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1932 -
f1_score: 0.6300 - val_loss: 1.6024 - val_f1_score: 0.5389
Epoch 132/500
28/28 [==============================] - 3s 100ms/step - loss: 1.1824 -
f1_score: 0.6412 - val_loss: 1.5201 - val_f1_score: 0.5796
Epoch 133/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1566 -
f1_score: 0.6451 - val_loss: 1.6194 - val_f1_score: 0.5290
Epoch 134/500
28/28 [==============================] - 3s 100ms/step - loss: 1.1773 -
f1_score: 0.6467 - val_loss: 1.5231 - val_f1_score: 0.5592
Epoch 135/500
28/28 [==============================] - 3s 107ms/step - loss: 1.1756 -
f1_score: 0.6293 - val_loss: 1.5914 - val_f1_score: 0.5472
Epoch 136/500
28/28 [==============================] - 3s 114ms/step - loss: 1.1465 -
f1_score: 0.6462 - val_loss: 1.5561 - val_f1_score: 0.5764
Epoch 137/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1507 -
f1_score: 0.6555 - val_loss: 1.5636 - val_f1_score: 0.5296
Epoch 138/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1565 -
f1_score: 0.6478 - val_loss: 1.5236 - val_f1_score: 0.5433
Epoch 139/500
28/28 [==============================] - 3s 100ms/step - loss: 1.1526 -
f1_score: 0.6424 - val_loss: 1.5315 - val_f1_score: 0.5423
Epoch 140/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1077 -
f1_score: 0.6528 - val_loss: 1.5597 - val_f1_score: 0.5441
Epoch 141/500
28/28 [==============================] - 3s 102ms/step - loss: 1.1396 -
f1_score: 0.6538 - val_loss: 1.4532 - val_f1_score: 0.5704
Epoch 142/500
28/28 [==============================] - 3s 102ms/step - loss: 1.1295 -
f1_score: 0.6521 - val_loss: 1.4744 - val_f1_score: 0.5771
Epoch 143/500
28/28 [==============================] - 3s 101ms/step - loss: 1.1187 -
f1_score: 0.6634 - val_loss: 1.5467 - val_f1_score: 0.5624
Epoch 144/500
28/28 [==============================] - 3s 100ms/step - loss: 1.0948 -
f1_score: 0.6663 - val_loss: 1.4972 - val_f1_score: 0.5690
Epoch 145/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0930 -
```

```
f1_score: 0.6635 - val_loss: 1.5837 - val_f1_score: 0.5477
Epoch 146/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0765 -
f1_score: 0.6758 - val_loss: 1.4831 - val_f1_score: 0.5767
Epoch 147/500
28/28 [==============================] - 3s 106ms/step - loss: 1.0971 -
f1_score: 0.6634 - val_loss: 1.4517 - val_f1_score: 0.5855
Epoch 148/500
28/28 [==============================] - 3s 102ms/step - loss: 1.0631 -
f1_score: 0.6761 - val_loss: 1.4500 - val_f1_score: 0.5881
Epoch 149/500
28/28 [==============================] - 3s 108ms/step - loss: 1.0506 -
f1_score: 0.6868 - val_loss: 1.5093 - val_f1_score: 0.5802
Epoch 150/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0336 -
f1_score: 0.6964 - val_loss: 1.5132 - val_f1_score: 0.5703
Epoch 151/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0341 -
f1_score: 0.6760 - val_loss: 1.5789 - val_f1_score: 0.5787
Epoch 152/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0174 -
f1_score: 0.6903 - val_loss: 1.5324 - val_f1_score: 0.5815
Epoch 153/500
28/28 [==============================] - 3s 102ms/step - loss: 1.0299 -
f1_score: 0.6799 - val_loss: 1.4066 - val_f1_score: 0.6121
Epoch 154/500
28/28 [==============================] - 3s 108ms/step - loss: 1.0083 -
f1_score: 0.6891 - val_loss: 1.3948 - val_f1_score: 0.6191
Epoch 155/500
28/28 [==============================] - 3s 114ms/step - loss: 1.0167 -
f1_score: 0.6915 - val_loss: 1.5111 - val_f1_score: 0.5753
Epoch 156/500
28/28 [==============================] - 3s 102ms/step - loss: 1.0307 -
f1_score: 0.6736 - val_loss: 1.4217 - val_f1_score: 0.6257
Epoch 157/500
28/28 [==============================] - 3s 101ms/step - loss: 1.0119 -
f1_score: 0.6888 - val_loss: 1.3823 - val_f1_score: 0.6198
Epoch 158/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9814 -
f1_score: 0.6974 - val_loss: 1.4730 - val_f1_score: 0.5851
Epoch 159/500
28/28 [==============================] - 3s 107ms/step - loss: 1.0034 -
f1_score: 0.6956 - val_loss: 1.5203 - val_f1_score: 0.6019
Epoch 160/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9987 -
f1_score: 0.7048 - val_loss: 1.4005 - val_f1_score: 0.6226
Epoch 161/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9906 -
```

```
f1_score: 0.6864 - val_loss: 1.3938 - val_f1_score: 0.6099
Epoch 162/500
28/28 [==============================] - 3s 100ms/step - loss: 0.9736 -
f1_score: 0.7012 - val_loss: 1.3672 - val_f1_score: 0.6258
Epoch 163/500
28/28 [==============================] - 3s 100ms/step - loss: 0.9604 -
f1_score: 0.7106 - val_loss: 1.3999 - val_f1_score: 0.6074
Epoch 164/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9594 -
f1_score: 0.7124 - val_loss: 1.4862 - val_f1_score: 0.6046
Epoch 165/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9476 -
f1_score: 0.7077 - val_loss: 1.3431 - val_f1_score: 0.6324
Epoch 166/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9589 -
f1_score: 0.7107 - val_loss: 1.3742 - val_f1_score: 0.6402
Epoch 167/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9487 -
f1_score: 0.7162 - val_loss: 1.3863 - val_f1_score: 0.6160
Epoch 168/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9277 -
f1_score: 0.7161 - val_loss: 1.4513 - val_f1_score: 0.6067
Epoch 169/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9256 -
f1_score: 0.7167 - val_loss: 1.3855 - val_f1_score: 0.6292
Epoch 170/500
28/28 [==============================] - 3s 102ms/step - loss: 0.9155 -
f1_score: 0.7235 - val_loss: 1.3866 - val_f1_score: 0.6139
Epoch 171/500
28/28 [==============================] - 3s 101ms/step - loss: 0.9126 -
f1_score: 0.7275 - val_loss: 1.3982 - val_f1_score: 0.6214
Epoch 172/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8977 -
f1_score: 0.7287 - val_loss: 1.4340 - val_f1_score: 0.6098
Epoch 173/500
28/28 [==============================] - 3s 103ms/step - loss: 0.9346 -
f1_score: 0.7132 - val_loss: 1.3789 - val_f1_score: 0.6328
Epoch 174/500
28/28 [==============================] - 3s 100ms/step - loss: 0.9159 -
f1_score: 0.7178 - val_loss: 1.4289 - val_f1_score: 0.6460
Epoch 175/500
28/28 [==============================] - 3s 102ms/step - loss: 0.8821 -
f1_score: 0.7342 - val_loss: 1.4447 - val_f1_score: 0.5790
Epoch 176/500
28/28 [==============================] - 3s 100ms/step - loss: 0.9376 -
f1_score: 0.7048 - val_loss: 1.4239 - val_f1_score: 0.6256
Epoch 177/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8772 -
```

```
f1_score: 0.7309 - val_loss: 1.5263 - val_f1_score: 0.5816
Epoch 178/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8680 -
f1_score: 0.7439 - val_loss: 1.3805 - val_f1_score: 0.6196
Epoch 179/500
28/28 [==============================] - 3s 102ms/step - loss: 0.8599 -
f1_score: 0.7470 - val_loss: 1.3427 - val_f1_score: 0.6341
Epoch 180/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8669 -
f1_score: 0.7341 - val_loss: 1.3829 - val_f1_score: 0.6334
Epoch 181/500
28/28 [==============================] - 3s 102ms/step - loss: 0.8941 -
f1_score: 0.7214 - val_loss: 1.3908 - val_f1_score: 0.6517
Epoch 182/500
28/28 [==============================] - 3s 102ms/step - loss: 0.8591 -
f1_score: 0.7345 - val_loss: 1.3218 - val_f1_score: 0.6556
Epoch 183/500
28/28 [==============================] - 3s 105ms/step - loss: 0.8510 -
f1_score: 0.7363 - val_loss: 1.3476 - val_f1_score: 0.6494
Epoch 184/500
28/28 [==============================] - 3s 100ms/step - loss: 0.8378 -
f1_score: 0.7482 - val_loss: 1.4044 - val_f1_score: 0.6128
Epoch 185/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8270 -
f1_score: 0.7497 - val_loss: 1.3851 - val_f1_score: 0.6369
Epoch 186/500
28/28 [==============================] - 3s 112ms/step - loss: 0.8060 -
f1_score: 0.7585 - val_loss: 1.3021 - val_f1_score: 0.6803
Epoch 187/500
28/28 [==============================] - 3s 100ms/step - loss: 0.8307 -
f1_score: 0.7465 - val_loss: 1.3363 - val_f1_score: 0.6505
Epoch 188/500
28/28 [==============================] - 3s 107ms/step - loss: 0.8353 -
f1_score: 0.7474 - val_loss: 1.3695 - val_f1_score: 0.6382
Epoch 189/500
28/28 [==============================] - 3s 102ms/step - loss: 0.8188 -
f1_score: 0.7505 - val_loss: 1.3619 - val_f1_score: 0.6423
Epoch 190/500
28/28 [==============================] - 3s 110ms/step - loss: 0.8277 -
f1_score: 0.7466 - val_loss: 1.3896 - val_f1_score: 0.6125
Epoch 191/500
28/28 [==============================] - 3s 108ms/step - loss: 0.8355 -
f1_score: 0.7435 - val_loss: 1.3970 - val_f1_score: 0.6208
Epoch 192/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8053 -
f1_score: 0.7623 - val_loss: 1.3815 - val_f1_score: 0.6237
Epoch 193/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8150 -
```

```
f1_score: 0.7573 - val_loss: 1.3617 - val_f1_score: 0.6600
Epoch 194/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7955 -
f1_score: 0.7548 - val_loss: 1.3283 - val_f1_score: 0.6586
Epoch 195/500
28/28 [==============================] - 3s 101ms/step - loss: 0.8023 -
f1_score: 0.7528 - val_loss: 1.3035 - val_f1_score: 0.6827
Epoch 196/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7871 -
f1_score: 0.7653 - val_loss: 1.2809 - val_f1_score: 0.6634
Epoch 197/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7392 -
f1_score: 0.7778 - val_loss: 1.3316 - val_f1_score: 0.6432
Epoch 198/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7506 -
f1_score: 0.7748 - val_loss: 1.3669 - val_f1_score: 0.6320
Epoch 199/500
28/28 [==============================] - 3s 100ms/step - loss: 0.7890 -
f1_score: 0.7567 - val_loss: 1.4307 - val_f1_score: 0.6296
Epoch 200/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7754 -
f1_score: 0.7650 - val_loss: 1.3372 - val_f1_score: 0.6421
Epoch 201/500
28/28 [==============================] - 3s 102ms/step - loss: 0.7883 -
f1_score: 0.7604 - val_loss: 1.3165 - val_f1_score: 0.6742
Epoch 202/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7727 -
f1_score: 0.7628 - val_loss: 1.4614 - val_f1_score: 0.6203
Epoch 203/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7784 -
f1_score: 0.7588 - val_loss: 1.3848 - val_f1_score: 0.6528
Epoch 204/500
28/28 [==============================] - 3s 102ms/step - loss: 0.7482 -
f1_score: 0.7695 - val_loss: 1.3396 - val_f1_score: 0.6593
Epoch 205/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7406 -
f1_score: 0.7758 - val_loss: 1.3825 - val_f1_score: 0.6527
Epoch 206/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7547 -
f1_score: 0.7696 - val_loss: 1.2606 - val_f1_score: 0.6939
Epoch 207/500
28/28 [==============================] - 3s 101ms/step - loss: 0.7180 -
f1_score: 0.7876 - val_loss: 1.3006 - val_f1_score: 0.6609
Epoch 208/500
28/28 [==============================] - 3s 106ms/step - loss: 0.7219 -
f1_score: 0.7743 - val_loss: 1.3535 - val_f1_score: 0.6412
Epoch 209/500
28/28 [==============================] - 3s 104ms/step - loss: 0.7525 -
```

```
f1_score: 0.7765 - val_loss: 1.4097 - val_f1_score: 0.6405
Epoch 210/500
28/28 [==============================] - 3s 104ms/step - loss: 0.7214 -
f1_score: 0.7789 - val_loss: 1.3495 - val_f1_score: 0.6432
Epoch 211/500
28/28 [==============================] - 3s 102ms/step - loss: 0.7189 -
f1_score: 0.7785 - val_loss: 1.3061 - val_f1_score: 0.6595
Epoch 212/500
28/28 [==============================] - 3s 100ms/step - loss: 0.7406 -
f1_score: 0.7740 - val_loss: 1.3144 - val_f1_score: 0.6453
Epoch 213/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7141 -
f1_score: 0.7771 - val_loss: 1.2963 - val_f1_score: 0.6821
Epoch 214/500
28/28 [==============================] - 3s 115ms/step - loss: 0.7003 -
f1_score: 0.7917 - val_loss: 1.3373 - val_f1_score: 0.6545
Epoch 215/500
28/28 [==============================] - 3s 98ms/step - loss: 0.7100 - f1_score:
0.7838 - val_loss: 1.2830 - val_f1_score: 0.6831
Epoch 216/500
28/28 [==============================] - 3s 99ms/step - loss: 0.7088 - f1_score:
0.7843 - val_loss: 1.3384 - val_f1_score: 0.6797
Epoch 217/500
28/28 [==============================] - 3s 99ms/step - loss: 0.7031 - f1_score:
0.7871 - val_loss: 1.3250 - val_f1_score: 0.6866
Epoch 218/500
28/28 [==============================] - 3s 99ms/step - loss: 0.7252 - f1_score:
0.7753 - val_loss: 1.3944 - val_f1_score: 0.6531
Epoch 219/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6891 - f1_score:
0.7888 - val_loss: 1.5129 - val_f1_score: 0.6269
Epoch 220/500
28/28 [==============================] - 3s 99ms/step - loss: 0.7175 - f1_score:
0.7737 - val_loss: 1.3621 - val_f1_score: 0.6540
Epoch 221/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6453 - f1_score:
0.8077 - val_loss: 1.3664 - val_f1_score: 0.6595
Epoch 222/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6778 - f1_score:
0.7920 - val_loss: 1.3366 - val_f1_score: 0.6591
Epoch 223/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6740 - f1_score:
0.7912 - val_loss: 1.3119 - val_f1_score: 0.6694
Epoch 224/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6750 - f1_score:
0.7993 - val_loss: 1.3749 - val_f1_score: 0.6653
Epoch 225/500
28/28 [==============================] - 3s 98ms/step - loss: 0.6610 - f1_score:
```

```
0.7974 - val_loss: 1.3542 - val_f1_score: 0.6627
Epoch 226/500
28/28 [==============================] - 3s 101ms/step - loss: 0.6678 -
f1_score: 0.8048 - val_loss: 1.3342 - val_f1_score: 0.6705
Epoch 227/500
28/28 [==============================] - 3s 112ms/step - loss: 0.6564 -
f1_score: 0.8088 - val_loss: 1.2534 - val_f1_score: 0.6879
Epoch 228/500
28/28 [==============================] - 3s 101ms/step - loss: 0.6288 -
f1_score: 0.8100 - val_loss: 1.3585 - val_f1_score: 0.6388
Epoch 229/500
28/28 [==============================] - 3s 105ms/step - loss: 0.6470 -
f1_score: 0.8111 - val_loss: 1.3806 - val_f1_score: 0.6639
Epoch 230/500
28/28 [==============================] - 3s 105ms/step - loss: 0.6627 -
f1_score: 0.8057 - val_loss: 1.2660 - val_f1_score: 0.6786
Epoch 231/500
28/28 [==============================] - 3s 101ms/step - loss: 0.6335 -
f1_score: 0.8188 - val_loss: 1.3085 - val_f1_score: 0.6970
Epoch 232/500
28/28 [==============================] - 3s 105ms/step - loss: 0.6558 -
f1_score: 0.8010 - val_loss: 1.2990 - val_f1_score: 0.6727
Epoch 233/500
28/28 [==============================] - 3s 103ms/step - loss: 0.6165 -
f1_score: 0.8230 - val_loss: 1.2746 - val_f1_score: 0.6679
Epoch 234/500
28/28 [==============================] - 3s 100ms/step - loss: 0.6195 -
f1_score: 0.8109 - val_loss: 1.2716 - val_f1_score: 0.6670
Epoch 235/500
28/28 [==============================] - 3s 100ms/step - loss: 0.6417 -
f1_score: 0.8026 - val_loss: 1.3599 - val_f1_score: 0.6471
Epoch 236/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6227 -
f1_score: 0.8169 - val_loss: 1.3744 - val_f1_score: 0.6593
Epoch 237/500
28/28 [==============================] - 3s 106ms/step - loss: 0.6270 -
f1_score: 0.8133 - val_loss: 1.4233 - val_f1_score: 0.6208
Epoch 238/500
28/28 [==============================] - 3s 105ms/step - loss: 0.6200 -
f1_score: 0.8125 - val_loss: 1.3195 - val_f1_score: 0.6595
Epoch 239/500
28/28 [==============================] - 3s 108ms/step - loss: 0.6069 -
f1_score: 0.8267 - val_loss: 1.3394 - val_f1_score: 0.6359
Epoch 240/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5967 -
f1_score: 0.8207 - val_loss: 1.2884 - val_f1_score: 0.6812
Epoch 241/500
28/28 [==============================] - 3s 119ms/step - loss: 0.6018 -
```

```
f1_score: 0.8202 - val_loss: 1.3116 - val_f1_score: 0.6660
Epoch 242/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5945 -
f1_score: 0.8233 - val_loss: 1.3239 - val_f1_score: 0.6479
Epoch 243/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5972 -
f1_score: 0.8146 - val_loss: 1.3211 - val_f1_score: 0.6590
Epoch 244/500
28/28 [==============================] - 3s 108ms/step - loss: 0.5945 -
f1_score: 0.8237 - val_loss: 1.3475 - val_f1_score: 0.6585
Epoch 245/500
28/28 [==============================] - 3s 110ms/step - loss: 0.5665 -
f1_score: 0.8399 - val_loss: 1.2965 - val_f1_score: 0.6883
Epoch 246/500
28/28 [==============================] - 3s 112ms/step - loss: 0.5879 -
f1_score: 0.8191 - val_loss: 1.3880 - val_f1_score: 0.6823
Epoch 247/500
28/28 [==============================] - 3s 112ms/step - loss: 0.5972 -
f1_score: 0.8208 - val_loss: 1.3331 - val_f1_score: 0.6896
Epoch 248/500
28/28 [==============================] - 3s 105ms/step - loss: 0.5783 -
f1_score: 0.8246 - val_loss: 1.3219 - val_f1_score: 0.6623
Epoch 249/500
28/28 [==============================] - 3s 103ms/step - loss: 0.5523 -
f1_score: 0.8465 - val_loss: 1.3124 - val_f1_score: 0.6780
Epoch 250/500
28/28 [==============================] - 3s 102ms/step - loss: 0.5727 -
f1_score: 0.8305 - val_loss: 1.2582 - val_f1_score: 0.6785
Epoch 251/500
28/28 [==============================] - 3s 109ms/step - loss: 0.5629 -
f1_score: 0.8375 - val_loss: 1.3496 - val_f1_score: 0.6855
Epoch 252/500
28/28 [==============================] - 3s 110ms/step - loss: 0.5645 -
f1_score: 0.8355 - val_loss: 1.3797 - val_f1_score: 0.6782
Epoch 253/500
28/28 [==============================] - 3s 112ms/step - loss: 0.5645 -
f1_score: 0.8394 - val_loss: 1.2880 - val_f1_score: 0.6830
Epoch 254/500
28/28 [==============================] - 3s 102ms/step - loss: 0.5682 -
f1_score: 0.8313 - val_loss: 1.2823 - val_f1_score: 0.6949
Epoch 255/500
28/28 [==============================] - 3s 101ms/step - loss: 0.5709 -
f1_score: 0.8400 - val_loss: 1.2945 - val_f1_score: 0.6835
Epoch 256/500
28/28 [==============================] - 3s 109ms/step - loss: 0.5572 -
f1_score: 0.8415 - val_loss: 1.3709 - val_f1_score: 0.6755
Epoch 257/500
28/28 [==============================] - 3s 116ms/step - loss: 0.5393 -
```

```
f1_score: 0.8359 - val_loss: 1.2911 - val_f1_score: 0.6758
Epoch 258/500
28/28 [==============================] - 3s 106ms/step - loss: 0.5528 -
f1_score: 0.8358 - val_loss: 1.3790 - val_f1_score: 0.6668
Epoch 259/500
28/28 [==============================] - 3s 101ms/step - loss: 0.5553 -
f1_score: 0.8273 - val_loss: 1.3132 - val_f1_score: 0.6752
Epoch 260/500
28/28 [==============================] - 3s 106ms/step - loss: 0.5381 -
f1_score: 0.8506 - val_loss: 1.3047 - val_f1_score: 0.6795
Epoch 261/500
28/28 [==============================] - 3s 103ms/step - loss: 0.5209 -
f1_score: 0.8467 - val_loss: 1.3087 - val_f1_score: 0.7204
Epoch 262/500
28/28 [==============================] - 3s 103ms/step - loss: 0.5496 -
f1_score: 0.8368 - val_loss: 1.3005 - val_f1_score: 0.6997
Epoch 263/500
28/28 [==============================] - 3s 108ms/step - loss: 0.5352 -
f1_score: 0.8504 - val_loss: 1.3237 - val_f1_score: 0.6817
Epoch 264/500
28/28 [==============================] - 3s 99ms/step - loss: 0.5233 - f1_score:
0.8527 - val_loss: 1.2959 - val_f1_score: 0.6931
Epoch 265/500
28/28 [==============================] - 3s 101ms/step - loss: 0.5400 -
f1_score: 0.8423 - val_loss: 1.3256 - val_f1_score: 0.6805
Epoch 266/500
28/28 [==============================] - 3s 103ms/step - loss: 0.5446 -
f1_score: 0.8378 - val_loss: 1.4272 - val_f1_score: 0.6427
Epoch 267/500
28/28 [==============================] - 3s 100ms/step - loss: 0.5317 -
f1_score: 0.8488 - val_loss: 1.4023 - val_f1_score: 0.6568
Epoch 268/500
28/28 [==============================] - 3s 104ms/step - loss: 0.5261 -
f1_score: 0.8464 - val_loss: 1.3538 - val_f1_score: 0.6746
Epoch 269/500
28/28 [==============================] - 3s 101ms/step - loss: 0.5021 -
f1_score: 0.8509 - val_loss: 1.3044 - val_f1_score: 0.7070
Epoch 270/500
28/28 [==============================] - 3s 102ms/step - loss: 0.5113 -
f1_score: 0.8624 - val_loss: 1.3235 - val_f1_score: 0.6881
Epoch 271/500
28/28 [==============================] - 3s 101ms/step - loss: 0.4973 -
f1_score: 0.8519 - val_loss: 1.3910 - val_f1_score: 0.6646
Epoch 272/500
28/28 [==============================] - 3s 102ms/step - loss: 0.5133 -
f1_score: 0.8479 - val_loss: 1.4418 - val_f1_score: 0.6672
Epoch 273/500
28/28 [==============================] - 3s 105ms/step - loss: 0.5160 -
```

```
f1_score: 0.8502 - val_loss: 1.4238 - val_f1_score: 0.6726
Epoch 274/500
28/28 [==============================] - 3s 106ms/step - loss: 0.5037 -
f1_score: 0.8499 - val_loss: 1.3678 - val_f1_score: 0.6979
Epoch 275/500
28/28 [==============================] - 3s 107ms/step - loss: 0.5018 -
f1_score: 0.8618 - val_loss: 1.3652 - val_f1_score: 0.6723
Epoch 276/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4851 -
f1_score: 0.8703 - val_loss: 1.4128 - val_f1_score: 0.6756
Epoch 277/500
28/28 [==============================] - 3s 124ms/step - loss: 0.4764 -
f1_score: 0.8673 - val_loss: 1.4115 - val_f1_score: 0.6895
Epoch 278/500
28/28 [==============================] - 3s 110ms/step - loss: 0.5047 -
f1_score: 0.8549 - val_loss: 1.4242 - val_f1_score: 0.6908
Epoch 279/500
28/28 [==============================] - 3s 105ms/step - loss: 0.5050 -
f1_score: 0.8516 - val_loss: 1.4028 - val_f1_score: 0.6560
Epoch 280/500
28/28 [==============================] - 3s 107ms/step - loss: 0.5006 -
f1_score: 0.8541 - val_loss: 1.4150 - val_f1_score: 0.6553
Epoch 281/500
28/28 [==============================] - 3s 104ms/step - loss: 0.5055 -
f1_score: 0.8477 - val_loss: 1.4337 - val_f1_score: 0.6553
Epoch 282/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4969 - f1_score:
0.8597 - val_loss: 1.3004 - val_f1_score: 0.7177
Epoch 283/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4848 - f1_score:
0.8580 - val_loss: 1.3815 - val_f1_score: 0.6673
Epoch 284/500
28/28 [==============================] - 3s 100ms/step - loss: 0.4940 -
f1_score: 0.8571 - val_loss: 1.2902 - val_f1_score: 0.6875
Epoch 285/500
28/28 [==============================] - 3s 100ms/step - loss: 0.4701 -
f1_score: 0.8615 - val_loss: 1.3898 - val_f1_score: 0.6748
Epoch 286/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4834 - f1_score:
0.8668 - val_loss: 1.3075 - val_f1_score: 0.6623
Epoch 287/500
28/28 [==============================] - 3s 101ms/step - loss: 0.4937 -
f1_score: 0.8587 - val_loss: 1.3418 - val_f1_score: 0.6707
Epoch 288/500
28/28 [==============================] - 4s 128ms/step - loss: 0.4880 -
f1_score: 0.8507 - val_loss: 1.4224 - val_f1_score: 0.6591
Epoch 289/500
28/28 [==============================] - 3s 112ms/step - loss: 0.4374 -
```

```
f1_score: 0.8807 - val_loss: 1.3714 - val_f1_score: 0.6694
Epoch 290/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4434 -
f1_score: 0.8825 - val_loss: 1.3647 - val_f1_score: 0.6638
Epoch 291/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4584 -
f1_score: 0.8735 - val_loss: 1.3789 - val_f1_score: 0.6690
Epoch 292/500
28/28 [==============================] - 3s 104ms/step - loss: 0.4579 -
f1_score: 0.8759 - val_loss: 1.2967 - val_f1_score: 0.6808
Epoch 293/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4434 -
f1_score: 0.8752 - val_loss: 1.3830 - val_f1_score: 0.6729
Epoch 294/500
28/28 [==============================] - 3s 106ms/step - loss: 0.4501 -
f1_score: 0.8789 - val_loss: 1.2974 - val_f1_score: 0.6996
Epoch 295/500
28/28 [==============================] - 3s 102ms/step - loss: 0.4703 -
f1_score: 0.8645 - val_loss: 1.3167 - val_f1_score: 0.6766
Epoch 296/500
28/28 [==============================] - 3s 106ms/step - loss: 0.4530 -
f1_score: 0.8721 - val_loss: 1.3696 - val_f1_score: 0.6460
Epoch 297/500
28/28 [==============================] - 3s 109ms/step - loss: 0.4488 -
f1_score: 0.8756 - val_loss: 1.3945 - val_f1_score: 0.6589
Epoch 298/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4336 -
f1_score: 0.8788 - val_loss: 1.4020 - val_f1_score: 0.6945
Epoch 299/500
28/28 [==============================] - 3s 110ms/step - loss: 0.4370 -
f1_score: 0.8797 - val_loss: 1.3806 - val_f1_score: 0.6663
Epoch 300/500
28/28 [==============================] - 3s 110ms/step - loss: 0.4557 -
f1_score: 0.8678 - val_loss: 1.3338 - val_f1_score: 0.6804
Epoch 301/500
28/28 [==============================] - 3s 121ms/step - loss: 0.4442 -
f1_score: 0.8791 - val_loss: 1.3184 - val_f1_score: 0.6869
Epoch 302/500
28/28 [==============================] - 3s 110ms/step - loss: 0.4226 -
f1_score: 0.8801 - val_loss: 1.3847 - val_f1_score: 0.6717
Epoch 303/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4321 -
f1_score: 0.8780 - val_loss: 1.3936 - val_f1_score: 0.6689
Epoch 304/500
28/28 [==============================] - 3s 109ms/step - loss: 0.4123 -
f1_score: 0.8878 - val_loss: 1.3471 - val_f1_score: 0.6818
Epoch 305/500
28/28 [==============================] - 3s 105ms/step - loss: 0.4096 -
```

```
f1_score: 0.8848 - val_loss: 1.3261 - val_f1_score: 0.6836
Epoch 306/500
28/28 [==============================] - 3s 102ms/step - loss: 0.4290 -
f1_score: 0.8835 - val_loss: 1.3165 - val_f1_score: 0.6850
Epoch 307/500
28/28 [==============================] - 3s 106ms/step - loss: 0.4480 -
f1_score: 0.8691 - val_loss: 1.4225 - val_f1_score: 0.6544
Epoch 308/500
28/28 [==============================] - 3s 110ms/step - loss: 0.4363 -
f1_score: 0.8750 - val_loss: 1.4983 - val_f1_score: 0.6687
Epoch 309/500
28/28 [==============================] - 3s 107ms/step - loss: 0.4449 -
f1_score: 0.8761 - val_loss: 1.4142 - val_f1_score: 0.6859
Epoch 310/500
28/28 [==============================] - 3s 103ms/step - loss: 0.4179 -
f1_score: 0.8806 - val_loss: 1.3875 - val_f1_score: 0.6852
Epoch 311/500
28/28 [==============================] - 3s 110ms/step - loss: 0.4163 -
f1_score: 0.8855 - val_loss: 1.3752 - val_f1_score: 0.6838
Epoch 312/500
28/28 [==============================] - 3s 108ms/step - loss: 0.4000 -
f1_score: 0.8910 - val_loss: 1.3672 - val_f1_score: 0.6845
Epoch 313/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4335 -
f1_score: 0.8793 - val_loss: 1.4142 - val_f1_score: 0.6628
Epoch 314/500
28/28 [==============================] - 3s 101ms/step - loss: 0.4370 -
f1_score: 0.8773 - val_loss: 1.3419 - val_f1_score: 0.7022
Epoch 315/500
28/28 [==============================] - 3s 100ms/step - loss: 0.4204 -
f1_score: 0.8926 - val_loss: 1.3426 - val_f1_score: 0.6983
Epoch 316/500
28/28 [==============================] - 3s 102ms/step - loss: 0.4109 -
f1_score: 0.8875 - val_loss: 1.4004 - val_f1_score: 0.6945
Epoch 317/500
28/28 [==============================] - 3s 100ms/step - loss: 0.4044 -
f1_score: 0.8867 - val_loss: 1.4185 - val_f1_score: 0.6753
Epoch 318/500
28/28 [==============================] - 3s 102ms/step - loss: 0.3916 -
f1_score: 0.8980 - val_loss: 1.4182 - val_f1_score: 0.6916
Epoch 319/500
28/28 [==============================] - 3s 106ms/step - loss: 0.3917 -
f1_score: 0.8901 - val_loss: 1.4045 - val_f1_score: 0.6693
Epoch 320/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3982 -
f1_score: 0.8912 - val_loss: 1.3554 - val_f1_score: 0.6750
Epoch 321/500
28/28 [==============================] - 3s 102ms/step - loss: 0.4025 -
```

```
f1_score: 0.8931 - val_loss: 1.3308 - val_f1_score: 0.6985
Epoch 322/500
28/28 [==============================] - 3s 111ms/step - loss: 0.4114 -
f1_score: 0.8859 - val_loss: 1.4259 - val_f1_score: 0.6722
Epoch 323/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3854 -
f1_score: 0.8952 - val_loss: 1.3762 - val_f1_score: 0.6846
Epoch 324/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3966 - f1_score:
0.8944 - val_loss: 1.3676 - val_f1_score: 0.6895
Epoch 325/500
28/28 [==============================] - 3s 113ms/step - loss: 0.3834 -
f1_score: 0.8877 - val_loss: 1.4966 - val_f1_score: 0.6464
Epoch 326/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3909 -
f1_score: 0.8996 - val_loss: 1.3921 - val_f1_score: 0.6678
Epoch 327/500
28/28 [==============================] - 3s 102ms/step - loss: 0.3935 -
f1_score: 0.8879 - val_loss: 1.3823 - val_f1_score: 0.6638
Epoch 328/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3803 -
f1_score: 0.8995 - val_loss: 1.4733 - val_f1_score: 0.6573
Epoch 329/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3873 -
f1_score: 0.8922 - val_loss: 1.3745 - val_f1_score: 0.6595
Epoch 330/500
28/28 [==============================] - 3s 102ms/step - loss: 0.3750 -
f1_score: 0.9029 - val_loss: 1.4158 - val_f1_score: 0.6578
Epoch 331/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3602 - f1_score:
0.9078 - val_loss: 1.4235 - val_f1_score: 0.6602
Epoch 332/500
28/28 [==============================] - 3s 126ms/step - loss: 0.3631 -
f1_score: 0.9014 - val_loss: 1.3830 - val_f1_score: 0.6566
Epoch 333/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3825 -
f1_score: 0.8998 - val_loss: 1.3445 - val_f1_score: 0.6892
Epoch 334/500
28/28 [==============================] - 3s 109ms/step - loss: 0.3985 -
f1_score: 0.8912 - val_loss: 1.4322 - val_f1_score: 0.6969
Epoch 335/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3937 -
f1_score: 0.8851 - val_loss: 1.3900 - val_f1_score: 0.6707
Epoch 336/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3575 -
f1_score: 0.9036 - val_loss: 1.4185 - val_f1_score: 0.6634
Epoch 337/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3774 -
```

```
f1_score: 0.8942 - val_loss: 1.4656 - val_f1_score: 0.6577
Epoch 338/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3776 -
f1_score: 0.9018 - val_loss: 1.4652 - val_f1_score: 0.6942
Epoch 339/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3787 -
f1_score: 0.8967 - val_loss: 1.3950 - val_f1_score: 0.6844
Epoch 340/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3810 -
f1_score: 0.8962 - val_loss: 1.4113 - val_f1_score: 0.6783
Epoch 341/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3726 -
f1_score: 0.8989 - val_loss: 1.4269 - val_f1_score: 0.6452
Epoch 342/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3822 - f1_score:
0.9002 - val_loss: 1.4589 - val_f1_score: 0.6695
Epoch 343/500
28/28 [==============================] - 3s 105ms/step - loss: 0.3765 -
f1_score: 0.8997 - val_loss: 1.4620 - val_f1_score: 0.6578
Epoch 344/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3407 -
f1_score: 0.9127 - val_loss: 1.5414 - val_f1_score: 0.6657
Epoch 345/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3565 -
f1_score: 0.9062 - val_loss: 1.4847 - val_f1_score: 0.6748
Epoch 346/500
28/28 [==============================] - 3s 102ms/step - loss: 0.3493 -
f1_score: 0.9100 - val_loss: 1.4378 - val_f1_score: 0.6702
Epoch 347/500
28/28 [==============================] - 3s 113ms/step - loss: 0.3476 -
f1_score: 0.9072 - val_loss: 1.4907 - val_f1_score: 0.6655
Epoch 348/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3431 -
f1_score: 0.9077 - val_loss: 1.5026 - val_f1_score: 0.6754
Epoch 349/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3295 -
f1_score: 0.9166 - val_loss: 1.3422 - val_f1_score: 0.6809
Epoch 350/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3722 -
f1_score: 0.8992 - val_loss: 1.4504 - val_f1_score: 0.6737
Epoch 351/500
28/28 [==============================] - 3s 107ms/step - loss: 0.3520 -
f1_score: 0.8994 - val_loss: 1.4318 - val_f1_score: 0.6429
Epoch 352/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3568 -
f1_score: 0.9014 - val_loss: 1.4520 - val_f1_score: 0.6697
Epoch 353/500
28/28 [==============================] - 4s 126ms/step - loss: 0.3536 -
```

```
f1_score: 0.9037 - val_loss: 1.4828 - val_f1_score: 0.6780
Epoch 354/500
28/28 [==============================] - 3s 120ms/step - loss: 0.3500 -
f1_score: 0.9050 - val_loss: 1.4881 - val_f1_score: 0.6424
Epoch 355/500
28/28 [==============================] - 3s 115ms/step - loss: 0.3332 -
f1_score: 0.9124 - val_loss: 1.4943 - val_f1_score: 0.6664
Epoch 356/500
28/28 [==============================] - 3s 112ms/step - loss: 0.3497 -
f1_score: 0.9045 - val_loss: 1.3875 - val_f1_score: 0.6849
Epoch 357/500
28/28 [==============================] - 4s 126ms/step - loss: 0.3186 -
f1_score: 0.9182 - val_loss: 1.4019 - val_f1_score: 0.6734
Epoch 358/500
28/28 [==============================] - 4s 136ms/step - loss: 0.3308 -
f1_score: 0.9124 - val_loss: 1.4239 - val_f1_score: 0.6629
Epoch 359/500
28/28 [==============================] - 4s 142ms/step - loss: 0.3247 -
f1_score: 0.9134 - val_loss: 1.4435 - val_f1_score: 0.6867
Epoch 360/500
28/28 [==============================] - 4s 134ms/step - loss: 0.3349 -
f1_score: 0.9109 - val_loss: 1.3981 - val_f1_score: 0.6722
Epoch 361/500
28/28 [==============================] - 4s 131ms/step - loss: 0.3367 -
f1_score: 0.9123 - val_loss: 1.4632 - val_f1_score: 0.6695
Epoch 362/500
28/28 [==============================] - 4s 131ms/step - loss: 0.3227 -
f1_score: 0.9189 - val_loss: 1.5524 - val_f1_score: 0.6799
Epoch 363/500
28/28 [==============================] - 3s 112ms/step - loss: 0.3278 -
f1_score: 0.9159 - val_loss: 1.4664 - val_f1_score: 0.6712
Epoch 364/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3355 -
f1_score: 0.9086 - val_loss: 1.3735 - val_f1_score: 0.6855
Epoch 365/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3223 -
f1_score: 0.9164 - val_loss: 1.4131 - val_f1_score: 0.6718
Epoch 366/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3482 -
f1_score: 0.9052 - val_loss: 1.5092 - val_f1_score: 0.7004
Epoch 367/500
28/28 [==============================] - 3s 107ms/step - loss: 0.3379 -
f1_score: 0.9112 - val_loss: 1.5698 - val_f1_score: 0.6641
Epoch 368/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3271 -
f1_score: 0.9183 - val_loss: 1.5216 - val_f1_score: 0.6818
Epoch 369/500
28/28 [==============================] - 3s 106ms/step - loss: 0.3187 -
```

```
f1_score: 0.9191 - val_loss: 1.4989 - val_f1_score: 0.6905
Epoch 370/500
28/28 [==============================] - 3s 125ms/step - loss: 0.3217 -
f1_score: 0.9175 - val_loss: 1.4462 - val_f1_score: 0.7042
Epoch 371/500
28/28 [==============================] - 3s 110ms/step - loss: 0.3248 -
f1_score: 0.9102 - val_loss: 1.4500 - val_f1_score: 0.6995
Epoch 372/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3012 -
f1_score: 0.9230 - val_loss: 1.5226 - val_f1_score: 0.6896
Epoch 373/500
28/28 [==============================] - 3s 110ms/step - loss: 0.3196 -
f1_score: 0.9203 - val_loss: 1.4572 - val_f1_score: 0.6773
Epoch 374/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3259 -
f1_score: 0.9109 - val_loss: 1.4583 - val_f1_score: 0.7013
Epoch 375/500
28/28 [==============================] - 3s 113ms/step - loss: 0.3141 -
f1_score: 0.9200 - val_loss: 1.5603 - val_f1_score: 0.6468
Epoch 376/500
28/28 [==============================] - 3s 112ms/step - loss: 0.3200 -
f1_score: 0.9155 - val_loss: 1.4261 - val_f1_score: 0.6733
Epoch 377/500
28/28 [==============================] - 3s 115ms/step - loss: 0.3191 -
f1_score: 0.9163 - val_loss: 1.4465 - val_f1_score: 0.6913
Epoch 378/500
28/28 [==============================] - 3s 116ms/step - loss: 0.3031 -
f1_score: 0.9256 - val_loss: 1.4359 - val_f1_score: 0.6638
Epoch 379/500
28/28 [==============================] - 3s 117ms/step - loss: 0.3229 -
f1_score: 0.9180 - val_loss: 1.4758 - val_f1_score: 0.6392
Epoch 380/500
28/28 [==============================] - 4s 127ms/step - loss: 0.3006 -
f1_score: 0.9202 - val_loss: 1.4394 - val_f1_score: 0.6718
Epoch 381/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3236 -
f1_score: 0.9226 - val_loss: 1.5310 - val_f1_score: 0.6527
Epoch 382/500
28/28 [==============================] - 4s 132ms/step - loss: 0.3117 -
f1_score: 0.9215 - val_loss: 1.5013 - val_f1_score: 0.7066
Epoch 383/500
28/28 [==============================] - 3s 118ms/step - loss: 0.3099 -
f1_score: 0.9232 - val_loss: 1.5063 - val_f1_score: 0.6822
Epoch 384/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2982 -
f1_score: 0.9218 - val_loss: 1.5514 - val_f1_score: 0.6825
Epoch 385/500
28/28 [==============================] - 3s 113ms/step - loss: 0.3037 -
```

```
f1_score: 0.9223 - val_loss: 1.5126 - val_f1_score: 0.6458
Epoch 386/500
28/28 [==============================] - 3s 111ms/step - loss: 0.3200 -
f1_score: 0.9145 - val_loss: 1.5062 - val_f1_score: 0.6629
Epoch 387/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2909 -
f1_score: 0.9305 - val_loss: 1.4757 - val_f1_score: 0.6767
Epoch 388/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2915 -
f1_score: 0.9247 - val_loss: 1.4855 - val_f1_score: 0.6463
Epoch 389/500
28/28 [==============================] - 3s 118ms/step - loss: 0.2977 -
f1_score: 0.9234 - val_loss: 1.5354 - val_f1_score: 0.6567
Epoch 390/500
28/28 [==============================] - 3s 117ms/step - loss: 0.2792 -
f1_score: 0.9379 - val_loss: 1.5325 - val_f1_score: 0.6766
Epoch 391/500
28/28 [==============================] - 3s 117ms/step - loss: 0.2833 -
f1_score: 0.9277 - val_loss: 1.5106 - val_f1_score: 0.6972
Epoch 392/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3040 -
f1_score: 0.9262 - val_loss: 1.5272 - val_f1_score: 0.6648
Epoch 393/500
28/28 [==============================] - 3s 118ms/step - loss: 0.2893 -
f1_score: 0.9313 - val_loss: 1.5433 - val_f1_score: 0.6892
Epoch 394/500
28/28 [==============================] - 3s 119ms/step - loss: 0.2995 -
f1_score: 0.9220 - val_loss: 1.5123 - val_f1_score: 0.6855
Epoch 395/500
28/28 [==============================] - 4s 133ms/step - loss: 0.2917 -
f1_score: 0.9201 - val_loss: 1.4702 - val_f1_score: 0.6647
Epoch 396/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2977 -
f1_score: 0.9278 - val_loss: 1.4810 - val_f1_score: 0.6779
Epoch 397/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2918 -
f1_score: 0.9198 - val_loss: 1.4894 - val_f1_score: 0.7040
Epoch 398/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2876 -
f1_score: 0.9258 - val_loss: 1.5530 - val_f1_score: 0.6729
Epoch 399/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3053 -
f1_score: 0.9226 - val_loss: 1.5254 - val_f1_score: 0.6694
Epoch 400/500
28/28 [==============================] - 3s 120ms/step - loss: 0.2769 -
f1_score: 0.9376 - val_loss: 1.4583 - val_f1_score: 0.6812
Epoch 401/500
28/28 [==============================] - 3s 117ms/step - loss: 0.3181 -
```

```
f1_score: 0.9152 - val_loss: 1.4990 - val_f1_score: 0.6974
Epoch 402/500
28/28 [==============================] - 3s 119ms/step - loss: 0.3042 -
f1_score: 0.9271 - val_loss: 1.4512 - val_f1_score: 0.6909
Epoch 403/500
28/28 [==============================] - 3s 120ms/step - loss: 0.2596 -
f1_score: 0.9390 - val_loss: 1.5193 - val_f1_score: 0.6742
Epoch 404/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2725 -
f1_score: 0.9355 - val_loss: 1.5188 - val_f1_score: 0.6851
Epoch 405/500
28/28 [==============================] - 3s 124ms/step - loss: 0.2905 -
f1_score: 0.9307 - val_loss: 1.6439 - val_f1_score: 0.6383
Epoch 406/500
28/28 [==============================] - 3s 118ms/step - loss: 0.2895 -
f1_score: 0.9287 - val_loss: 1.5473 - val_f1_score: 0.7015
Epoch 407/500
28/28 [==============================] - 3s 118ms/step - loss: 0.2813 -
f1_score: 0.9326 - val_loss: 1.6461 - val_f1_score: 0.6559
Epoch 408/500
28/28 [==============================] - 4s 134ms/step - loss: 0.2657 -
f1_score: 0.9362 - val_loss: 1.5047 - val_f1_score: 0.6576
Epoch 409/500
28/28 [==============================] - 3s 119ms/step - loss: 0.2720 -
f1_score: 0.9379 - val_loss: 1.4546 - val_f1_score: 0.6735
Epoch 410/500
28/28 [==============================] - 3s 117ms/step - loss: 0.2568 -
f1_score: 0.9401 - val_loss: 1.4224 - val_f1_score: 0.7000
Epoch 411/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2644 -
f1_score: 0.9325 - val_loss: 1.4559 - val_f1_score: 0.6716
Epoch 412/500
28/28 [==============================] - 3s 116ms/step - loss: 0.2666 -
f1_score: 0.9361 - val_loss: 1.6269 - val_f1_score: 0.6502
Epoch 413/500
28/28 [==============================] - 4s 127ms/step - loss: 0.2826 -
f1_score: 0.9307 - val_loss: 1.4576 - val_f1_score: 0.6750
Epoch 414/500
28/28 [==============================] - 4s 136ms/step - loss: 0.2790 -
f1_score: 0.9353 - val_loss: 1.5402 - val_f1_score: 0.6664
Epoch 415/500
28/28 [==============================] - 4s 133ms/step - loss: 0.2636 -
f1_score: 0.9340 - val_loss: 1.4972 - val_f1_score: 0.6565
Epoch 416/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2746 -
f1_score: 0.9318 - val_loss: 1.4953 - val_f1_score: 0.6552
Epoch 417/500
28/28 [==============================] - 3s 116ms/step - loss: 0.2696 -
```

```
f1_score: 0.9372 - val_loss: 1.6228 - val_f1_score: 0.6690
Epoch 418/500
28/28 [==============================] - 3s 116ms/step - loss: 0.2753 -
f1_score: 0.9252 - val_loss: 1.5359 - val_f1_score: 0.6703
Epoch 419/500
28/28 [==============================] - 3s 120ms/step - loss: 0.2761 -
f1_score: 0.9293 - val_loss: 1.4616 - val_f1_score: 0.6743
Epoch 420/500
28/28 [==============================] - 3s 121ms/step - loss: 0.2534 -
f1_score: 0.9485 - val_loss: 1.5052 - val_f1_score: 0.6875
Epoch 421/500
28/28 [==============================] - 4s 136ms/step - loss: 0.2596 -
f1_score: 0.9364 - val_loss: 1.5718 - val_f1_score: 0.6931
Epoch 422/500
28/28 [==============================] - 3s 117ms/step - loss: 0.2647 -
f1_score: 0.9320 - val_loss: 1.5175 - val_f1_score: 0.6892
Epoch 423/500
28/28 [==============================] - 3s 121ms/step - loss: 0.2391 -
f1_score: 0.9496 - val_loss: 1.5344 - val_f1_score: 0.6863
Epoch 424/500
28/28 [==============================] - 3s 122ms/step - loss: 0.2693 -
f1_score: 0.9344 - val_loss: 1.5473 - val_f1_score: 0.6841
Epoch 425/500
28/28 [==============================] - 5s 168ms/step - loss: 0.2544 -
f1_score: 0.9430 - val_loss: 1.4874 - val_f1_score: 0.6759
Epoch 426/500
28/28 [==============================] - 4s 129ms/step - loss: 0.2503 -
f1_score: 0.9405 - val_loss: 1.5284 - val_f1_score: 0.6714
Epoch 427/500
28/28 [==============================] - 4s 133ms/step - loss: 0.2690 -
f1_score: 0.9330 - val_loss: 1.5232 - val_f1_score: 0.6849
Epoch 428/500
28/28 [==============================] - 4s 146ms/step - loss: 0.2613 -
f1_score: 0.9408 - val_loss: 1.5619 - val_f1_score: 0.6654
Epoch 429/500
28/28 [==============================] - 3s 117ms/step - loss: 0.2666 -
f1_score: 0.9380 - val_loss: 1.4125 - val_f1_score: 0.6949
Epoch 430/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2435 -
f1_score: 0.9445 - val_loss: 1.4769 - val_f1_score: 0.6688
Epoch 431/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2465 -
f1_score: 0.9449 - val_loss: 1.4449 - val_f1_score: 0.6690
Epoch 432/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2501 -
f1_score: 0.9430 - val_loss: 1.5203 - val_f1_score: 0.6765
Epoch 433/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2728 -
```

```
f1_score: 0.9375 - val_loss: 1.4708 - val_f1_score: 0.6834
Epoch 434/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2778 -
f1_score: 0.9310 - val_loss: 1.5245 - val_f1_score: 0.6543
Epoch 435/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2580 -
f1_score: 0.9397 - val_loss: 1.5795 - val_f1_score: 0.6441
Epoch 436/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2542 -
f1_score: 0.9453 - val_loss: 1.5038 - val_f1_score: 0.7113
Epoch 437/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2458 -
f1_score: 0.9423 - val_loss: 1.5497 - val_f1_score: 0.7016
Epoch 438/500
28/28 [==============================] - 3s 123ms/step - loss: 0.2284 -
f1_score: 0.9490 - val_loss: 1.4938 - val_f1_score: 0.6921
Epoch 439/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2636 -
f1_score: 0.9372 - val_loss: 1.4490 - val_f1_score: 0.6748
Epoch 440/500
28/28 [==============================] - 4s 126ms/step - loss: 0.2325 -
f1_score: 0.9482 - val_loss: 1.5213 - val_f1_score: 0.6644
Epoch 441/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2389 -
f1_score: 0.9474 - val_loss: 1.4974 - val_f1_score: 0.6756
Epoch 442/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2360 -
f1_score: 0.9467 - val_loss: 1.5737 - val_f1_score: 0.6839
Epoch 443/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2544 -
f1_score: 0.9418 - val_loss: 1.5124 - val_f1_score: 0.6660
Epoch 444/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2327 -
f1_score: 0.9463 - val_loss: 1.5299 - val_f1_score: 0.6801
Epoch 445/500
28/28 [==============================] - 3s 116ms/step - loss: 0.2371 -
f1_score: 0.9463 - val_loss: 1.4810 - val_f1_score: 0.6899
Epoch 446/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2366 -
f1_score: 0.9435 - val_loss: 1.4957 - val_f1_score: 0.6699
Epoch 447/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2459 -
f1_score: 0.9360 - val_loss: 1.5575 - val_f1_score: 0.6528
Epoch 448/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2379 -
f1_score: 0.9452 - val_loss: 1.5238 - val_f1_score: 0.6859
Epoch 449/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2356 -
```

```
f1_score: 0.9414 - val_loss: 1.7209 - val_f1_score: 0.6579
Epoch 450/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2452 -
f1_score: 0.9400 - val_loss: 1.5368 - val_f1_score: 0.6438
Epoch 451/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2452 -
f1_score: 0.9452 - val_loss: 1.5393 - val_f1_score: 0.6890
Epoch 452/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2309 -
f1_score: 0.9433 - val_loss: 1.5025 - val_f1_score: 0.6949
Epoch 453/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2261 -
f1_score: 0.9458 - val_loss: 1.5567 - val_f1_score: 0.6845
Epoch 454/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2538 -
f1_score: 0.9416 - val_loss: 1.4526 - val_f1_score: 0.6822
Epoch 455/500
28/28 [==============================] - 3s 122ms/step - loss: 0.2267 -
f1_score: 0.9464 - val_loss: 1.5265 - val_f1_score: 0.6725
Epoch 456/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2300 -
f1_score: 0.9422 - val_loss: 1.6003 - val_f1_score: 0.6819
Epoch 457/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2248 -
f1_score: 0.9527 - val_loss: 1.5726 - val_f1_score: 0.6832
Epoch 458/500
28/28 [==============================] - 4s 126ms/step - loss: 0.2529 -
f1_score: 0.9371 - val_loss: 1.5423 - val_f1_score: 0.6784
Epoch 459/500
28/28 [==============================] - 3s 107ms/step - loss: 0.2323 -
f1_score: 0.9483 - val_loss: 1.6266 - val_f1_score: 0.6535
Epoch 460/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2209 -
f1_score: 0.9501 - val_loss: 1.6301 - val_f1_score: 0.6595
Epoch 461/500
28/28 [==============================] - 3s 116ms/step - loss: 0.2324 -
f1_score: 0.9462 - val_loss: 1.5503 - val_f1_score: 0.6937
Epoch 462/500
28/28 [==============================] - 3s 119ms/step - loss: 0.2361 -
f1_score: 0.9449 - val_loss: 1.5871 - val_f1_score: 0.6947
Epoch 463/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2449 -
f1_score: 0.9392 - val_loss: 1.5521 - val_f1_score: 0.6872
Epoch 464/500
28/28 [==============================] - 3s 114ms/step - loss: 0.2566 -
f1_score: 0.9439 - val_loss: 1.5315 - val_f1_score: 0.7000
Epoch 465/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2279 -
```

```
f1_score: 0.9486 - val_loss: 1.6137 - val_f1_score: 0.6771
Epoch 466/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2232 -
f1_score: 0.9480 - val_loss: 1.5697 - val_f1_score: 0.6915
Epoch 467/500
28/28 [==============================] - 3s 110ms/step - loss: 0.2255 -
f1_score: 0.9453 - val_loss: 1.5031 - val_f1_score: 0.7023
Epoch 468/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2181 -
f1_score: 0.9526 - val_loss: 1.5195 - val_f1_score: 0.6842
Epoch 469/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2289 -
f1_score: 0.9430 - val_loss: 1.5580 - val_f1_score: 0.6788
Epoch 470/500
28/28 [==============================] - 3s 124ms/step - loss: 0.2058 -
f1_score: 0.9547 - val_loss: 1.5713 - val_f1_score: 0.6842
Epoch 471/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2258 -
f1_score: 0.9469 - val_loss: 1.5503 - val_f1_score: 0.7015
Epoch 472/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2188 -
f1_score: 0.9483 - val_loss: 1.4524 - val_f1_score: 0.7067
Epoch 473/500
28/28 [==============================] - 3s 115ms/step - loss: 0.2370 -
f1_score: 0.9448 - val_loss: 1.6262 - val_f1_score: 0.6707
Epoch 474/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2455 -
f1_score: 0.9364 - val_loss: 1.6885 - val_f1_score: 0.6311
Epoch 475/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2309 -
f1_score: 0.9498 - val_loss: 1.5416 - val_f1_score: 0.7085
Epoch 476/500
28/28 [==============================] - 3s 110ms/step - loss: 0.2154 -
f1_score: 0.9514 - val_loss: 1.5737 - val_f1_score: 0.6832
Epoch 477/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2136 -
f1_score: 0.9529 - val_loss: 1.5302 - val_f1_score: 0.6994
Epoch 478/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2087 -
f1_score: 0.9557 - val_loss: 1.5243 - val_f1_score: 0.6603
Epoch 479/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2083 -
f1_score: 0.9542 - val_loss: 1.6517 - val_f1_score: 0.6739
Epoch 480/500
28/28 [==============================] - 3s 112ms/step - loss: 0.2018 -
f1_score: 0.9523 - val_loss: 1.5610 - val_f1_score: 0.6561
Epoch 481/500
28/28 [==============================] - 3s 119ms/step - loss: 0.2115 -
```

```
f1_score: 0.9507 - val_loss: 1.5415 - val_f1_score: 0.7084
Epoch 482/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2084 -
f1_score: 0.9552 - val_loss: 1.5955 - val_f1_score: 0.6991
Epoch 483/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2134 -
f1_score: 0.9539 - val_loss: 1.5411 - val_f1_score: 0.6718
Epoch 484/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2159 -
f1_score: 0.9507 - val_loss: 1.5683 - val_f1_score: 0.6879
Epoch 485/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2260 -
f1_score: 0.9463 - val_loss: 1.5770 - val_f1_score: 0.6976
Epoch 486/500
28/28 [==============================] - 3s 110ms/step - loss: 0.2231 -
f1_score: 0.9532 - val_loss: 1.5506 - val_f1_score: 0.6744
Epoch 487/500
28/28 [==============================] - 3s 118ms/step - loss: 0.1938 -
f1_score: 0.9576 - val_loss: 1.5310 - val_f1_score: 0.6797
Epoch 488/500
28/28 [==============================] - 3s 111ms/step - loss: 0.2090 -
f1_score: 0.9551 - val_loss: 1.6556 - val_f1_score: 0.6970
Epoch 489/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2391 -
f1_score: 0.9385 - val_loss: 1.5256 - val_f1_score: 0.6889
Epoch 490/500
28/28 [==============================] - 3s 113ms/step - loss: 0.2079 -
f1_score: 0.9523 - val_loss: 1.5711 - val_f1_score: 0.6775
Epoch 491/500
28/28 [==============================] - 3s 121ms/step - loss: 0.2039 -
f1_score: 0.9592 - val_loss: 1.5811 - val_f1_score: 0.6975
Epoch 492/500
28/28 [==============================] - 3s 123ms/step - loss: 0.2003 -
f1_score: 0.9548 - val_loss: 1.5829 - val_f1_score: 0.6883
Epoch 493/500
28/28 [==============================] - 3s 105ms/step - loss: 0.2012 -
f1_score: 0.9529 - val_loss: 1.5835 - val_f1_score: 0.6992
Epoch 494/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2106 -
f1_score: 0.9532 - val_loss: 1.6836 - val_f1_score: 0.6873
Epoch 495/500
28/28 [==============================] - 3s 109ms/step - loss: 0.1954 -
f1_score: 0.9563 - val_loss: 1.5608 - val_f1_score: 0.6956
Epoch 496/500
28/28 [==============================] - 3s 102ms/step - loss: 0.2027 -
f1_score: 0.9540 - val_loss: 1.5666 - val_f1_score: 0.6985
Epoch 497/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2082 -
```

```
f1_score: 0.9541 - val_loss: 1.6228 - val_f1_score: 0.6942
Epoch 498/500
28/28 [==============================] - 3s 105ms/step - loss: 0.2109 -
f1_score: 0.9474 - val_loss: 1.6700 - val_f1_score: 0.6818
Epoch 499/500
28/28 [==============================] - 3s 103ms/step - loss: 0.2047 -
f1_score: 0.9558 - val_loss: 1.6161 - val_f1_score: 0.6914
Epoch 500/500
28/28 [==============================] - 3s 105ms/step - loss: 0.1954 -
f1_score: 0.9606 - val_loss: 1.5150 - val_f1_score: 0.7061
```

[128]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 12ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      1.000     0.900     0.947        10
         BEE      0.571     0.400     0.471        10
        BELT      1.000     1.000     1.000         4
        BITE      0.600     0.375     0.462         8
   BREAKFAST      1.000     0.333     0.500         6
      CANCER      0.778     0.875     0.824         8
   CHRISTMAS      0.600     1.000     0.750         6
    CONFUSED      0.429     1.000     0.600         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.500     0.333     0.400         6
      DECIDE      0.750     1.000     0.857         6
      DEMAND      0.750     0.750     0.750         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      0.667     0.750     0.706         8
         DOG      0.571     0.667     0.615         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      1.000     0.500     0.667         4
         EAT      1.000     1.000     1.000         6
        EDIT      1.000     1.000     1.000         6
    ELEVATOR      0.455     0.625     0.526         8
        FINE      1.000     0.500     0.667         4
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      0.889     1.000     0.941         8
   HALLOWEEN      0.727     1.000     0.842         8
    HOSPITAL      0.750     0.500     0.600         6
```

```
 HURDLE/TRIP      0.667     0.500     0.571         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.400     0.500     0.444         4
        LOCK      0.714     0.625     0.667         8
       LUNCH      0.444     0.500     0.471         8
       MAPLE      0.750     0.750     0.750         4
        MEAT      0.500     0.667     0.571         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.667     1.000     0.800         8
        NOON      0.727     1.000     0.842         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.667     0.667     0.667         6
       RAZOR      1.000     0.500     0.667         4
       RIVER      0.750     1.000     0.857         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.778     0.700     0.737        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.400     0.500     0.444         4
        THEY      0.571     1.000     0.727         4
       TWINS      0.857     0.750     0.800         8
     WHATFOR      0.714     0.500     0.588        10

    accuracy                          0.725       324
   macro avg      0.740     0.718     0.706       324
weighted avg      0.738     0.725     0.712       324
```

```
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[122]:
```
reconstructed_model = tf.keras.models.load_model("1 1DCNN + 1 GRU Mish")
```

[130]:
```
reconstructed_model.summary()
```

```
Model: "sequential"
```

```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 121, 200)          798200

 max_pooling1d (MaxPooling1D  (None, 24, 200)          0
 )

 dropout (Dropout)           (None, 24, 200)           0

 gru (GRU)                   (None, 125)               122625

 dropout_1 (Dropout)         (None, 125)               0

 dense (Dense)               (None, 110)               13860

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 940,235
Trainable params: 940,235
Non-trainable params: 0
_________________________________________________________________
```

[131]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[131]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 121, 200)
MaxPooling1D
input:
(None, 121, 200)
output:
(None, 24, 200)
Dropout
input:
(None, 24, 200)
output:
(None, 24, 200)
GRU
input:
(None, 24, 200)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[132]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 16ms/step - loss: 1.3768 - f1_score:
0.7321
```

[132]: [1.3768343925476074, 0.7320820689201355]

[133]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 15ms/step - loss: 0.1364 - f1_score:
0.9908
```

[133]: [0.1363527923822403, 0.9908027648925781]

[134]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 12ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.600     1.000     0.750         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      1.000     0.800     0.889        10
        BELT      1.000     1.000     1.000         4
        BITE      0.857     0.750     0.800         8
   BREAKFAST      1.000     1.000     1.000         6
      CANCER      0.714     0.625     0.667         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      1.000     0.500     0.667         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.800     0.500     0.615         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      0.833     0.625     0.714         8
         DOG      0.375     0.500     0.429         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.400     0.500     0.444         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      0.455     0.625     0.526         8
        FINE      0.500     0.500     0.500         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.667     0.667     0.667         6
       GUESS      0.727     1.000     0.842         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.500     0.500     0.500         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.667     0.500     0.571         4
        LOCK      0.600     0.750     0.667         8
       LUNCH      0.857     0.750     0.800         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      1.000     0.667     0.800         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.750     0.857         8
       MOVIE      0.667     1.000     0.800         8
        NOON      0.889     1.000     0.941         8
       PARTY      1.000     0.625     0.769         8
     PATIENT      0.500     0.667     0.571         6
       RAZOR      0.667     0.500     0.571         4
       RIVER      0.500     1.000     0.667         6
ROCKINGCHAIR      0.889     1.000     0.941         8
       SHAVE      0.727     0.800     0.762        10
        SINK      0.200     0.167     0.182         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.667     1.000     0.800         4
       TWINS      0.571     0.500     0.533         8
     WHATFOR      0.857     0.600     0.706        10

    accuracy                          0.753       324
   macro avg      0.758     0.739     0.732       324
weighted avg      0.772     0.753     0.746       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

3.7.1 1 1D-CNN + 1 GRU Trial 593

[ ]:
```
best_model = tuner.get_best_models(num_models=3)[2]
```

[123]:
```
best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-10 14:31:37.264552: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

84/84 [==============================] - 2s 13ms/step - loss: 0.3788 - f1_score:
0.9373
```

[123]:
```
[0.378775417804718, 0.937265157699585]
```

[124]:
```
best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 14ms/step - loss: 1.3141 - f1_score:
0.7039
```

[124]:
```
[1.3140639066696167, 0.7038748860359192]
```

[123]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=3)[2]
```

[124]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1D-CNN + 1 GRU Trial 593/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[251]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - 6s 91ms/step - loss: 4.5026 - f1_score:
0.0197 - val_loss: 4.3038 - val_f1_score: 4.9231e-04
Epoch 2/500
28/28 [==============================] - 2s 55ms/step - loss: 4.3479 - f1_score:
0.0200 - val_loss: 4.2194 - val_f1_score: 0.0018
Epoch 3/500
28/28 [==============================] - 2s 58ms/step - loss: 4.2523 - f1_score:
0.0223 - val_loss: 4.1505 - val_f1_score: 0.0050
Epoch 4/500
```

```
28/28 [==============================] - 2s 56ms/step - loss: 4.1755 - f1_score:
0.0249 - val_loss: 4.0681 - val_f1_score: 0.0044
Epoch 5/500
28/28 [==============================] - 2s 56ms/step - loss: 4.0646 - f1_score:
0.0324 - val_loss: 3.8941 - val_f1_score: 0.0204
Epoch 6/500
28/28 [==============================] - 2s 58ms/step - loss: 3.8827 - f1_score:
0.0398 - val_loss: 3.6637 - val_f1_score: 0.0349
Epoch 7/500
28/28 [==============================] - 2s 57ms/step - loss: 3.7161 - f1_score:
0.0449 - val_loss: 3.4370 - val_f1_score: 0.0675
Epoch 8/500
28/28 [==============================] - 2s 56ms/step - loss: 3.5235 - f1_score:
0.0747 - val_loss: 3.2266 - val_f1_score: 0.0909
Epoch 9/500
28/28 [==============================] - 2s 58ms/step - loss: 3.3233 - f1_score:
0.0923 - val_loss: 3.0668 - val_f1_score: 0.0787
Epoch 10/500
28/28 [==============================] - 2s 60ms/step - loss: 3.1468 - f1_score:
0.1270 - val_loss: 3.0619 - val_f1_score: 0.1016
Epoch 11/500
28/28 [==============================] - 2s 60ms/step - loss: 3.0619 - f1_score:
0.1400 - val_loss: 2.8198 - val_f1_score: 0.1514
Epoch 12/500
28/28 [==============================] - 2s 58ms/step - loss: 2.8961 - f1_score:
0.1719 - val_loss: 2.7548 - val_f1_score: 0.1452
Epoch 13/500
28/28 [==============================] - 2s 58ms/step - loss: 2.8174 - f1_score:
0.1804 - val_loss: 2.4806 - val_f1_score: 0.2592
Epoch 14/500
28/28 [==============================] - 2s 56ms/step - loss: 2.7485 - f1_score:
0.1938 - val_loss: 2.6578 - val_f1_score: 0.1950
Epoch 15/500
28/28 [==============================] - 2s 60ms/step - loss: 2.6637 - f1_score:
0.2150 - val_loss: 2.3809 - val_f1_score: 0.2934
Epoch 16/500
28/28 [==============================] - 2s 59ms/step - loss: 2.5841 - f1_score:
0.2319 - val_loss: 2.2793 - val_f1_score: 0.3085
Epoch 17/500
28/28 [==============================] - 2s 56ms/step - loss: 2.5111 - f1_score:
0.2487 - val_loss: 2.2947 - val_f1_score: 0.3024
Epoch 18/500
28/28 [==============================] - 2s 56ms/step - loss: 2.4945 - f1_score:
0.2612 - val_loss: 2.3297 - val_f1_score: 0.2622
Epoch 19/500
28/28 [==============================] - 2s 57ms/step - loss: 2.4299 - f1_score:
0.2822 - val_loss: 2.1766 - val_f1_score: 0.3173
Epoch 20/500
```

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28/28 [==============================] - 2s 57ms/step - loss: 2.3723 - f1_score:
0.3045 - val_loss: 2.1020 - val_f1_score: 0.3774
Epoch 21/500
28/28 [==============================] - 2s 58ms/step - loss: 2.2897 - f1_score:
0.3158 - val_loss: 2.1633 - val_f1_score: 0.3554
Epoch 22/500
28/28 [==============================] - 2s 57ms/step - loss: 2.2679 - f1_score:
0.3195 - val_loss: 2.1357 - val_f1_score: 0.3651
Epoch 23/500
28/28 [==============================] - 2s 58ms/step - loss: 2.1965 - f1_score:
0.3466 - val_loss: 2.0167 - val_f1_score: 0.4309
Epoch 24/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1651 - f1_score:
0.3525 - val_loss: 1.9749 - val_f1_score: 0.4013
Epoch 25/500
28/28 [==============================] - 2s 60ms/step - loss: 2.1296 - f1_score:
0.3725 - val_loss: 1.9777 - val_f1_score: 0.3918
Epoch 26/500
28/28 [==============================] - 2s 60ms/step - loss: 2.0619 - f1_score:
0.3916 - val_loss: 2.0274 - val_f1_score: 0.3793
Epoch 27/500
28/28 [==============================] - 2s 62ms/step - loss: 2.0095 - f1_score:
0.3922 - val_loss: 1.9120 - val_f1_score: 0.4652
Epoch 28/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9844 - f1_score:
0.4100 - val_loss: 1.8628 - val_f1_score: 0.4331
Epoch 29/500
28/28 [==============================] - 2s 61ms/step - loss: 1.9409 - f1_score:
0.4197 - val_loss: 1.8124 - val_f1_score: 0.5102
Epoch 30/500
28/28 [==============================] - 2s 62ms/step - loss: 1.8872 - f1_score:
0.4429 - val_loss: 1.9322 - val_f1_score: 0.4286
Epoch 31/500
28/28 [==============================] - 2s 63ms/step - loss: 1.8496 - f1_score:
0.4528 - val_loss: 1.8394 - val_f1_score: 0.4726
Epoch 32/500
28/28 [==============================] - 2s 59ms/step - loss: 1.8341 - f1_score:
0.4493 - val_loss: 1.7839 - val_f1_score: 0.4552
Epoch 33/500
28/28 [==============================] - 2s 59ms/step - loss: 1.7617 - f1_score:
0.4723 - val_loss: 1.7879 - val_f1_score: 0.4683
Epoch 34/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7139 - f1_score:
0.4886 - val_loss: 1.6789 - val_f1_score: 0.5109
Epoch 35/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7192 - f1_score:
0.4884 - val_loss: 1.7468 - val_f1_score: 0.4969
Epoch 36/500
```

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28/28 [==============================] - 2s 59ms/step - loss: 1.6829 - f1_score:
0.5017 - val_loss: 1.6854 - val_f1_score: 0.5232
Epoch 37/500
28/28 [==============================] - 2s 59ms/step - loss: 1.6477 - f1_score:
0.4974 - val_loss: 1.6491 - val_f1_score: 0.5343
Epoch 38/500
28/28 [==============================] - 2s 60ms/step - loss: 1.6091 - f1_score:
0.5207 - val_loss: 1.6136 - val_f1_score: 0.5795
Epoch 39/500
28/28 [==============================] - 2s 63ms/step - loss: 1.5683 - f1_score:
0.5330 - val_loss: 1.6548 - val_f1_score: 0.5437
Epoch 40/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5614 - f1_score:
0.5363 - val_loss: 1.6044 - val_f1_score: 0.5679
Epoch 41/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5796 - f1_score:
0.5120 - val_loss: 1.5703 - val_f1_score: 0.5502
Epoch 42/500
28/28 [==============================] - 2s 64ms/step - loss: 1.5240 - f1_score:
0.5448 - val_loss: 1.6273 - val_f1_score: 0.5479
Epoch 43/500
28/28 [==============================] - 2s 63ms/step - loss: 1.5407 - f1_score:
0.5366 - val_loss: 1.5634 - val_f1_score: 0.5738
Epoch 44/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5039 - f1_score:
0.5420 - val_loss: 1.5193 - val_f1_score: 0.5986
Epoch 45/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4307 - f1_score:
0.5712 - val_loss: 1.5032 - val_f1_score: 0.6213
Epoch 46/500
28/28 [==============================] - 2s 59ms/step - loss: 1.4446 - f1_score:
0.5620 - val_loss: 1.5386 - val_f1_score: 0.5897
Epoch 47/500
28/28 [==============================] - 2s 59ms/step - loss: 1.3802 - f1_score:
0.5945 - val_loss: 1.5761 - val_f1_score: 0.5677
Epoch 48/500
28/28 [==============================] - 2s 59ms/step - loss: 1.3641 - f1_score:
0.5931 - val_loss: 1.5295 - val_f1_score: 0.5865
Epoch 49/500
28/28 [==============================] - 2s 64ms/step - loss: 1.3326 - f1_score:
0.5987 - val_loss: 1.5587 - val_f1_score: 0.5970
Epoch 50/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3419 - f1_score:
0.5949 - val_loss: 1.5555 - val_f1_score: 0.5618
Epoch 51/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3104 - f1_score:
0.6064 - val_loss: 1.6472 - val_f1_score: 0.5589
Epoch 52/500
```

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28/28 [==============================] - 2s 64ms/step - loss: 1.3482 - f1_score:
0.5950 - val_loss: 1.4593 - val_f1_score: 0.5986
Epoch 53/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2661 - f1_score:
0.6265 - val_loss: 1.6339 - val_f1_score: 0.5637
Epoch 54/500
28/28 [==============================] - 2s 65ms/step - loss: 1.2585 - f1_score:
0.6190 - val_loss: 1.5598 - val_f1_score: 0.5596
Epoch 55/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2548 - f1_score:
0.6336 - val_loss: 1.4931 - val_f1_score: 0.6138
Epoch 56/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2262 - f1_score:
0.6457 - val_loss: 1.4808 - val_f1_score: 0.5667
Epoch 57/500
28/28 [==============================] - 2s 80ms/step - loss: 1.2017 - f1_score:
0.6421 - val_loss: 1.5095 - val_f1_score: 0.5851
Epoch 58/500
28/28 [==============================] - 2s 78ms/step - loss: 1.2256 - f1_score:
0.6304 - val_loss: 1.5477 - val_f1_score: 0.5917
Epoch 59/500
28/28 [==============================] - 2s 70ms/step - loss: 1.1492 - f1_score:
0.6578 - val_loss: 1.4918 - val_f1_score: 0.5815
Epoch 60/500
28/28 [==============================] - 2s 78ms/step - loss: 1.1265 - f1_score:
0.6838 - val_loss: 1.6393 - val_f1_score: 0.5550
Epoch 61/500
28/28 [==============================] - 2s 77ms/step - loss: 1.1370 - f1_score:
0.6580 - val_loss: 1.5368 - val_f1_score: 0.5895
Epoch 62/500
28/28 [==============================] - 2s 66ms/step - loss: 1.1079 - f1_score:
0.6663 - val_loss: 1.5117 - val_f1_score: 0.5930
Epoch 63/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1344 - f1_score:
0.6571 - val_loss: 1.4785 - val_f1_score: 0.5789
Epoch 64/500
28/28 [==============================] - 2s 60ms/step - loss: 1.0979 - f1_score:
0.6815 - val_loss: 1.5382 - val_f1_score: 0.5657
Epoch 65/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0875 - f1_score:
0.6816 - val_loss: 1.4780 - val_f1_score: 0.6158
Epoch 66/500
28/28 [==============================] - 2s 60ms/step - loss: 1.0667 - f1_score:
0.6789 - val_loss: 1.4645 - val_f1_score: 0.6429
Epoch 67/500
28/28 [==============================] - 2s 61ms/step - loss: 1.0374 - f1_score:
0.7016 - val_loss: 1.5012 - val_f1_score: 0.6005
Epoch 68/500
```

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28/28 [==============================] - 2s 78ms/step - loss: 1.0506 - f1_score:
0.6844 - val_loss: 1.4025 - val_f1_score: 0.6421
Epoch 69/500
28/28 [==============================] - 2s 61ms/step - loss: 1.0317 - f1_score:
0.6893 - val_loss: 1.5166 - val_f1_score: 0.6029
Epoch 70/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0027 - f1_score:
0.7091 - val_loss: 1.4128 - val_f1_score: 0.6117
Epoch 71/500
28/28 [==============================] - 2s 60ms/step - loss: 1.0133 - f1_score:
0.6928 - val_loss: 1.4194 - val_f1_score: 0.6126
Epoch 72/500
28/28 [==============================] - 2s 59ms/step - loss: 0.9991 - f1_score:
0.7027 - val_loss: 1.4439 - val_f1_score: 0.6222
Epoch 73/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9286 - f1_score:
0.7229 - val_loss: 1.4063 - val_f1_score: 0.6217
Epoch 74/500
28/28 [==============================] - 2s 68ms/step - loss: 0.9413 - f1_score:
0.7231 - val_loss: 1.3792 - val_f1_score: 0.6268
Epoch 75/500
28/28 [==============================] - 2s 65ms/step - loss: 0.9072 - f1_score:
0.7262 - val_loss: 1.4927 - val_f1_score: 0.5935
Epoch 76/500
28/28 [==============================] - 2s 67ms/step - loss: 0.9426 - f1_score:
0.7290 - val_loss: 1.5094 - val_f1_score: 0.6044
Epoch 77/500
28/28 [==============================] - 2s 67ms/step - loss: 0.8876 - f1_score:
0.7487 - val_loss: 1.4533 - val_f1_score: 0.6176
Epoch 78/500
28/28 [==============================] - 2s 65ms/step - loss: 0.9013 - f1_score:
0.7301 - val_loss: 1.5090 - val_f1_score: 0.6017
Epoch 79/500
28/28 [==============================] - 2s 62ms/step - loss: 0.8777 - f1_score:
0.7469 - val_loss: 1.5102 - val_f1_score: 0.6183
Epoch 80/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8524 - f1_score:
0.7578 - val_loss: 1.4931 - val_f1_score: 0.6146
Epoch 81/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8649 - f1_score:
0.7515 - val_loss: 1.4376 - val_f1_score: 0.6273
Epoch 82/500
28/28 [==============================] - 2s 62ms/step - loss: 0.8137 - f1_score:
0.7682 - val_loss: 1.3954 - val_f1_score: 0.6372
Epoch 83/500
28/28 [==============================] - 2s 59ms/step - loss: 0.8486 - f1_score:
0.7484 - val_loss: 1.4304 - val_f1_score: 0.6354
Epoch 84/500
```

```
28/28 [==============================] - 2s 62ms/step - loss: 0.8491 - f1_score:
0.7569 - val_loss: 1.4887 - val_f1_score: 0.6143
Epoch 85/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8334 - f1_score:
0.7510

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_3_layer_call_fn, gru_cell_3_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

28/28 [==============================] - 12s 434ms/step - loss: 0.8312 -
f1_score: 0.7505 - val_loss: 1.4350 - val_f1_score: 0.6474
Epoch 86/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8528 - f1_score:
0.7604 - val_loss: 1.5866 - val_f1_score: 0.6060
Epoch 87/500
28/28 [==============================] - 2s 59ms/step - loss: 0.8095 - f1_score:
0.7629 - val_loss: 1.4224 - val_f1_score: 0.6413
Epoch 88/500
27/28 [===========================>..] - ETA: 0s - loss: 0.7765 - f1_score:
0.7727

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_3_layer_call_fn, gru_cell_3_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

28/28 [==============================] - 11s 390ms/step - loss: 0.7791 -
f1_score: 0.7727 - val_loss: 1.4189 - val_f1_score: 0.6541
Epoch 89/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8362 - f1_score:
0.7548 - val_loss: 1.4531 - val_f1_score: 0.6369
Epoch 90/500
28/28 [==============================] - 2s 61ms/step - loss: 0.8152 - f1_score:
0.7685 - val_loss: 1.4570 - val_f1_score: 0.6301
Epoch 91/500
28/28 [==============================] - 2s 60ms/step - loss: 0.7666 - f1_score:
0.7823 - val_loss: 1.4095 - val_f1_score: 0.6223
Epoch 92/500
28/28 [==============================] - 2s 60ms/step - loss: 0.7471 - f1_score:
0.7919 - val_loss: 1.4718 - val_f1_score: 0.6113
Epoch 93/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7564 - f1_score:
```

```
0.7834 - val_loss: 1.4611 - val_f1_score: 0.6213
Epoch 94/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7425 - f1_score:
0.7895 - val_loss: 1.4524 - val_f1_score: 0.6406
Epoch 95/500
28/28 [==============================] - 2s 60ms/step - loss: 0.7353 - f1_score:
0.7906 - val_loss: 1.5080 - val_f1_score: 0.6214
Epoch 96/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7435 - f1_score:
0.7867 - val_loss: 1.6437 - val_f1_score: 0.5971
Epoch 97/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6959 - f1_score:
0.7998 - val_loss: 1.5503 - val_f1_score: 0.6143
Epoch 98/500
28/28 [==============================] - 2s 60ms/step - loss: 0.7283 - f1_score:
0.7950 - val_loss: 1.4798 - val_f1_score: 0.6061
Epoch 99/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7003 - f1_score:
0.8027 - val_loss: 1.5087 - val_f1_score: 0.6051
Epoch 100/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7034 - f1_score:
0.7993 - val_loss: 1.6852 - val_f1_score: 0.5935
Epoch 101/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7086 - f1_score:
0.7986 - val_loss: 1.4884 - val_f1_score: 0.6402
Epoch 102/500
28/28 [==============================] - 2s 60ms/step - loss: 0.6961 - f1_score:
0.7960 - val_loss: 1.4611 - val_f1_score: 0.6519
Epoch 103/500
28/28 [==============================] - 2s 60ms/step - loss: 0.6760 - f1_score:
0.8038 - val_loss: 1.5244 - val_f1_score: 0.6143
Epoch 104/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6583 - f1_score:
0.8216 - val_loss: 1.5070 - val_f1_score: 0.6276
Epoch 105/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6606 - f1_score:
0.8082 - val_loss: 1.4214 - val_f1_score: 0.6278
Epoch 106/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6801 - f1_score:
0.8097 - val_loss: 1.5859 - val_f1_score: 0.5936
Epoch 107/500
28/28 [==============================] - 2s 61ms/step - loss: 0.6527 - f1_score:
0.8213 - val_loss: 1.4986 - val_f1_score: 0.6241
Epoch 108/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6697 - f1_score:
0.8071 - val_loss: 1.6140 - val_f1_score: 0.5943
Epoch 109/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6508 - f1_score:
```

```
0.8176 - val_loss: 1.5261 - val_f1_score: 0.6275
Epoch 110/500
28/28 [==============================] - 2s 61ms/step - loss: 0.6188 - f1_score:
0.8287 - val_loss: 1.5273 - val_f1_score: 0.6152
Epoch 111/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6138 - f1_score:
0.8236 - val_loss: 1.6069 - val_f1_score: 0.6224
Epoch 112/500
28/28 [==============================] - 2s 62ms/step - loss: 0.6351 - f1_score:
0.8275 - val_loss: 1.5085 - val_f1_score: 0.6226
Epoch 113/500
28/28 [==============================] - 2s 60ms/step - loss: 0.6800 - f1_score:
0.8178 - val_loss: 1.5918 - val_f1_score: 0.5939
Epoch 114/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6223 - f1_score:
0.8295 - val_loss: 1.6272 - val_f1_score: 0.6053
Epoch 115/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6222 - f1_score:
0.8285 - val_loss: 1.6033 - val_f1_score: 0.6083
Epoch 116/500
28/28 [==============================] - 2s 62ms/step - loss: 0.6078 - f1_score:
0.8209 - val_loss: 1.7098 - val_f1_score: 0.6011
Epoch 117/500
28/28 [==============================] - 2s 67ms/step - loss: 0.5956 - f1_score:
0.8341 - val_loss: 1.5502 - val_f1_score: 0.6404
Epoch 118/500
28/28 [==============================] - 2s 61ms/step - loss: 0.6094 - f1_score:
0.8293 - val_loss: 1.6136 - val_f1_score: 0.6268
Epoch 119/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6239 - f1_score:
0.8267 - val_loss: 1.6343 - val_f1_score: 0.6115
Epoch 120/500
28/28 [==============================] - 2s 62ms/step - loss: 0.5777 - f1_score:
0.8392 - val_loss: 1.6605 - val_f1_score: 0.6080
Epoch 121/500
28/28 [==============================] - 2s 62ms/step - loss: 0.5894 - f1_score:
0.8444 - val_loss: 1.4849 - val_f1_score: 0.6094
Epoch 122/500
28/28 [==============================] - 2s 63ms/step - loss: 0.5746 - f1_score:
0.8452 - val_loss: 1.5915 - val_f1_score: 0.6095
Epoch 123/500
28/28 [==============================] - 2s 65ms/step - loss: 0.5688 - f1_score:
0.8442 - val_loss: 1.7414 - val_f1_score: 0.5894
Epoch 124/500
28/28 [==============================] - 2s 75ms/step - loss: 0.5622 - f1_score:
0.8581 - val_loss: 1.4953 - val_f1_score: 0.6297
Epoch 125/500
28/28 [==============================] - 2s 68ms/step - loss: 0.5721 - f1_score:
```

```
0.8415 - val_loss: 1.4470 - val_f1_score: 0.6433
Epoch 126/500
28/28 [==============================] - 2s 65ms/step - loss: 0.5624 - f1_score:
0.8503 - val_loss: 1.6085 - val_f1_score: 0.5986
Epoch 127/500
28/28 [==============================] - 2s 63ms/step - loss: 0.5641 - f1_score:
0.8470 - val_loss: 1.5488 - val_f1_score: 0.6336
Epoch 128/500
28/28 [==============================] - 2s 62ms/step - loss: 0.5670 - f1_score:
0.8502 - val_loss: 1.6863 - val_f1_score: 0.5892
Epoch 129/500
28/28 [==============================] - 2s 67ms/step - loss: 0.5656 - f1_score:
0.8484 - val_loss: 1.5143 - val_f1_score: 0.6232
Epoch 130/500
28/28 [==============================] - 2s 81ms/step - loss: 0.5460 - f1_score:
0.8509 - val_loss: 1.6638 - val_f1_score: 0.5969
Epoch 131/500
28/28 [==============================] - 2s 80ms/step - loss: 0.5407 - f1_score:
0.8550 - val_loss: 1.5904 - val_f1_score: 0.6241
Epoch 132/500
28/28 [==============================] - 2s 68ms/step - loss: 0.5248 - f1_score:
0.8560 - val_loss: 1.6140 - val_f1_score: 0.6505
Epoch 133/500
28/28 [==============================] - 2s 67ms/step - loss: 0.5299 - f1_score:
0.8615 - val_loss: 1.5287 - val_f1_score: 0.6327
Epoch 134/500
28/28 [==============================] - 2s 69ms/step - loss: 0.5462 - f1_score:
0.8559 - val_loss: 1.5400 - val_f1_score: 0.6269
Epoch 135/500
27/28 [============================>..] - ETA: 0s - loss: 0.5128 - f1_score:
0.8579

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_3_layer_call_fn, gru_cell_3_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

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28/28 [==============================] - 13s 488ms/step - loss: 0.5128 -
f1_score: 0.8573 - val_loss: 1.6154 - val_f1_score: 0.6577
Epoch 136/500
28/28 [==============================] - ETA: 0s - loss: 0.4960 - f1_score:
0.8671

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_3_layer_call_fn, gru_cell_3_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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```
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

28/28 [==============================] - 12s 440ms/step - loss: 0.4960 -
f1_score: 0.8671 - val_loss: 1.4869 - val_f1_score: 0.6632
Epoch 137/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5518 - f1_score:
0.8472 - val_loss: 1.6393 - val_f1_score: 0.6143
Epoch 138/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4939 - f1_score:
0.8751 - val_loss: 1.6309 - val_f1_score: 0.5993
Epoch 139/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5241 - f1_score:
0.8593 - val_loss: 1.6808 - val_f1_score: 0.6252
Epoch 140/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5098 - f1_score:
0.8600 - val_loss: 1.6715 - val_f1_score: 0.6255
Epoch 141/500
28/28 [==============================] - 2s 64ms/step - loss: 0.5105 - f1_score:
0.8623 - val_loss: 1.5884 - val_f1_score: 0.6123
Epoch 142/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4901 - f1_score:
0.8766 - val_loss: 1.5430 - val_f1_score: 0.6194
Epoch 143/500
28/28 [==============================] - 2s 63ms/step - loss: 0.5186 - f1_score:
0.8619 - val_loss: 1.8009 - val_f1_score: 0.5782
Epoch 144/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4707 - f1_score:
0.8899 - val_loss: 1.7713 - val_f1_score: 0.6167
Epoch 145/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4871 - f1_score:
0.8754 - val_loss: 1.6303 - val_f1_score: 0.6088
Epoch 146/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4920 - f1_score:
0.8732 - val_loss: 1.5669 - val_f1_score: 0.6331
Epoch 147/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4848 - f1_score:
0.8737 - val_loss: 1.6384 - val_f1_score: 0.6313
Epoch 148/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4726 - f1_score:
0.8779 - val_loss: 1.5981 - val_f1_score: 0.6488
Epoch 149/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4560 - f1_score:
0.8798 - val_loss: 1.6923 - val_f1_score: 0.6177
Epoch 150/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4663 - f1_score:
```

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0.8796 - val_loss: 1.5746 - val_f1_score: 0.5758
Epoch 151/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4674 - f1_score:
0.8830 - val_loss: 1.5741 - val_f1_score: 0.6471
Epoch 152/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4691 - f1_score:
0.8777 - val_loss: 1.6350 - val_f1_score: 0.6341
Epoch 153/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4941 - f1_score:
0.8712 - val_loss: 1.6231 - val_f1_score: 0.6223
Epoch 154/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4858 - f1_score:
0.8721 - val_loss: 1.6275 - val_f1_score: 0.6201
Epoch 155/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4567 - f1_score:
0.8841 - val_loss: 1.5701 - val_f1_score: 0.6102
Epoch 156/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4457 - f1_score:
0.8789 - val_loss: 1.6787 - val_f1_score: 0.6123
Epoch 157/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4522 - f1_score:
0.8806 - val_loss: 1.6790 - val_f1_score: 0.6027
Epoch 158/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4542 - f1_score:
0.8799 - val_loss: 1.8163 - val_f1_score: 0.6048
Epoch 159/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4205 - f1_score:
0.8925 - val_loss: 1.6495 - val_f1_score: 0.6213
Epoch 160/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4689 - f1_score:
0.8806 - val_loss: 1.6298 - val_f1_score: 0.6116
Epoch 161/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4576 - f1_score:
0.8844 - val_loss: 1.6613 - val_f1_score: 0.6184
Epoch 162/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4552 - f1_score:
0.8826 - val_loss: 1.6969 - val_f1_score: 0.6130
Epoch 163/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4420 - f1_score:
0.8880 - val_loss: 1.5682 - val_f1_score: 0.6221
Epoch 164/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4395 - f1_score:
0.8878 - val_loss: 1.7133 - val_f1_score: 0.6303
Epoch 165/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4592 - f1_score:
0.8844 - val_loss: 1.7591 - val_f1_score: 0.6085
Epoch 166/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4248 - f1_score:
```

```
0.8967 - val_loss: 1.7090 - val_f1_score: 0.5894
Epoch 167/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4617 - f1_score:
0.8779 - val_loss: 1.6282 - val_f1_score: 0.6191
Epoch 168/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4363 - f1_score:
0.8873 - val_loss: 1.6023 - val_f1_score: 0.6121
Epoch 169/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4127 - f1_score:
0.8972 - val_loss: 1.5576 - val_f1_score: 0.6355
Epoch 170/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4332 - f1_score:
0.8913 - val_loss: 1.6055 - val_f1_score: 0.6124
Epoch 171/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4419 - f1_score:
0.8826 - val_loss: 1.7196 - val_f1_score: 0.6182
Epoch 172/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4118 - f1_score:
0.8966 - val_loss: 1.7552 - val_f1_score: 0.6145
Epoch 173/500
28/28 [==============================] - 2s 69ms/step - loss: 0.4371 - f1_score:
0.8900 - val_loss: 1.7127 - val_f1_score: 0.6176
Epoch 174/500
28/28 [==============================] - 2s 68ms/step - loss: 0.4363 - f1_score:
0.8911 - val_loss: 1.6765 - val_f1_score: 0.6148
Epoch 175/500
28/28 [==============================] - 2s 67ms/step - loss: 0.4174 - f1_score:
0.8988 - val_loss: 1.5412 - val_f1_score: 0.6577
Epoch 176/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4113 - f1_score:
0.8928 - val_loss: 1.7341 - val_f1_score: 0.6328
Epoch 177/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4038 - f1_score:
0.8967 - val_loss: 1.6264 - val_f1_score: 0.6417
Epoch 178/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4270 - f1_score:
0.8903 - val_loss: 1.5011 - val_f1_score: 0.6535
Epoch 179/500
28/28 [==============================] - ETA: 0s - loss: 0.3973 - f1_score:
0.9017

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 593/assets

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```

```
28/28 [==============================] - 13s 464ms/step - loss: 0.3973 -
f1_score: 0.9017 - val_loss: 1.5675 - val_f1_score: 0.6800
Epoch 180/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4172 - f1_score:
0.8893 - val_loss: 1.5735 - val_f1_score: 0.6344
Epoch 181/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4165 - f1_score:
0.8969 - val_loss: 1.5515 - val_f1_score: 0.6333
Epoch 182/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3956 - f1_score:
0.8963 - val_loss: 1.6506 - val_f1_score: 0.6080
Epoch 183/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4075 - f1_score:
0.8995 - val_loss: 1.7261 - val_f1_score: 0.5913
Epoch 184/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3882 - f1_score:
0.9065 - val_loss: 1.7312 - val_f1_score: 0.6148
Epoch 185/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3882 - f1_score:
0.9028 - val_loss: 1.7692 - val_f1_score: 0.5957
Epoch 186/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3956 - f1_score:
0.9030 - val_loss: 1.5968 - val_f1_score: 0.6373
Epoch 187/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4215 - f1_score:
0.8914 - val_loss: 1.6929 - val_f1_score: 0.6260
Epoch 188/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3875 - f1_score:
0.9013 - val_loss: 1.8027 - val_f1_score: 0.6346
Epoch 189/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3928 - f1_score:
0.9076 - val_loss: 1.7826 - val_f1_score: 0.6195
Epoch 190/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3948 - f1_score:
0.9064 - val_loss: 1.9099 - val_f1_score: 0.6000
Epoch 191/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4030 - f1_score:
0.9001 - val_loss: 1.9416 - val_f1_score: 0.5877
Epoch 192/500
28/28 [==============================] - 2s 71ms/step - loss: 0.3590 - f1_score:
0.9153 - val_loss: 1.7895 - val_f1_score: 0.6019
Epoch 193/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3895 - f1_score:
0.9027 - val_loss: 1.7462 - val_f1_score: 0.6176
Epoch 194/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3911 - f1_score:
0.9120 - val_loss: 1.7132 - val_f1_score: 0.6207
Epoch 195/500
```

```
28/28 [==============================] - 2s 68ms/step - loss: 0.3580 - f1_score:
0.9171 - val_loss: 1.6581 - val_f1_score: 0.6183
Epoch 196/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3586 - f1_score:
0.9111 - val_loss: 1.9861 - val_f1_score: 0.5987
Epoch 197/500
28/28 [==============================] - 2s 66ms/step - loss: 0.4061 - f1_score:
0.8916 - val_loss: 1.6706 - val_f1_score: 0.6228
Epoch 198/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3864 - f1_score:
0.9006 - val_loss: 1.7059 - val_f1_score: 0.5948
Epoch 199/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3731 - f1_score:
0.9084 - val_loss: 1.8882 - val_f1_score: 0.6094
Epoch 200/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3646 - f1_score:
0.9177 - val_loss: 1.6811 - val_f1_score: 0.5943
Epoch 201/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3971 - f1_score:
0.9006 - val_loss: 2.0152 - val_f1_score: 0.5940
Epoch 202/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3866 - f1_score:
0.9027 - val_loss: 1.6788 - val_f1_score: 0.6410
Epoch 203/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3735 - f1_score:
0.9065 - val_loss: 1.8172 - val_f1_score: 0.6337
Epoch 204/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3614 - f1_score:
0.9128 - val_loss: 1.6563 - val_f1_score: 0.6281
Epoch 205/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3622 - f1_score:
0.9165 - val_loss: 1.7552 - val_f1_score: 0.5888
Epoch 206/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3725 - f1_score:
0.9056 - val_loss: 1.9656 - val_f1_score: 0.5923
Epoch 207/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3828 - f1_score:
0.9029 - val_loss: 1.7246 - val_f1_score: 0.6213
Epoch 208/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3714 - f1_score:
0.9094 - val_loss: 1.8550 - val_f1_score: 0.6222
Epoch 209/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3957 - f1_score:
0.9019 - val_loss: 1.9408 - val_f1_score: 0.5959
Epoch 210/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3446 - f1_score:
0.9254 - val_loss: 1.7551 - val_f1_score: 0.6152
Epoch 211/500
```

```
28/28 [==============================] - 2s 63ms/step - loss: 0.3301 - f1_score:
0.9253 - val_loss: 1.9479 - val_f1_score: 0.6177
Epoch 212/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3583 - f1_score:
0.9123 - val_loss: 1.8022 - val_f1_score: 0.6395
Epoch 213/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3378 - f1_score:
0.9185 - val_loss: 1.9625 - val_f1_score: 0.6160
Epoch 214/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3492 - f1_score:
0.9177 - val_loss: 1.8335 - val_f1_score: 0.6089
Epoch 215/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3532 - f1_score:
0.9157 - val_loss: 1.7957 - val_f1_score: 0.6049
Epoch 216/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3688 - f1_score:
0.9101 - val_loss: 1.7446 - val_f1_score: 0.6095
Epoch 217/500
28/28 [==============================] - 2s 70ms/step - loss: 0.3547 - f1_score:
0.9107 - val_loss: 1.9139 - val_f1_score: 0.5912
Epoch 218/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3759 - f1_score:
0.9087 - val_loss: 1.8217 - val_f1_score: 0.6104
Epoch 219/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3575 - f1_score:
0.9122 - val_loss: 1.9459 - val_f1_score: 0.5976
Epoch 220/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3748 - f1_score:
0.9114 - val_loss: 2.0766 - val_f1_score: 0.5851
Epoch 221/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3498 - f1_score:
0.9163 - val_loss: 1.7986 - val_f1_score: 0.5904
Epoch 222/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3559 - f1_score:
0.9138 - val_loss: 1.8871 - val_f1_score: 0.6138
Epoch 223/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3195 - f1_score:
0.9263 - val_loss: 1.7667 - val_f1_score: 0.6272
Epoch 224/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3437 - f1_score:
0.9194 - val_loss: 1.7545 - val_f1_score: 0.6407
Epoch 225/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3508 - f1_score:
0.9145 - val_loss: 2.0771 - val_f1_score: 0.6032
Epoch 226/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3636 - f1_score:
0.9105 - val_loss: 1.9133 - val_f1_score: 0.6386
Epoch 227/500
```

```
28/28 [==============================] - 2s 69ms/step - loss: 0.3711 - f1_score:
0.9096 - val_loss: 1.8316 - val_f1_score: 0.6082
Epoch 228/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3681 - f1_score:
0.9148 - val_loss: 1.8909 - val_f1_score: 0.5979
Epoch 229/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3643 - f1_score:
0.9134 - val_loss: 1.9064 - val_f1_score: 0.6296
Epoch 230/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3334 - f1_score:
0.9257 - val_loss: 2.0421 - val_f1_score: 0.5784
Epoch 231/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3234 - f1_score:
0.9285 - val_loss: 1.9169 - val_f1_score: 0.6176
Epoch 232/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3892 - f1_score:
0.9019 - val_loss: 2.1670 - val_f1_score: 0.6069
Epoch 233/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3663 - f1_score:
0.9110 - val_loss: 1.7667 - val_f1_score: 0.6263
Epoch 234/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3509 - f1_score:
0.9164 - val_loss: 1.8955 - val_f1_score: 0.6060
Epoch 235/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3151 - f1_score:
0.9283 - val_loss: 2.0125 - val_f1_score: 0.5605
Epoch 236/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3324 - f1_score:
0.9212 - val_loss: 1.7574 - val_f1_score: 0.6233
Epoch 237/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3523 - f1_score:
0.9154 - val_loss: 2.0156 - val_f1_score: 0.6157
Epoch 238/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3397 - f1_score:
0.9116 - val_loss: 1.9745 - val_f1_score: 0.5853
Epoch 239/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3521 - f1_score:
0.9186 - val_loss: 1.8362 - val_f1_score: 0.6231
Epoch 240/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2942 - f1_score:
0.9365 - val_loss: 1.8064 - val_f1_score: 0.5861
Epoch 241/500
28/28 [==============================] - 2s 73ms/step - loss: 0.3250 - f1_score:
0.9217 - val_loss: 1.9284 - val_f1_score: 0.6134
Epoch 242/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3820 - f1_score:
0.9107 - val_loss: 1.7934 - val_f1_score: 0.6091
Epoch 243/500
```

```
28/28 [==============================] - 2s 78ms/step - loss: 0.3325 - f1_score:
0.9246 - val_loss: 2.0598 - val_f1_score: 0.6022
Epoch 244/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3225 - f1_score:
0.9240 - val_loss: 1.9114 - val_f1_score: 0.6332
Epoch 245/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3604 - f1_score:
0.9171 - val_loss: 1.8428 - val_f1_score: 0.5928
Epoch 246/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3549 - f1_score:
0.9050 - val_loss: 1.9739 - val_f1_score: 0.5769
Epoch 247/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3266 - f1_score:
0.9183 - val_loss: 2.0259 - val_f1_score: 0.5709
Epoch 248/500
28/28 [==============================] - 2s 71ms/step - loss: 0.3519 - f1_score:
0.9121 - val_loss: 1.9462 - val_f1_score: 0.5933
Epoch 249/500
28/28 [==============================] - 2s 71ms/step - loss: 0.3430 - f1_score:
0.9143 - val_loss: 1.8647 - val_f1_score: 0.6386
Epoch 250/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3188 - f1_score:
0.9241 - val_loss: 1.9530 - val_f1_score: 0.6190
Epoch 251/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3089 - f1_score:
0.9262 - val_loss: 1.8108 - val_f1_score: 0.6237
Epoch 252/500
28/28 [==============================] - 2s 72ms/step - loss: 0.3183 - f1_score:
0.9244 - val_loss: 1.7981 - val_f1_score: 0.6315
Epoch 253/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3074 - f1_score:
0.9320 - val_loss: 1.7862 - val_f1_score: 0.6626
Epoch 254/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3128 - f1_score:
0.9355 - val_loss: 1.9167 - val_f1_score: 0.6349
Epoch 255/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3263 - f1_score:
0.9202 - val_loss: 2.0467 - val_f1_score: 0.5859
Epoch 256/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3018 - f1_score:
0.9324 - val_loss: 1.7621 - val_f1_score: 0.6210
Epoch 257/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3021 - f1_score:
0.9313 - val_loss: 2.0488 - val_f1_score: 0.5965
Epoch 258/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2983 - f1_score:
0.9368 - val_loss: 1.6953 - val_f1_score: 0.6349
Epoch 259/500
```

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28/28 [==============================] - 2s 66ms/step - loss: 0.2935 - f1_score:
0.9300 - val_loss: 1.8508 - val_f1_score: 0.6306
Epoch 260/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3014 - f1_score:
0.9309 - val_loss: 1.8867 - val_f1_score: 0.5934
Epoch 261/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3097 - f1_score:
0.9279 - val_loss: 1.9369 - val_f1_score: 0.6329
Epoch 262/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3259 - f1_score:
0.9229 - val_loss: 1.8317 - val_f1_score: 0.6171
Epoch 263/500
28/28 [==============================] - 2s 75ms/step - loss: 0.3214 - f1_score:
0.9194 - val_loss: 1.8719 - val_f1_score: 0.6554
Epoch 264/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2971 - f1_score:
0.9332 - val_loss: 1.7813 - val_f1_score: 0.6131
Epoch 265/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2950 - f1_score:
0.9371 - val_loss: 2.1123 - val_f1_score: 0.5994
Epoch 266/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3094 - f1_score:
0.9264 - val_loss: 1.9703 - val_f1_score: 0.5829
Epoch 267/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3186 - f1_score:
0.9247 - val_loss: 1.8480 - val_f1_score: 0.6278
Epoch 268/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3235 - f1_score:
0.9220 - val_loss: 1.8518 - val_f1_score: 0.6406
Epoch 269/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3693 - f1_score:
0.9118 - val_loss: 1.9793 - val_f1_score: 0.6068
Epoch 270/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3206 - f1_score:
0.9240 - val_loss: 1.8640 - val_f1_score: 0.6262
Epoch 271/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3016 - f1_score:
0.9297 - val_loss: 1.9106 - val_f1_score: 0.6111
Epoch 272/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2986 - f1_score:
0.9380 - val_loss: 1.7430 - val_f1_score: 0.6363
Epoch 273/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3314 - f1_score:
0.9265 - val_loss: 1.7135 - val_f1_score: 0.6134
Epoch 274/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3002 - f1_score:
0.9312 - val_loss: 1.8147 - val_f1_score: 0.6108
Epoch 275/500
```

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28/28 [==============================] - 2s 74ms/step - loss: 0.2983 - f1_score:
0.9337 - val_loss: 1.8710 - val_f1_score: 0.6333
Epoch 276/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2973 - f1_score:
0.9310 - val_loss: 1.8524 - val_f1_score: 0.6082
Epoch 277/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2943 - f1_score:
0.9306 - val_loss: 2.1336 - val_f1_score: 0.5787
Epoch 278/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2969 - f1_score:
0.9297 - val_loss: 1.9292 - val_f1_score: 0.5866
Epoch 279/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3305 - f1_score:
0.9247 - val_loss: 2.1380 - val_f1_score: 0.5722
Epoch 280/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3317 - f1_score:
0.9241 - val_loss: 1.9043 - val_f1_score: 0.6048
Epoch 281/500
28/28 [==============================] - 2s 71ms/step - loss: 0.3194 - f1_score:
0.9196 - val_loss: 2.0722 - val_f1_score: 0.5877
Epoch 282/500
28/28 [==============================] - 2s 81ms/step - loss: 0.3341 - f1_score:
0.9223 - val_loss: 2.0587 - val_f1_score: 0.5734
Epoch 283/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3429 - f1_score:
0.9184 - val_loss: 2.0772 - val_f1_score: 0.6109
Epoch 284/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2945 - f1_score:
0.9295 - val_loss: 1.9359 - val_f1_score: 0.6036
Epoch 285/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2726 - f1_score:
0.9405 - val_loss: 2.0861 - val_f1_score: 0.5880
Epoch 286/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2859 - f1_score:
0.9438 - val_loss: 2.0239 - val_f1_score: 0.5981
Epoch 287/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2850 - f1_score:
0.9400 - val_loss: 2.0125 - val_f1_score: 0.5927
Epoch 288/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2738 - f1_score:
0.9386 - val_loss: 2.1541 - val_f1_score: 0.5839
Epoch 289/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2998 - f1_score:
0.9360 - val_loss: 2.0387 - val_f1_score: 0.6106
Epoch 290/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2897 - f1_score:
0.9359 - val_loss: 1.9804 - val_f1_score: 0.6175
Epoch 291/500
```

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28/28 [==============================] - 2s 67ms/step - loss: 0.3186 - f1_score:
0.9198 - val_loss: 1.8484 - val_f1_score: 0.6233
Epoch 292/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2924 - f1_score:
0.9313 - val_loss: 2.1391 - val_f1_score: 0.5941
Epoch 293/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3302 - f1_score:
0.9170 - val_loss: 1.8441 - val_f1_score: 0.6395
Epoch 294/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2949 - f1_score:
0.9375 - val_loss: 1.9999 - val_f1_score: 0.5954
Epoch 295/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3079 - f1_score:
0.9278 - val_loss: 2.3189 - val_f1_score: 0.5650
Epoch 296/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2807 - f1_score:
0.9330 - val_loss: 2.1220 - val_f1_score: 0.5979
Epoch 297/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2778 - f1_score:
0.9377 - val_loss: 2.2500 - val_f1_score: 0.5860
Epoch 298/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3079 - f1_score:
0.9283 - val_loss: 2.1351 - val_f1_score: 0.5737
Epoch 299/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2703 - f1_score:
0.9458 - val_loss: 1.9817 - val_f1_score: 0.6013
Epoch 300/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2751 - f1_score:
0.9383 - val_loss: 2.0452 - val_f1_score: 0.5848
Epoch 301/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2701 - f1_score:
0.9461 - val_loss: 2.1379 - val_f1_score: 0.5950
Epoch 302/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2897 - f1_score:
0.9397 - val_loss: 2.0159 - val_f1_score: 0.6083
Epoch 303/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2863 - f1_score:
0.9338 - val_loss: 1.9026 - val_f1_score: 0.6122
Epoch 304/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2794 - f1_score:
0.9342 - val_loss: 2.1854 - val_f1_score: 0.5890
Epoch 305/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2950 - f1_score:
0.9294 - val_loss: 2.1080 - val_f1_score: 0.5590
Epoch 306/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2749 - f1_score:
0.9400 - val_loss: 2.1630 - val_f1_score: 0.5639
Epoch 307/500
```

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28/28 [==============================] - 2s 63ms/step - loss: 0.2686 - f1_score:
0.9407 - val_loss: 2.3322 - val_f1_score: 0.5721
Epoch 308/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2501 - f1_score:
0.9429 - val_loss: 2.0275 - val_f1_score: 0.5965
Epoch 309/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2851 - f1_score:
0.9321 - val_loss: 1.8876 - val_f1_score: 0.6297
Epoch 310/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2926 - f1_score:
0.9303 - val_loss: 2.0058 - val_f1_score: 0.5924
Epoch 311/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2479 - f1_score:
0.9487 - val_loss: 2.2902 - val_f1_score: 0.5433
Epoch 312/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2493 - f1_score:
0.9519 - val_loss: 2.1043 - val_f1_score: 0.5889
Epoch 313/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2669 - f1_score:
0.9401 - val_loss: 2.0232 - val_f1_score: 0.5969
Epoch 314/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2637 - f1_score:
0.9431 - val_loss: 2.1233 - val_f1_score: 0.5836
Epoch 315/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3383 - f1_score:
0.9123 - val_loss: 1.9484 - val_f1_score: 0.5978
Epoch 316/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3222 - f1_score:
0.9257 - val_loss: 2.0727 - val_f1_score: 0.5969
Epoch 317/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2885 - f1_score:
0.9355 - val_loss: 1.9500 - val_f1_score: 0.5963
Epoch 318/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2854 - f1_score:
0.9333 - val_loss: 2.2840 - val_f1_score: 0.5410
Epoch 319/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2922 - f1_score:
0.9306 - val_loss: 2.0216 - val_f1_score: 0.6067
Epoch 320/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2986 - f1_score:
0.9371 - val_loss: 2.1644 - val_f1_score: 0.5912
Epoch 321/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3109 - f1_score:
0.9279 - val_loss: 1.9015 - val_f1_score: 0.6225
Epoch 322/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2872 - f1_score:
0.9326 - val_loss: 2.1554 - val_f1_score: 0.5760
Epoch 323/500
```

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28/28 [==============================] - 2s 65ms/step - loss: 0.2786 - f1_score:
0.9339 - val_loss: 1.8676 - val_f1_score: 0.6156
Epoch 324/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2587 - f1_score:
0.9447 - val_loss: 2.0137 - val_f1_score: 0.6000
Epoch 325/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2826 - f1_score:
0.9372 - val_loss: 2.0642 - val_f1_score: 0.6018
Epoch 326/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2670 - f1_score:
0.9380 - val_loss: 2.4504 - val_f1_score: 0.5369
Epoch 327/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3006 - f1_score:
0.9321 - val_loss: 2.1286 - val_f1_score: 0.5876
Epoch 328/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2564 - f1_score:
0.9431 - val_loss: 1.9275 - val_f1_score: 0.5894
Epoch 329/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2927 - f1_score:
0.9342 - val_loss: 2.3791 - val_f1_score: 0.5721
Epoch 330/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2704 - f1_score:
0.9418 - val_loss: 2.1672 - val_f1_score: 0.5543
Epoch 331/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2766 - f1_score:
0.9417 - val_loss: 2.1929 - val_f1_score: 0.5950
Epoch 332/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2380 - f1_score:
0.9489 - val_loss: 2.2192 - val_f1_score: 0.5791
Epoch 333/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2891 - f1_score:
0.9368 - val_loss: 2.0637 - val_f1_score: 0.6041
Epoch 334/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2497 - f1_score:
0.9468 - val_loss: 2.0044 - val_f1_score: 0.5704
Epoch 335/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2541 - f1_score:
0.9468 - val_loss: 2.0322 - val_f1_score: 0.5819
Epoch 336/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2845 - f1_score:
0.9404 - val_loss: 2.0006 - val_f1_score: 0.5940
Epoch 337/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2530 - f1_score:
0.9448 - val_loss: 2.0100 - val_f1_score: 0.5961
Epoch 338/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2576 - f1_score:
0.9443 - val_loss: 2.0288 - val_f1_score: 0.6033
Epoch 339/500
```

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28/28 [==============================] - 2s 72ms/step - loss: 0.2616 - f1_score:
0.9446 - val_loss: 2.2619 - val_f1_score: 0.5907
Epoch 340/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2584 - f1_score:
0.9414 - val_loss: 2.1695 - val_f1_score: 0.6136
Epoch 341/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2725 - f1_score:
0.9418 - val_loss: 2.1320 - val_f1_score: 0.5895
Epoch 342/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2708 - f1_score:
0.9425 - val_loss: 2.1737 - val_f1_score: 0.5776
Epoch 343/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2824 - f1_score:
0.9371 - val_loss: 2.1518 - val_f1_score: 0.6210
Epoch 344/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2447 - f1_score:
0.9485 - val_loss: 2.1816 - val_f1_score: 0.6088
Epoch 345/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2880 - f1_score:
0.9382 - val_loss: 1.9015 - val_f1_score: 0.6539
Epoch 346/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2374 - f1_score:
0.9498 - val_loss: 2.0759 - val_f1_score: 0.6218
Epoch 347/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2586 - f1_score:
0.9440 - val_loss: 2.3390 - val_f1_score: 0.5583
Epoch 348/500
28/28 [==============================] - 3s 92ms/step - loss: 0.2447 - f1_score:
0.9485 - val_loss: 2.1530 - val_f1_score: 0.5925
Epoch 349/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2520 -
f1_score: 0.9439 - val_loss: 2.1915 - val_f1_score: 0.5976
Epoch 350/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2637 - f1_score:
0.9382 - val_loss: 2.1073 - val_f1_score: 0.5850
Epoch 351/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2905 - f1_score:
0.9283 - val_loss: 2.2542 - val_f1_score: 0.5739
Epoch 352/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2581 - f1_score:
0.9449 - val_loss: 2.0730 - val_f1_score: 0.5950
Epoch 353/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2589 - f1_score:
0.9442 - val_loss: 2.3394 - val_f1_score: 0.5650
Epoch 354/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3225 - f1_score:
0.9285 - val_loss: 2.0943 - val_f1_score: 0.5940
Epoch 355/500
```

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28/28 [==============================] - 2s 81ms/step - loss: 0.2835 - f1_score:
0.9330 - val_loss: 2.3843 - val_f1_score: 0.5773
Epoch 356/500
28/28 [==============================] - 2s 89ms/step - loss: 0.2822 - f1_score:
0.9404 - val_loss: 2.1701 - val_f1_score: 0.5904
Epoch 357/500
28/28 [==============================] - 2s 87ms/step - loss: 0.2745 - f1_score:
0.9429 - val_loss: 2.2380 - val_f1_score: 0.5524
Epoch 358/500
28/28 [==============================] - 2s 81ms/step - loss: 0.2471 - f1_score:
0.9428 - val_loss: 2.0527 - val_f1_score: 0.5981
Epoch 359/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2720 - f1_score:
0.9397 - val_loss: 2.1456 - val_f1_score: 0.6024
Epoch 360/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2646 - f1_score:
0.9406 - val_loss: 2.0993 - val_f1_score: 0.6048
Epoch 361/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2647 - f1_score:
0.9434 - val_loss: 2.1725 - val_f1_score: 0.5990
Epoch 362/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2447 - f1_score:
0.9452 - val_loss: 2.2127 - val_f1_score: 0.5676
Epoch 363/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2692 - f1_score:
0.9404 - val_loss: 2.2335 - val_f1_score: 0.5921
Epoch 364/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2713 - f1_score:
0.9404 - val_loss: 2.0958 - val_f1_score: 0.6073
Epoch 365/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2473 - f1_score:
0.9436 - val_loss: 2.0215 - val_f1_score: 0.6271
Epoch 366/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2472 - f1_score:
0.9462 - val_loss: 2.3123 - val_f1_score: 0.5910
Epoch 367/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2540 - f1_score:
0.9480 - val_loss: 2.3897 - val_f1_score: 0.5604
Epoch 368/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2703 - f1_score:
0.9382 - val_loss: 2.3842 - val_f1_score: 0.5966
Epoch 369/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2319 - f1_score:
0.9533 - val_loss: 2.2238 - val_f1_score: 0.5952
Epoch 370/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2508 - f1_score:
0.9448 - val_loss: 2.3191 - val_f1_score: 0.5749
Epoch 371/500
```

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28/28 [==============================] - 2s 68ms/step - loss: 0.2630 - f1_score:
0.9376 - val_loss: 2.3394 - val_f1_score: 0.5689
Epoch 372/500
28/28 [==============================] - 2s 81ms/step - loss: 0.2598 - f1_score:
0.9476 - val_loss: 2.2499 - val_f1_score: 0.5728
Epoch 373/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2453 - f1_score:
0.9488 - val_loss: 2.1568 - val_f1_score: 0.5879
Epoch 374/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2559 - f1_score:
0.9447 - val_loss: 2.1461 - val_f1_score: 0.6045
Epoch 375/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2138 - f1_score:
0.9580 - val_loss: 2.3466 - val_f1_score: 0.5690
Epoch 376/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2677 - f1_score:
0.9445 - val_loss: 2.3893 - val_f1_score: 0.6074
Epoch 377/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2691 - f1_score:
0.9426 - val_loss: 2.3337 - val_f1_score: 0.5705
Epoch 378/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2702 - f1_score:
0.9370 - val_loss: 2.2757 - val_f1_score: 0.5632
Epoch 379/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2366 - f1_score:
0.9516 - val_loss: 2.0336 - val_f1_score: 0.5981
Epoch 380/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2540 - f1_score:
0.9430 - val_loss: 2.1235 - val_f1_score: 0.5507
Epoch 381/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2773 - f1_score:
0.9339 - val_loss: 2.4635 - val_f1_score: 0.5650
Epoch 382/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2773 - f1_score:
0.9386 - val_loss: 2.1074 - val_f1_score: 0.5982
Epoch 383/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2923 - f1_score:
0.9286 - val_loss: 2.0667 - val_f1_score: 0.5980
Epoch 384/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2568 - f1_score:
0.9477 - val_loss: 2.1601 - val_f1_score: 0.5708
Epoch 385/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2506 - f1_score:
0.9458 - val_loss: 2.0635 - val_f1_score: 0.5830
Epoch 386/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2508 - f1_score:
0.9460 - val_loss: 2.2023 - val_f1_score: 0.5879
Epoch 387/500
```

```
28/28 [==============================] - 2s 77ms/step - loss: 0.2705 - f1_score:
0.9355 - val_loss: 2.0541 - val_f1_score: 0.5904
Epoch 388/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2432 - f1_score:
0.9478 - val_loss: 2.0905 - val_f1_score: 0.5794
Epoch 389/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2511 - f1_score:
0.9460 - val_loss: 2.1703 - val_f1_score: 0.6196
Epoch 390/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2284 - f1_score:
0.9583 - val_loss: 2.1944 - val_f1_score: 0.5891
Epoch 391/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2441 - f1_score:
0.9470 - val_loss: 2.3520 - val_f1_score: 0.5681
Epoch 392/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2268 - f1_score:
0.9570 - val_loss: 2.0256 - val_f1_score: 0.5881
Epoch 393/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2425 - f1_score:
0.9504 - val_loss: 2.2258 - val_f1_score: 0.5825
Epoch 394/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2649 - f1_score:
0.9441 - val_loss: 2.0547 - val_f1_score: 0.5861
Epoch 395/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2576 - f1_score:
0.9431 - val_loss: 2.1651 - val_f1_score: 0.5843
Epoch 396/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2740 - f1_score:
0.9371 - val_loss: 2.2289 - val_f1_score: 0.5840
Epoch 397/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2699 - f1_score:
0.9346 - val_loss: 2.1825 - val_f1_score: 0.6264
Epoch 398/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2687 - f1_score:
0.9369 - val_loss: 2.2804 - val_f1_score: 0.5936
Epoch 399/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2356 - f1_score:
0.9567 - val_loss: 2.3325 - val_f1_score: 0.5688
Epoch 400/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2394 - f1_score:
0.9486 - val_loss: 2.4057 - val_f1_score: 0.5698
Epoch 401/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2562 - f1_score:
0.9457 - val_loss: 2.3101 - val_f1_score: 0.5578
Epoch 402/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2821 - f1_score:
0.9357 - val_loss: 2.3171 - val_f1_score: 0.5800
Epoch 403/500
```

```
28/28 [==============================] - 2s 69ms/step - loss: 0.2725 - f1_score:
0.9439 - val_loss: 2.3037 - val_f1_score: 0.5630
Epoch 404/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2597 - f1_score:
0.9452 - val_loss: 2.3211 - val_f1_score: 0.6056
Epoch 405/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2440 - f1_score:
0.9478 - val_loss: 2.1763 - val_f1_score: 0.5798
Epoch 406/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2404 - f1_score:
0.9478 - val_loss: 2.2968 - val_f1_score: 0.5558
Epoch 407/500
28/28 [==============================] - 2s 81ms/step - loss: 0.2537 - f1_score:
0.9454 - val_loss: 2.4902 - val_f1_score: 0.5359
Epoch 408/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2730 - f1_score:
0.9345 - val_loss: 2.0409 - val_f1_score: 0.5892
Epoch 409/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2292 - f1_score:
0.9523 - val_loss: 2.2945 - val_f1_score: 0.5590
Epoch 410/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2567 - f1_score:
0.9448 - val_loss: 2.2179 - val_f1_score: 0.5550
Epoch 411/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2429 - f1_score:
0.9461 - val_loss: 2.2067 - val_f1_score: 0.5648
Epoch 412/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2458 - f1_score:
0.9488 - val_loss: 2.1561 - val_f1_score: 0.5834
Epoch 413/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2421 - f1_score:
0.9457 - val_loss: 2.3883 - val_f1_score: 0.5716
Epoch 414/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2273 - f1_score:
0.9543 - val_loss: 2.1613 - val_f1_score: 0.5538
Epoch 415/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2675 - f1_score:
0.9482 - val_loss: 2.2800 - val_f1_score: 0.5577
Epoch 416/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2617 - f1_score:
0.9382 - val_loss: 2.2131 - val_f1_score: 0.5799
Epoch 417/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2594 - f1_score:
0.9454 - val_loss: 2.1713 - val_f1_score: 0.5781
Epoch 418/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2565 - f1_score:
0.9460 - val_loss: 2.3569 - val_f1_score: 0.5321
Epoch 419/500
```

```
28/28 [==============================] - 2s 88ms/step - loss: 0.2328 - f1_score:
0.9533 - val_loss: 2.0790 - val_f1_score: 0.5895
Epoch 420/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2377 - f1_score:
0.9520 - val_loss: 2.1116 - val_f1_score: 0.5893
Epoch 421/500
28/28 [==============================] - 3s 122ms/step - loss: 0.2417 -
f1_score: 0.9499 - val_loss: 2.1931 - val_f1_score: 0.5877
Epoch 422/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2179 - f1_score:
0.9558 - val_loss: 2.1374 - val_f1_score: 0.5974
Epoch 423/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2804 - f1_score:
0.9384 - val_loss: 2.2831 - val_f1_score: 0.5475
Epoch 424/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3020 - f1_score:
0.9358 - val_loss: 2.2827 - val_f1_score: 0.5800
Epoch 425/500
28/28 [==============================] - 2s 81ms/step - loss: 0.2770 - f1_score:
0.9348 - val_loss: 2.1485 - val_f1_score: 0.5836
Epoch 426/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2546 - f1_score:
0.9452 - val_loss: 2.2001 - val_f1_score: 0.5929
Epoch 427/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2338 - f1_score:
0.9538 - val_loss: 2.5381 - val_f1_score: 0.5674
Epoch 428/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2440 - f1_score:
0.9475 - val_loss: 2.3352 - val_f1_score: 0.5789
Epoch 429/500
28/28 [==============================] - 2s 90ms/step - loss: 0.2571 - f1_score:
0.9465 - val_loss: 2.2222 - val_f1_score: 0.5805
Epoch 430/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2772 - f1_score:
0.9420 - val_loss: 2.0713 - val_f1_score: 0.6186
Epoch 431/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2445 - f1_score:
0.9465 - val_loss: 2.3828 - val_f1_score: 0.5665
Epoch 432/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2552 - f1_score:
0.9500 - val_loss: 2.2425 - val_f1_score: 0.5984
Epoch 433/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2246 - f1_score:
0.9553 - val_loss: 2.1941 - val_f1_score: 0.6021
Epoch 434/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2326 - f1_score:
0.9521 - val_loss: 2.2111 - val_f1_score: 0.5929
Epoch 435/500
```

```
28/28 [==============================] - 2s 79ms/step - loss: 0.2623 - f1_score:
0.9465 - val_loss: 2.2016 - val_f1_score: 0.5760
Epoch 436/500
28/28 [==============================] - 3s 90ms/step - loss: 0.2368 - f1_score:
0.9505 - val_loss: 2.4713 - val_f1_score: 0.5910
Epoch 437/500
28/28 [==============================] - 3s 121ms/step - loss: 0.2324 -
f1_score: 0.9497 - val_loss: 2.4003 - val_f1_score: 0.5650
Epoch 438/500
28/28 [==============================] - 3s 109ms/step - loss: 0.2476 -
f1_score: 0.9483 - val_loss: 2.2116 - val_f1_score: 0.5870
Epoch 439/500
28/28 [==============================] - 3s 105ms/step - loss: 0.2515 -
f1_score: 0.9412 - val_loss: 2.3040 - val_f1_score: 0.5708
Epoch 440/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2605 - f1_score:
0.9435 - val_loss: 2.3817 - val_f1_score: 0.5932
Epoch 441/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2637 - f1_score:
0.9486 - val_loss: 2.2522 - val_f1_score: 0.5369
Epoch 442/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2685 - f1_score:
0.9434 - val_loss: 2.2447 - val_f1_score: 0.5809
Epoch 443/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2487 - f1_score:
0.9455 - val_loss: 2.1668 - val_f1_score: 0.5889
Epoch 444/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2613 - f1_score:
0.9403 - val_loss: 2.1536 - val_f1_score: 0.5897
Epoch 445/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2358 - f1_score:
0.9505 - val_loss: 2.0351 - val_f1_score: 0.6009
Epoch 446/500
28/28 [==============================] - 2s 89ms/step - loss: 0.2599 - f1_score:
0.9414 - val_loss: 2.1948 - val_f1_score: 0.5754
Epoch 447/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2378 - f1_score:
0.9471 - val_loss: 2.1889 - val_f1_score: 0.5756
Epoch 448/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2532 - f1_score:
0.9408 - val_loss: 2.1480 - val_f1_score: 0.6021
Epoch 449/500
28/28 [==============================] - 3s 105ms/step - loss: 0.2446 -
f1_score: 0.9477 - val_loss: 2.0827 - val_f1_score: 0.6100
Epoch 450/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2382 -
f1_score: 0.9558 - val_loss: 2.1792 - val_f1_score: 0.5835
Epoch 451/500
```

```
28/28 [==============================] - 2s 77ms/step - loss: 0.2506 - f1_score:
0.9484 - val_loss: 2.2636 - val_f1_score: 0.6022
Epoch 452/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2329 - f1_score:
0.9539 - val_loss: 2.1711 - val_f1_score: 0.5834
Epoch 453/500
28/28 [==============================] - 3s 108ms/step - loss: 0.2135 -
f1_score: 0.9604 - val_loss: 2.4613 - val_f1_score: 0.5199
Epoch 454/500
28/28 [==============================] - 3s 88ms/step - loss: 0.2302 - f1_score:
0.9553 - val_loss: 2.2330 - val_f1_score: 0.6071
Epoch 455/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2352 - f1_score:
0.9515 - val_loss: 2.1965 - val_f1_score: 0.6004
Epoch 456/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2191 - f1_score:
0.9575 - val_loss: 2.1112 - val_f1_score: 0.5790
Epoch 457/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2299 - f1_score:
0.9537 - val_loss: 2.1297 - val_f1_score: 0.5967
Epoch 458/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2474 - f1_score:
0.9423 - val_loss: 2.2079 - val_f1_score: 0.5753
Epoch 459/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2411 - f1_score:
0.9522 - val_loss: 2.2680 - val_f1_score: 0.5465
Epoch 460/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2351 - f1_score:
0.9542 - val_loss: 2.0968 - val_f1_score: 0.6068
Epoch 461/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2432 - f1_score:
0.9516 - val_loss: 2.1464 - val_f1_score: 0.6030
Epoch 462/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2281 - f1_score:
0.9531 - val_loss: 2.2224 - val_f1_score: 0.5967
Epoch 463/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2346 - f1_score:
0.9487 - val_loss: 2.2287 - val_f1_score: 0.5653
Epoch 464/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2524 - f1_score:
0.9482 - val_loss: 2.2352 - val_f1_score: 0.5437
Epoch 465/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2311 - f1_score:
0.9527 - val_loss: 2.1636 - val_f1_score: 0.6235
Epoch 466/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2159 - f1_score:
0.9546 - val_loss: 2.4447 - val_f1_score: 0.5641
Epoch 467/500
```

```
28/28 [==============================] - 2s 62ms/step - loss: 0.2266 - f1_score:
0.9562 - val_loss: 2.1904 - val_f1_score: 0.5488
Epoch 468/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2176 - f1_score:
0.9526 - val_loss: 2.3408 - val_f1_score: 0.5366
Epoch 469/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2339 - f1_score:
0.9502 - val_loss: 2.3933 - val_f1_score: 0.5529
Epoch 470/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2522 - f1_score:
0.9509 - val_loss: 2.6681 - val_f1_score: 0.5567
Epoch 471/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2241 - f1_score:
0.9518 - val_loss: 2.1902 - val_f1_score: 0.5817
Epoch 472/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2151 - f1_score:
0.9596 - val_loss: 2.1580 - val_f1_score: 0.5911
Epoch 473/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2562 - f1_score:
0.9446 - val_loss: 2.1941 - val_f1_score: 0.5863
Epoch 474/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2621 - f1_score:
0.9393 - val_loss: 2.1678 - val_f1_score: 0.5962
Epoch 475/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2419 - f1_score:
0.9528 - val_loss: 2.5292 - val_f1_score: 0.5323
Epoch 476/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2266 - f1_score:
0.9540 - val_loss: 2.2497 - val_f1_score: 0.5806
Epoch 477/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2202 - f1_score:
0.9574 - val_loss: 2.3895 - val_f1_score: 0.5877
Epoch 478/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2400 - f1_score:
0.9470 - val_loss: 2.4008 - val_f1_score: 0.5790
Epoch 479/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2670 - f1_score:
0.9408 - val_loss: 2.3344 - val_f1_score: 0.5878
Epoch 480/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2264 - f1_score:
0.9555 - val_loss: 2.4085 - val_f1_score: 0.5517
Epoch 481/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2244 - f1_score:
0.9546 - val_loss: 2.3001 - val_f1_score: 0.5741
Epoch 482/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2445 - f1_score:
0.9443 - val_loss: 2.5735 - val_f1_score: 0.5115
Epoch 483/500
```

```
28/28 [==============================] - 2s 70ms/step - loss: 0.2147 - f1_score:
0.9559 - val_loss: 2.2548 - val_f1_score: 0.6044
Epoch 484/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2269 - f1_score:
0.9553 - val_loss: 2.4416 - val_f1_score: 0.5813
Epoch 485/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2280 - f1_score:
0.9538 - val_loss: 2.3161 - val_f1_score: 0.5770
Epoch 486/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2349 - f1_score:
0.9509 - val_loss: 2.3960 - val_f1_score: 0.5591
Epoch 487/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2298 - f1_score:
0.9522 - val_loss: 2.3543 - val_f1_score: 0.5712
Epoch 488/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2365 - f1_score:
0.9504 - val_loss: 2.3375 - val_f1_score: 0.5723
Epoch 489/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2630 - f1_score:
0.9408 - val_loss: 2.4296 - val_f1_score: 0.5723
Epoch 490/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1995 - f1_score:
0.9643 - val_loss: 2.2484 - val_f1_score: 0.5964
Epoch 491/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2210 - f1_score:
0.9561 - val_loss: 2.4108 - val_f1_score: 0.5875
Epoch 492/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2522 - f1_score:
0.9488 - val_loss: 2.5689 - val_f1_score: 0.5440
Epoch 493/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2710 - f1_score:
0.9389 - val_loss: 2.4917 - val_f1_score: 0.5408
Epoch 494/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2632 - f1_score:
0.9452 - val_loss: 2.2641 - val_f1_score: 0.5717
Epoch 495/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2221 - f1_score:
0.9585 - val_loss: 2.5086 - val_f1_score: 0.5518
Epoch 496/500
28/28 [==============================] - 2s 83ms/step - loss: 0.1984 - f1_score:
0.9657 - val_loss: 2.5087 - val_f1_score: 0.5643
Epoch 497/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2020 - f1_score:
0.9624 - val_loss: 2.2736 - val_f1_score: 0.5699
Epoch 498/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2153 - f1_score:
0.9558 - val_loss: 2.1588 - val_f1_score: 0.5988
Epoch 499/500
```

```
28/28 [==============================] - 2s 71ms/step - loss: 0.2052 - f1_score:
0.9621 - val_loss: 2.2760 - val_f1_score: 0.5873
Epoch 500/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2209 - f1_score:
0.9529 - val_loss: 2.2402 - val_f1_score: 0.5718
```

[252]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 8ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.600     1.000     0.750         6
  BASKETBALL      0.625     1.000     0.769        10
         BEE      0.357     0.500     0.417        10
        BELT      0.500     1.000     0.667         4
        BITE      0.750     0.375     0.500         8
   BREAKFAST      0.667     0.333     0.444         6
      CANCER      0.727     1.000     0.842         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.250     0.333     0.286         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.800     0.500     0.615         8
     DEVELOP      0.286     0.333     0.308         6
      DINNER      0.667     0.500     0.571         8
         DOG      0.429     0.500     0.462         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.000     0.000     0.000         4
         EAT      1.000     0.500     0.667         6
        EDIT      0.800     0.667     0.727         6
    ELEVATOR      0.500     0.500     0.500         8
        FINE      0.400     0.500     0.444         4
       FLOAT      0.500     0.500     0.500         4
   FOREIGNER      0.600     1.000     0.750         6
       GUESS      0.667     0.750     0.706         8
   HALLOWEEN      1.000     0.750     0.857         8
    HOSPITAL      0.500     0.167     0.250         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.500     0.250     0.333         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.600     0.375     0.462         8
```

```
       MAPLE      0.500     1.000     0.667         4
        MEAT      0.444     0.667     0.533         6
    MECHANIC      0.500     1.000     0.667         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.500     0.875     0.636         8
        NOON      0.615     1.000     0.762         8
       PARTY      0.667     0.500     0.571         8
     PATIENT      0.250     0.167     0.200         6
       RAZOR      0.500     0.500     0.500         4
       RIVER      1.000     0.500     0.667         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.400     0.200     0.267        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.250     0.250     0.250         4
        THEY      0.400     0.500     0.444         4
       TWINS      0.417     0.625     0.500         8
     WHATFOR      0.833     0.500     0.625        10

    accuracy                           0.608       324
   macro avg      0.608     0.597     0.572       324
weighted avg      0.631     0.608     0.588       324
```

[253]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1D-CNN + 1 GRU Trial 593/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[254]:
```
hist_df = pd.read_csv('1 1D-CNN + 1 GRU Trial 593/history.csv', index_col=0)
hist_df.tail()
```

[254]:

	loss	f1_score	val_loss	val_f1_score
495	0.198441	0.965655	2.508691	0.564297
496	0.201955	0.962449	2.273557	0.569904
497	0.215270	0.955840	2.158836	0.598835
498	0.205172	0.962075	2.276037	0.587324
499	0.220950	0.952867	2.240231	0.571802

[255]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
```

```
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[256]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')

plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[127]:
```
reconstructed_model = tf.keras.models.load_model("1 1D-CNN + 1 GRU Trial 593")
```

```
2023-09-23 11:44:09.464948: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-23 11:44:09.466493: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1435 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[128]:
```
reconstructed_model.summary()
```

```
Model: "sequential_3"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_3 (Conv1D)           (None, 126, 100)          199600

 max_pooling1d_3 (MaxPooling  (None, 8, 100)           0
 1D)

 dropout_6 (Dropout)         (None, 8, 100)            0
```

```
 gru_3 (GRU)                 (None, 175)               145425

 dropout_7 (Dropout)         (None, 175)               0

 dense_6 (Dense)             (None, 80)                14080

 dense_7 (Dense)             (None, 50)                4050

=================================================================
Total params: 363,155
Trainable params: 363,155
Non-trainable params: 0
_________________________________________________________________
```

[129]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[129]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 126, 100)
MaxPooling1D
input:
(None, 126, 100)
output:
(None, 8, 100)
Dropout
input:
(None, 8, 100)
output:
(None, 8, 100)
GRU
input:
(None, 8, 100)
output:
(None, 175)
Dropout
input:
(None, 175)
output:
(None, 175)
Dense
input:
(None, 175)
output:
(None, 80)
Dense
input:
(None, 80)
output:
(None, 50)

[130]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[130]:

Conv1D
MaxPooling1D
Dropout
GRU
Dense

[131]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
2023-09-23 11:44:20.094498: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [==============================] - 1s 13ms/step - loss: 1.5675 - f1_score:
0.6800
```

[131]:
```
[1.5674517154693604, 0.6800420880317688]
```

[132]:
```
reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)
```

```
2023-09-23 11:44:22.579545: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
2023-09-23 11:44:23.059729: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.

28/28 [==============================] - 1s 23ms/step - loss: 0.1200 - f1_score:
0.9996
```

[132]:
```
[0.11997100710868835, 0.9995791912078857]
```

[133]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 10ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      1.000     0.800     0.889        10
         BEE      0.417     0.500     0.455        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.500     0.667         8
   BREAKFAST      0.333     0.333     0.333         6
      CANCER      1.000     1.000     1.000         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.500     0.667         8
```

```
     DEVELOP      0.500     0.333     0.400         6
      DINNER      0.727     1.000     0.842         8
         DOG      0.667     0.667     0.667         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.400     0.500     0.444         4
         EAT      0.667     0.667     0.667         6
        EDIT      0.800     0.667     0.727         6
    ELEVATOR      0.400     0.500     0.444         8
        FINE      0.333     0.500     0.400         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      1.000     0.750     0.857         8
   HALLOWEEN      0.667     1.000     0.800         8
    HOSPITAL      0.400     0.333     0.364         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.667     0.250     0.364         8
       MAPLE      0.800     1.000     0.889         4
        MEAT      0.500     0.500     0.500         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.471     1.000     0.640         8
        NOON      0.615     1.000     0.762         8
       PARTY      0.857     0.750     0.800         8
     PATIENT      0.571     0.667     0.615         6
       RAZOR      1.000     0.500     0.667         4
       RIVER      0.625     0.833     0.714         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.636     0.700     0.667        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.556     0.625     0.588         8
     WHATFOR      1.000     0.500     0.667        10

    accuracy                          0.694       324
   macro avg      0.716     0.687     0.680       324
weighted avg      0.728     0.694     0.688       324
```

3.7.2 1 1D-CNN + 1 GRU Trial 722

[ ]:
```
best_model = tuner.get_best_models(num_models=4)[3]
```

[123]:
```
best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-10 15:39:03.643462: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

84/84 [==============================] - 2s 16ms/step - loss: 0.5961 - f1_score:
0.8469
```

[123]:
```
[0.5960583686828613, 0.8469364643096924]
```

[124]:
```
best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 18ms/step - loss: 1.1756 - f1_score:
0.6961
```

[124]:
```
[1.1756278276443481, 0.6960964798927307]
```

[125]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=4)[3]
```

[126]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1D-CNN + 1 GRU Trial 722/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[127]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500

2023-09-10 15:39:25.506746: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0xd72eb00 initialized for platform CUDA (this does not guarantee
that XLA will be used). Devices:
2023-09-10 15:39:25.506786: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-10 15:39:25.520431: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-10 15:39:25.716663: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.

28/28 [==============================] - ETA: 0s - loss: 4.6688 - f1_score:
0.0186
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 16s 392ms/step - loss: 4.6688 -
f1_score: 0.0186 - val_loss: 4.1136 - val_f1_score: 0.0022
Epoch 2/500
28/28 [==============================] - 3s 106ms/step - loss: 4.5605 -
f1_score: 0.0175 - val_loss: 4.1977 - val_f1_score: 4.1237e-04
Epoch 3/500
28/28 [==============================] - ETA: 0s - loss: 4.5649 - f1_score:
0.0248

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 382ms/step - loss: 4.5649 -
f1_score: 0.0248 - val_loss: 4.0892 - val_f1_score: 0.0028
Epoch 4/500
28/28 [==============================] - 3s 107ms/step - loss: 4.4667 -
f1_score: 0.0161 - val_loss: 4.1107 - val_f1_score: 7.2948e-04
Epoch 5/500
28/28 [==============================] - 3s 108ms/step - loss: 4.4170 -
f1_score: 0.0171 - val_loss: 4.0656 - val_f1_score: 7.3171e-04
Epoch 6/500
28/28 [==============================] - ETA: 0s - loss: 4.3702 - f1_score:
0.0192

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 358ms/step - loss: 4.3702 -
f1_score: 0.0192 - val_loss: 4.0635 - val_f1_score: 0.0044
Epoch 7/500
28/28 [==============================] - 3s 107ms/step - loss: 4.3189 -
f1_score: 0.0211 - val_loss: 4.0402 - val_f1_score: 0.0018
```

```
Epoch 8/500
28/28 [==============================] - 3s 108ms/step - loss: 4.3279 -
f1_score: 0.0179 - val_loss: 4.0425 - val_f1_score: 5.3691e-04
Epoch 9/500
28/28 [==============================] - ETA: 0s - loss: 4.2354 - f1_score:
0.0191

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 414ms/step - loss: 4.2354 -
f1_score: 0.0191 - val_loss: 3.9986 - val_f1_score: 0.0048
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 4.2419 - f1_score:
0.0153

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 416ms/step - loss: 4.2419 -
f1_score: 0.0153 - val_loss: 3.9872 - val_f1_score: 0.0048
Epoch 11/500
28/28 [==============================] - ETA: 0s - loss: 4.1671 - f1_score:
0.0206

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 391ms/step - loss: 4.1671 -
f1_score: 0.0206 - val_loss: 3.9864 - val_f1_score: 0.0050
Epoch 12/500
28/28 [==============================] - ETA: 0s - loss: 4.1746 - f1_score:
0.0230

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
```

```
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 384ms/step - loss: 4.1746 -
f1_score: 0.0230 - val_loss: 3.9727 - val_f1_score: 0.0090
Epoch 13/500
28/28 [==============================] - 3s 107ms/step - loss: 4.1741 -
f1_score: 0.0227 - val_loss: 3.9908 - val_f1_score: 0.0020
Epoch 14/500
28/28 [==============================] - ETA: 0s - loss: 4.1115 - f1_score:
0.0270

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 371ms/step - loss: 4.1115 -
f1_score: 0.0270 - val_loss: 3.9555 - val_f1_score: 0.0290
Epoch 15/500
28/28 [==============================] - 3s 108ms/step - loss: 4.0820 -
f1_score: 0.0257 - val_loss: 3.9487 - val_f1_score: 0.0044
Epoch 16/500
28/28 [==============================] - 3s 108ms/step - loss: 4.0657 -
f1_score: 0.0280 - val_loss: 3.9306 - val_f1_score: 0.0072
Epoch 17/500
28/28 [==============================] - 3s 108ms/step - loss: 4.0476 -
f1_score: 0.0224 - val_loss: 3.9069 - val_f1_score: 0.0164
Epoch 18/500
28/28 [==============================] - 3s 108ms/step - loss: 4.0174 -
f1_score: 0.0347 - val_loss: 3.8849 - val_f1_score: 0.0272
Epoch 19/500
28/28 [==============================] - ETA: 0s - loss: 4.0129 - f1_score:
0.0308

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
```

```
28/28 [==============================] - 10s 373ms/step - loss: 4.0129 -
f1_score: 0.0308 - val_loss: 3.8430 - val_f1_score: 0.0419
Epoch 20/500
28/28 [==============================] - 3s 108ms/step - loss: 3.9702 -
f1_score: 0.0347 - val_loss: 3.8029 - val_f1_score: 0.0233
Epoch 21/500
28/28 [==============================] - 3s 109ms/step - loss: 3.9430 -
f1_score: 0.0343 - val_loss: 3.7550 - val_f1_score: 0.0228
Epoch 22/500
28/28 [==============================] - 3s 110ms/step - loss: 3.8810 -
f1_score: 0.0392 - val_loss: 3.6834 - val_f1_score: 0.0252
Epoch 23/500
28/28 [==============================] - 3s 110ms/step - loss: 3.8517 -
f1_score: 0.0416 - val_loss: 3.6391 - val_f1_score: 0.0301
Epoch 24/500
28/28 [==============================] - 3s 110ms/step - loss: 3.8016 -
f1_score: 0.0508 - val_loss: 3.5648 - val_f1_score: 0.0196
Epoch 25/500
28/28 [==============================] - ETA: 0s - loss: 3.7613 - f1_score:
0.0523

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 447ms/step - loss: 3.7613 -
f1_score: 0.0523 - val_loss: 3.4920 - val_f1_score: 0.0446
Epoch 26/500
28/28 [==============================] - 3s 108ms/step - loss: 3.7213 -
f1_score: 0.0494 - val_loss: 3.4562 - val_f1_score: 0.0372
Epoch 27/500
28/28 [==============================] - 3s 111ms/step - loss: 3.6549 -
f1_score: 0.0651 - val_loss: 3.4007 - val_f1_score: 0.0371
Epoch 28/500
28/28 [==============================] - ETA: 0s - loss: 3.6372 - f1_score:
0.0634

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
```

```
28/28 [==============================] - 12s 429ms/step - loss: 3.6372 -
f1_score: 0.0634 - val_loss: 3.3608 - val_f1_score: 0.0465
Epoch 29/500
28/28 [==============================] - 3s 109ms/step - loss: 3.5687 -
f1_score: 0.0669 - val_loss: 3.3299 - val_f1_score: 0.0407
Epoch 30/500
28/28 [==============================] - ETA: 0s - loss: 3.5368 - f1_score:
0.0734

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 392ms/step - loss: 3.5368 -
f1_score: 0.0734 - val_loss: 3.2529 - val_f1_score: 0.0561
Epoch 31/500
28/28 [==============================] - ETA: 0s - loss: 3.4942 - f1_score:
0.0724

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 428ms/step - loss: 3.4942 -
f1_score: 0.0724 - val_loss: 3.2261 - val_f1_score: 0.0715
Epoch 32/500
28/28 [==============================] - 3s 112ms/step - loss: 3.4533 -
f1_score: 0.0838 - val_loss: 3.1425 - val_f1_score: 0.0695
Epoch 33/500
28/28 [==============================] - ETA: 0s - loss: 3.3964 - f1_score:
0.0829

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 404ms/step - loss: 3.3964 -
f1_score: 0.0829 - val_loss: 3.0893 - val_f1_score: 0.0768
Epoch 34/500
```

```
28/28 [==============================] - ETA: 0s - loss: 3.3534 - f1_score:
0.0924

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 13s 461ms/step - loss: 3.3534 -
f1_score: 0.0924 - val_loss: 3.0657 - val_f1_score: 0.0808
Epoch 35/500
28/28 [==============================] - 3s 109ms/step - loss: 3.3354 -
f1_score: 0.0867 - val_loss: 2.9923 - val_f1_score: 0.0780
Epoch 36/500
28/28 [==============================] - ETA: 0s - loss: 3.3080 - f1_score:
0.0933

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 405ms/step - loss: 3.3080 -
f1_score: 0.0933 - val_loss: 2.9822 - val_f1_score: 0.0931
Epoch 37/500
28/28 [==============================] - ETA: 0s - loss: 3.2385 - f1_score:
0.0953

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 398ms/step - loss: 3.2385 -
f1_score: 0.0953 - val_loss: 2.8903 - val_f1_score: 0.0996
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 3.1920 - f1_score:
0.1124

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
```

```
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 415ms/step - loss: 3.1920 -
f1_score: 0.1124 - val_loss: 2.8880 - val_f1_score: 0.1012
Epoch 39/500
28/28 [==============================] - ETA: 0s - loss: 3.1541 - f1_score:
0.1125

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 364ms/step - loss: 3.1541 -
f1_score: 0.1125 - val_loss: 2.8251 - val_f1_score: 0.1317
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 3.1307 - f1_score:
0.1186

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 384ms/step - loss: 3.1307 -
f1_score: 0.1186 - val_loss: 2.7966 - val_f1_score: 0.1364
Epoch 41/500
28/28 [==============================] - 3s 108ms/step - loss: 3.1178 -
f1_score: 0.1178 - val_loss: 2.7679 - val_f1_score: 0.1340
Epoch 42/500
28/28 [==============================] - ETA: 0s - loss: 3.0717 - f1_score:
0.1327

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
```

```
28/28 [==============================] - 11s 391ms/step - loss: 3.0717 -
f1_score: 0.1327 - val_loss: 2.7575 - val_f1_score: 0.1616
Epoch 43/500
28/28 [==============================] - ETA: 0s - loss: 3.0541 - f1_score:
0.1368

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 374ms/step - loss: 3.0541 -
f1_score: 0.1368 - val_loss: 2.7088 - val_f1_score: 0.1678
Epoch 44/500
28/28 [==============================] - 3s 107ms/step - loss: 3.0140 -
f1_score: 0.1328 - val_loss: 2.6969 - val_f1_score: 0.1529
Epoch 45/500
28/28 [==============================] - ETA: 0s - loss: 2.9631 - f1_score:
0.1484

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 397ms/step - loss: 2.9631 -
f1_score: 0.1484 - val_loss: 2.6878 - val_f1_score: 0.2036
Epoch 46/500
28/28 [==============================] - 3s 108ms/step - loss: 2.9539 -
f1_score: 0.1483 - val_loss: 2.6354 - val_f1_score: 0.1827
Epoch 47/500
28/28 [==============================] - 3s 108ms/step - loss: 2.9489 -
f1_score: 0.1659 - val_loss: 2.6301 - val_f1_score: 0.1746
Epoch 48/500
28/28 [==============================] - ETA: 0s - loss: 2.9054 - f1_score:
0.1694

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
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```
28/28 [==============================] - 11s 408ms/step - loss: 2.9054 -
f1_score: 0.1694 - val_loss: 2.6026 - val_f1_score: 0.2118
Epoch 49/500
28/28 [==============================] - 3s 108ms/step - loss: 2.8821 -
f1_score: 0.1552 - val_loss: 2.5643 - val_f1_score: 0.2018
Epoch 50/500
28/28 [==============================] - ETA: 0s - loss: 2.8840 - f1_score:
0.1645

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 371ms/step - loss: 2.8840 -
f1_score: 0.1645 - val_loss: 2.5460 - val_f1_score: 0.2125
Epoch 51/500
28/28 [==============================] - ETA: 0s - loss: 2.8372 - f1_score:
0.1701

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 373ms/step - loss: 2.8372 -
f1_score: 0.1701 - val_loss: 2.5092 - val_f1_score: 0.2558
Epoch 52/500
28/28 [==============================] - 3s 108ms/step - loss: 2.8002 -
f1_score: 0.1854 - val_loss: 2.5071 - val_f1_score: 0.2200
Epoch 53/500
28/28 [==============================] - 3s 108ms/step - loss: 2.8044 -
f1_score: 0.1856 - val_loss: 2.4907 - val_f1_score: 0.2409
Epoch 54/500
28/28 [==============================] - 3s 109ms/step - loss: 2.8005 -
f1_score: 0.1855 - val_loss: 2.4826 - val_f1_score: 0.2363
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 2.7548 - f1_score:
0.1869

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 436ms/step - loss: 2.7548 -
f1_score: 0.1869 - val_loss: 2.3952 - val_f1_score: 0.2732
Epoch 56/500
28/28 [==============================] - ETA: 0s - loss: 2.7674 - f1_score:
0.1853

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 18s 670ms/step - loss: 2.7674 -
f1_score: 0.1853 - val_loss: 2.4219 - val_f1_score: 0.2966
Epoch 57/500
28/28 [==============================] - 3s 107ms/step - loss: 2.7318 -
f1_score: 0.2041 - val_loss: 2.4136 - val_f1_score: 0.2800
Epoch 58/500
28/28 [==============================] - ETA: 0s - loss: 2.6908 - f1_score:
0.2035

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 371ms/step - loss: 2.6908 -
f1_score: 0.2035 - val_loss: 2.3842 - val_f1_score: 0.3113
Epoch 59/500
28/28 [==============================] - 3s 107ms/step - loss: 2.6878 -
f1_score: 0.2126 - val_loss: 2.3581 - val_f1_score: 0.2850
Epoch 60/500
28/28 [==============================] - 3s 110ms/step - loss: 2.6685 -
f1_score: 0.2309 - val_loss: 2.3529 - val_f1_score: 0.2920
Epoch 61/500
28/28 [==============================] - 3s 108ms/step - loss: 2.6588 -
f1_score: 0.2202 - val_loss: 2.3587 - val_f1_score: 0.3062
Epoch 62/500
28/28 [==============================] - 3s 109ms/step - loss: 2.6268 -
f1_score: 0.2279 - val_loss: 2.3459 - val_f1_score: 0.2723
Epoch 63/500
```

```
28/28 [==============================] - ETA: 0s - loss: 2.6340 - f1_score:
0.2189

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 397ms/step - loss: 2.6340 -
f1_score: 0.2189 - val_loss: 2.3020 - val_f1_score: 0.3252
Epoch 64/500
28/28 [==============================] - ETA: 0s - loss: 2.5701 - f1_score:
0.2448

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 14s 532ms/step - loss: 2.5701 -
f1_score: 0.2448 - val_loss: 2.2953 - val_f1_score: 0.3449
Epoch 65/500
28/28 [==============================] - 3s 107ms/step - loss: 2.5991 -
f1_score: 0.2255 - val_loss: 2.2891 - val_f1_score: 0.3238
Epoch 66/500
28/28 [==============================] - ETA: 0s - loss: 2.5784 - f1_score:
0.2295

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 393ms/step - loss: 2.5784 -
f1_score: 0.2295 - val_loss: 2.2731 - val_f1_score: 0.3519
Epoch 67/500
28/28 [==============================] - 3s 107ms/step - loss: 2.5866 -
f1_score: 0.2267 - val_loss: 2.2530 - val_f1_score: 0.3354
Epoch 68/500
28/28 [==============================] - ETA: 0s - loss: 2.5577 - f1_score:
0.2356
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 10s 375ms/step - loss: 2.5577 -
f1_score: 0.2356 - val_loss: 2.2304 - val_f1_score: 0.3550
Epoch 69/500
28/28 [==============================] - 3s 109ms/step - loss: 2.5231 -
f1_score: 0.2508 - val_loss: 2.2283 - val_f1_score: 0.3416
Epoch 70/500
28/28 [==============================] - ETA: 0s - loss: 2.5146 - f1_score:
0.2518

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 390ms/step - loss: 2.5146 -
f1_score: 0.2518 - val_loss: 2.1799 - val_f1_score: 0.3590
Epoch 71/500
28/28 [==============================] - 3s 108ms/step - loss: 2.5114 -
f1_score: 0.2545 - val_loss: 2.2104 - val_f1_score: 0.3565
Epoch 72/500
28/28 [==============================] - ETA: 0s - loss: 2.5045 - f1_score:
0.2485

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 425ms/step - loss: 2.5045 -
f1_score: 0.2485 - val_loss: 2.1938 - val_f1_score: 0.3740
Epoch 73/500
28/28 [==============================] - 3s 108ms/step - loss: 2.4740 -
f1_score: 0.2619 - val_loss: 2.1747 - val_f1_score: 0.3685
Epoch 74/500
28/28 [==============================] - 3s 108ms/step - loss: 2.4562 -
f1_score: 0.2732 - val_loss: 2.1740 - val_f1_score: 0.3662
```

```
Epoch 75/500
28/28 [==============================] - 3s 108ms/step - loss: 2.4596 -
f1_score: 0.2714 - val_loss: 2.1336 - val_f1_score: 0.3611
Epoch 76/500
28/28 [==============================] - 3s 109ms/step - loss: 2.4562 -
f1_score: 0.2608 - val_loss: 2.1472 - val_f1_score: 0.3703
Epoch 77/500
28/28 [==============================] - ETA: 0s - loss: 2.4430 - f1_score:
0.2681

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 386ms/step - loss: 2.4430 -
f1_score: 0.2681 - val_loss: 2.1205 - val_f1_score: 0.3877
Epoch 78/500
28/28 [==============================] - 3s 108ms/step - loss: 2.4213 -
f1_score: 0.2782 - val_loss: 2.1076 - val_f1_score: 0.3726
Epoch 79/500
28/28 [==============================] - ETA: 0s - loss: 2.3752 - f1_score:
0.2848

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 399ms/step - loss: 2.3752 -
f1_score: 0.2848 - val_loss: 2.0875 - val_f1_score: 0.3924
Epoch 80/500
28/28 [==============================] - ETA: 0s - loss: 2.3996 - f1_score:
0.2896

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 403ms/step - loss: 2.3996 -
f1_score: 0.2896 - val_loss: 2.1138 - val_f1_score: 0.4045
```

```
Epoch 81/500
28/28 [==============================] - ETA: 0s - loss: 2.3815 - f1_score:
0.2752

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 419ms/step - loss: 2.3815 -
f1_score: 0.2752 - val_loss: 2.0564 - val_f1_score: 0.4109
Epoch 82/500
28/28 [==============================] - 3s 108ms/step - loss: 2.3558 -
f1_score: 0.2927 - val_loss: 2.0691 - val_f1_score: 0.4053
Epoch 83/500
28/28 [==============================] - 3s 108ms/step - loss: 2.3382 -
f1_score: 0.2932 - val_loss: 2.0273 - val_f1_score: 0.4067
Epoch 84/500
28/28 [==============================] - 3s 108ms/step - loss: 2.3354 -
f1_score: 0.2896 - val_loss: 2.1134 - val_f1_score: 0.3835
Epoch 85/500
28/28 [==============================] - 3s 109ms/step - loss: 2.3171 -
f1_score: 0.3095 - val_loss: 2.0581 - val_f1_score: 0.3891
Epoch 86/500
28/28 [==============================] - 3s 110ms/step - loss: 2.3122 -
f1_score: 0.3143 - val_loss: 2.1061 - val_f1_score: 0.3919
Epoch 87/500
28/28 [==============================] - ETA: 0s - loss: 2.2910 - f1_score:
0.3168

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 397ms/step - loss: 2.2910 -
f1_score: 0.3168 - val_loss: 2.0170 - val_f1_score: 0.4221
Epoch 88/500
28/28 [==============================] - 3s 110ms/step - loss: 2.3064 -
f1_score: 0.2960 - val_loss: 2.0227 - val_f1_score: 0.3748
Epoch 89/500
28/28 [==============================] - 3s 108ms/step - loss: 2.3001 -
f1_score: 0.3143 - val_loss: 2.0376 - val_f1_score: 0.3908
Epoch 90/500
```

```
28/28 [==============================] - 3s 110ms/step - loss: 2.2523 -
f1_score: 0.3186 - val_loss: 1.9887 - val_f1_score: 0.4036
Epoch 91/500
28/28 [==============================] - 3s 110ms/step - loss: 2.2554 -
f1_score: 0.3170 - val_loss: 1.9863 - val_f1_score: 0.4072
Epoch 92/500
28/28 [==============================] - 3s 110ms/step - loss: 2.2113 -
f1_score: 0.3326 - val_loss: 1.9726 - val_f1_score: 0.3883
Epoch 93/500
28/28 [==============================] - 3s 118ms/step - loss: 2.2296 -
f1_score: 0.3216 - val_loss: 2.0183 - val_f1_score: 0.3875
Epoch 94/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2581 -
f1_score: 0.3255 - val_loss: 1.9276 - val_f1_score: 0.4078
Epoch 95/500
28/28 [==============================] - ETA: 0s - loss: 2.2015 - f1_score:
0.3406

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 423ms/step - loss: 2.2015 -
f1_score: 0.3406 - val_loss: 1.9955 - val_f1_score: 0.4277
Epoch 96/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1915 -
f1_score: 0.3222 - val_loss: 1.9826 - val_f1_score: 0.4195
Epoch 97/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1786 -
f1_score: 0.3341 - val_loss: 1.9251 - val_f1_score: 0.4195
Epoch 98/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1872 -
f1_score: 0.3309 - val_loss: 2.0147 - val_f1_score: 0.3916
Epoch 99/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1320 -
f1_score: 0.3456 - val_loss: 1.8857 - val_f1_score: 0.4275
Epoch 100/500
28/28 [==============================] - ETA: 0s - loss: 2.1367 - f1_score:
0.3564

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 390ms/step - loss: 2.1367 -
f1_score: 0.3564 - val_loss: 1.9231 - val_f1_score: 0.4370
Epoch 101/500
28/28 [==============================] - 3s 109ms/step - loss: 2.1655 -
f1_score: 0.3332 - val_loss: 1.9079 - val_f1_score: 0.4005
Epoch 102/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1237 -
f1_score: 0.3572 - val_loss: 1.9258 - val_f1_score: 0.4226
Epoch 103/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1152 -
f1_score: 0.3541 - val_loss: 1.8885 - val_f1_score: 0.4078
Epoch 104/500
28/28 [==============================] - 3s 110ms/step - loss: 2.1028 -
f1_score: 0.3680 - val_loss: 1.9596 - val_f1_score: 0.4303
Epoch 105/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0703 -
f1_score: 0.3705 - val_loss: 1.8501 - val_f1_score: 0.4355
Epoch 106/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0826 -
f1_score: 0.3694 - val_loss: 1.8761 - val_f1_score: 0.4281
Epoch 107/500
28/28 [==============================] - ETA: 0s - loss: 2.0780 - f1_score:
0.3641

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 454ms/step - loss: 2.0780 -
f1_score: 0.3641 - val_loss: 1.8709 - val_f1_score: 0.4633
Epoch 108/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0676 -
f1_score: 0.3723 - val_loss: 1.8665 - val_f1_score: 0.4252
Epoch 109/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0056 -
f1_score: 0.3948 - val_loss: 1.8248 - val_f1_score: 0.4311
Epoch 110/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0220 -
f1_score: 0.3732 - val_loss: 1.8610 - val_f1_score: 0.4273
Epoch 111/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0492 -
f1_score: 0.3810 - val_loss: 1.8252 - val_f1_score: 0.4339
Epoch 112/500
```

```
28/28 [==============================] - 3s 110ms/step - loss: 2.0315 -
f1_score: 0.3771 - val_loss: 1.8996 - val_f1_score: 0.3843
Epoch 113/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0178 -
f1_score: 0.4021 - val_loss: 1.8793 - val_f1_score: 0.4209
Epoch 114/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0041 -
f1_score: 0.3898 - val_loss: 1.8248 - val_f1_score: 0.4514
Epoch 115/500
28/28 [==============================] - ETA: 0s - loss: 1.9853 - f1_score:
0.3954

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 418ms/step - loss: 1.9853 -
f1_score: 0.3954 - val_loss: 1.7862 - val_f1_score: 0.4856
Epoch 116/500
28/28 [==============================] - 3s 109ms/step - loss: 1.9542 -
f1_score: 0.4051 - val_loss: 1.7780 - val_f1_score: 0.4658
Epoch 117/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9835 -
f1_score: 0.4013 - val_loss: 1.7599 - val_f1_score: 0.4677
Epoch 118/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9635 -
f1_score: 0.3975 - val_loss: 1.8050 - val_f1_score: 0.4298
Epoch 119/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9462 -
f1_score: 0.3909 - val_loss: 1.7354 - val_f1_score: 0.4609
Epoch 120/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9499 -
f1_score: 0.4159 - val_loss: 1.8533 - val_f1_score: 0.4485
Epoch 121/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9227 -
f1_score: 0.4124 - val_loss: 1.8317 - val_f1_score: 0.4207
Epoch 122/500
28/28 [==============================] - ETA: 0s - loss: 1.9517 - f1_score:
0.4041

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
```

```
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 402ms/step - loss: 1.9517 -
f1_score: 0.4041 - val_loss: 1.7359 - val_f1_score: 0.4888
Epoch 123/500
28/28 [==============================] - 3s 109ms/step - loss: 1.9054 -
f1_score: 0.4220 - val_loss: 1.7487 - val_f1_score: 0.4788
Epoch 124/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9403 -
f1_score: 0.4067 - val_loss: 1.7180 - val_f1_score: 0.4555
Epoch 125/500
28/28 [==============================] - 3s 111ms/step - loss: 1.8738 -
f1_score: 0.4163 - val_loss: 1.7282 - val_f1_score: 0.4632
Epoch 126/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9090 -
f1_score: 0.4230 - val_loss: 1.7242 - val_f1_score: 0.4829
Epoch 127/500
28/28 [==============================] - 3s 111ms/step - loss: 1.8382 -
f1_score: 0.4395 - val_loss: 1.6839 - val_f1_score: 0.4885
Epoch 128/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8702 -
f1_score: 0.4342 - val_loss: 1.8338 - val_f1_score: 0.4274
Epoch 129/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8636 -
f1_score: 0.4375 - val_loss: 1.6962 - val_f1_score: 0.4887
Epoch 130/500
28/28 [==============================] - ETA: 0s - loss: 1.8707 - f1_score:
0.4289

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 436ms/step - loss: 1.8707 -
f1_score: 0.4289 - val_loss: 1.6833 - val_f1_score: 0.5026
Epoch 131/500
28/28 [==============================] - 3s 109ms/step - loss: 1.8686 -
f1_score: 0.4295 - val_loss: 1.7191 - val_f1_score: 0.4672
Epoch 132/500
28/28 [==============================] - 3s 110ms/step - loss: 1.8342 -
f1_score: 0.4416 - val_loss: 1.6559 - val_f1_score: 0.4714
Epoch 133/500
28/28 [==============================] - 3s 110ms/step - loss: 1.8359 -
f1_score: 0.4382 - val_loss: 1.6541 - val_f1_score: 0.4810
Epoch 134/500
```

```
28/28 [==============================] - 3s 111ms/step - loss: 1.8079 -
f1_score: 0.4361 - val_loss: 1.6414 - val_f1_score: 0.4839
Epoch 135/500
28/28 [==============================] - 3s 111ms/step - loss: 1.8207 -
f1_score: 0.4457 - val_loss: 1.6936 - val_f1_score: 0.4711
Epoch 136/500
28/28 [==============================] - 3s 111ms/step - loss: 1.7831 -
f1_score: 0.4465 - val_loss: 1.6170 - val_f1_score: 0.5013
Epoch 137/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7605 -
f1_score: 0.4545 - val_loss: 1.6376 - val_f1_score: 0.4898
Epoch 138/500
28/28 [==============================] - 3s 111ms/step - loss: 1.7528 -
f1_score: 0.4520 - val_loss: 1.6608 - val_f1_score: 0.4853
Epoch 139/500
28/28 [==============================] - ETA: 0s - loss: 1.7547 - f1_score:
0.4616

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 424ms/step - loss: 1.7547 -
f1_score: 0.4616 - val_loss: 1.5912 - val_f1_score: 0.5139
Epoch 140/500
28/28 [==============================] - ETA: 0s - loss: 1.7899 - f1_score:
0.4432

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 393ms/step - loss: 1.7899 -
f1_score: 0.4432 - val_loss: 1.5661 - val_f1_score: 0.5272
Epoch 141/500
28/28 [==============================] - 3s 108ms/step - loss: 1.7275 -
f1_score: 0.4736 - val_loss: 1.6422 - val_f1_score: 0.4759
Epoch 142/500
28/28 [==============================] - 3s 110ms/step - loss: 1.7305 -
f1_score: 0.4697 - val_loss: 1.6152 - val_f1_score: 0.4928
Epoch 143/500
28/28 [==============================] - 3s 110ms/step - loss: 1.7478 -
```

```
f1_score: 0.4732 - val_loss: 1.6066 - val_f1_score: 0.4995
Epoch 144/500
28/28 [==============================] - 3s 110ms/step - loss: 1.7292 -
f1_score: 0.4701 - val_loss: 1.5718 - val_f1_score: 0.5173
Epoch 145/500
28/28 [==============================] - ETA: 0s - loss: 1.7116 - f1_score:
0.4837

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 438ms/step - loss: 1.7116 -
f1_score: 0.4837 - val_loss: 1.6114 - val_f1_score: 0.5309
Epoch 146/500
28/28 [==============================] - 3s 109ms/step - loss: 1.7049 -
f1_score: 0.4817 - val_loss: 1.5978 - val_f1_score: 0.5152
Epoch 147/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7062 -
f1_score: 0.4743 - val_loss: 1.6013 - val_f1_score: 0.4879
Epoch 148/500
28/28 [==============================] - 3s 111ms/step - loss: 1.6791 -
f1_score: 0.4912 - val_loss: 1.6937 - val_f1_score: 0.4763
Epoch 149/500
28/28 [==============================] - 3s 110ms/step - loss: 1.6522 -
f1_score: 0.4938 - val_loss: 1.6138 - val_f1_score: 0.5235
Epoch 150/500
28/28 [==============================] - ETA: 0s - loss: 1.6692 - f1_score:
0.4904

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 417ms/step - loss: 1.6692 -
f1_score: 0.4904 - val_loss: 1.5988 - val_f1_score: 0.5476
Epoch 151/500
28/28 [==============================] - 3s 109ms/step - loss: 1.6431 -
f1_score: 0.5056 - val_loss: 1.5635 - val_f1_score: 0.5009
Epoch 152/500
28/28 [==============================] - ETA: 0s - loss: 1.6439 - f1_score:
0.4975
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 395ms/step - loss: 1.6439 -
f1_score: 0.4975 - val_loss: 1.5105 - val_f1_score: 0.5570
Epoch 153/500
28/28 [==============================] - 3s 108ms/step - loss: 1.6357 -
f1_score: 0.4962 - val_loss: 1.5215 - val_f1_score: 0.5345
Epoch 154/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5930 -
f1_score: 0.5116 - val_loss: 1.5289 - val_f1_score: 0.5391
Epoch 155/500
28/28 [==============================] - ETA: 0s - loss: 1.6099 - f1_score:
0.5085

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 414ms/step - loss: 1.6099 -
f1_score: 0.5085 - val_loss: 1.4694 - val_f1_score: 0.5862
Epoch 156/500
28/28 [==============================] - 3s 108ms/step - loss: 1.6167 -
f1_score: 0.5138 - val_loss: 1.4706 - val_f1_score: 0.5543
Epoch 157/500
28/28 [==============================] - 3s 110ms/step - loss: 1.6094 -
f1_score: 0.5114 - val_loss: 1.4724 - val_f1_score: 0.5436
Epoch 158/500
28/28 [==============================] - ETA: 0s - loss: 1.5972 - f1_score:
0.5214

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 420ms/step - loss: 1.5972 -
f1_score: 0.5214 - val_loss: 1.4479 - val_f1_score: 0.5899
```

```
Epoch 159/500
28/28 [==============================] - 3s 108ms/step - loss: 1.5748 -
f1_score: 0.5252 - val_loss: 1.6497 - val_f1_score: 0.5300
Epoch 160/500
28/28 [==============================] - 3s 109ms/step - loss: 1.5905 -
f1_score: 0.5086 - val_loss: 1.4376 - val_f1_score: 0.5670
Epoch 161/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5598 -
f1_score: 0.5210 - val_loss: 1.4810 - val_f1_score: 0.5128
Epoch 162/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5366 -
f1_score: 0.5245 - val_loss: 1.4581 - val_f1_score: 0.5571
Epoch 163/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5342 -
f1_score: 0.5197 - val_loss: 1.4738 - val_f1_score: 0.5563
Epoch 164/500
28/28 [==============================] - 3s 112ms/step - loss: 1.5584 -
f1_score: 0.5266 - val_loss: 1.4647 - val_f1_score: 0.5505
Epoch 165/500
28/28 [==============================] - 3s 111ms/step - loss: 1.5387 -
f1_score: 0.5270 - val_loss: 1.4056 - val_f1_score: 0.5885
Epoch 166/500
28/28 [==============================] - 3s 111ms/step - loss: 1.5137 -
f1_score: 0.5501 - val_loss: 1.4643 - val_f1_score: 0.5731
Epoch 167/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4977 -
f1_score: 0.5406 - val_loss: 1.5110 - val_f1_score: 0.5338
Epoch 168/500
28/28 [==============================] - 3s 111ms/step - loss: 1.5253 -
f1_score: 0.5292 - val_loss: 1.4774 - val_f1_score: 0.5459
Epoch 169/500
28/28 [==============================] - 3s 112ms/step - loss: 1.4982 -
f1_score: 0.5454 - val_loss: 1.4882 - val_f1_score: 0.5611
Epoch 170/500
28/28 [==============================] - ETA: 0s - loss: 1.4966 - f1_score:
0.5578

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 423ms/step - loss: 1.4966 -
f1_score: 0.5578 - val_loss: 1.4231 - val_f1_score: 0.5958
Epoch 171/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4999 -
```

```
f1_score: 0.5404 - val_loss: 1.3809 - val_f1_score: 0.5726
Epoch 172/500
28/28 [==============================] - 3s 110ms/step - loss: 1.4555 -
f1_score: 0.5497 - val_loss: 1.4764 - val_f1_score: 0.5623
Epoch 173/500
28/28 [==============================] - 3s 110ms/step - loss: 1.5032 -
f1_score: 0.5262 - val_loss: 1.4795 - val_f1_score: 0.5491
Epoch 174/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4780 -
f1_score: 0.5533 - val_loss: 1.4966 - val_f1_score: 0.5561
Epoch 175/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4474 -
f1_score: 0.5566 - val_loss: 1.4389 - val_f1_score: 0.5615
Epoch 176/500
28/28 [==============================] - ETA: 0s - loss: 1.4584 - f1_score:
0.5481

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 447ms/step - loss: 1.4584 -
f1_score: 0.5481 - val_loss: 1.4306 - val_f1_score: 0.5966
Epoch 177/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4586 -
f1_score: 0.5595 - val_loss: 1.4419 - val_f1_score: 0.5663
Epoch 178/500
28/28 [==============================] - 3s 112ms/step - loss: 1.4400 -
f1_score: 0.5629 - val_loss: 1.4392 - val_f1_score: 0.5719
Epoch 179/500
28/28 [==============================] - ETA: 0s - loss: 1.4609 - f1_score:
0.5657

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 433ms/step - loss: 1.4609 -
f1_score: 0.5657 - val_loss: 1.3487 - val_f1_score: 0.6154
Epoch 180/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4507 -
f1_score: 0.5529 - val_loss: 1.3831 - val_f1_score: 0.6036
```

```
Epoch 181/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4326 -
f1_score: 0.5659 - val_loss: 1.4155 - val_f1_score: 0.5825
Epoch 182/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4146 -
f1_score: 0.5684 - val_loss: 1.3802 - val_f1_score: 0.6090
Epoch 183/500
28/28 [==============================] - 3s 111ms/step - loss: 1.4075 -
f1_score: 0.5640 - val_loss: 1.3411 - val_f1_score: 0.6094
Epoch 184/500
28/28 [==============================] - 3s 110ms/step - loss: 1.3964 -
f1_score: 0.5714 - val_loss: 1.3828 - val_f1_score: 0.6020
Epoch 185/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3907 -
f1_score: 0.5731 - val_loss: 1.3620 - val_f1_score: 0.5967
Epoch 186/500
28/28 [==============================] - ETA: 0s - loss: 1.3896 - f1_score:
0.5760

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 458ms/step - loss: 1.3896 -
f1_score: 0.5760 - val_loss: 1.3807 - val_f1_score: 0.6240
Epoch 187/500
28/28 [==============================] - 3s 109ms/step - loss: 1.4100 -
f1_score: 0.5643 - val_loss: 1.3365 - val_f1_score: 0.5992
Epoch 188/500
28/28 [==============================] - 3s 110ms/step - loss: 1.3540 -
f1_score: 0.5908 - val_loss: 1.3725 - val_f1_score: 0.6081
Epoch 189/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3720 -
f1_score: 0.5697 - val_loss: 1.3539 - val_f1_score: 0.6040
Epoch 190/500
28/28 [==============================] - 3s 110ms/step - loss: 1.3565 -
f1_score: 0.6018 - val_loss: 1.3538 - val_f1_score: 0.5774
Epoch 191/500
28/28 [==============================] - 3s 117ms/step - loss: 1.3589 -
f1_score: 0.5814 - val_loss: 1.3835 - val_f1_score: 0.6143
Epoch 192/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3468 -
f1_score: 0.5742 - val_loss: 1.3033 - val_f1_score: 0.6209
Epoch 193/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3533 -
```

```
f1_score: 0.5862 - val_loss: 1.3300 - val_f1_score: 0.5932
Epoch 194/500
28/28 [==============================] - ETA: 0s - loss: 1.3419 - f1_score:
0.5997

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 408ms/step - loss: 1.3419 -
f1_score: 0.5997 - val_loss: 1.3279 - val_f1_score: 0.6400
Epoch 195/500
28/28 [==============================] - 3s 109ms/step - loss: 1.3342 -
f1_score: 0.5904 - val_loss: 1.3712 - val_f1_score: 0.6150
Epoch 196/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2939 -
f1_score: 0.5887 - val_loss: 1.3135 - val_f1_score: 0.6380
Epoch 197/500
28/28 [==============================] - 3s 110ms/step - loss: 1.3203 -
f1_score: 0.5919 - val_loss: 1.3104 - val_f1_score: 0.6024
Epoch 198/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3094 -
f1_score: 0.6019 - val_loss: 1.3160 - val_f1_score: 0.6199
Epoch 199/500
28/28 [==============================] - 3s 113ms/step - loss: 1.2921 -
f1_score: 0.6003 - val_loss: 1.3377 - val_f1_score: 0.6128
Epoch 200/500
28/28 [==============================] - 3s 111ms/step - loss: 1.3082 -
f1_score: 0.5926 - val_loss: 1.3227 - val_f1_score: 0.6091
Epoch 201/500
28/28 [==============================] - 3s 113ms/step - loss: 1.3111 -
f1_score: 0.5832 - val_loss: 1.2967 - val_f1_score: 0.6252
Epoch 202/500
28/28 [==============================] - 3s 112ms/step - loss: 1.3077 -
f1_score: 0.6069 - val_loss: 1.3615 - val_f1_score: 0.5634
Epoch 203/500
28/28 [==============================] - ETA: 0s - loss: 1.2799 - f1_score:
0.6029

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 418ms/step - loss: 1.2799 -
f1_score: 0.6029 - val_loss: 1.2430 - val_f1_score: 0.6692
Epoch 204/500
28/28 [==============================] - 3s 109ms/step - loss: 1.2873 -
f1_score: 0.6011 - val_loss: 1.3025 - val_f1_score: 0.6431
Epoch 205/500
28/28 [==============================] - 3s 110ms/step - loss: 1.2356 -
f1_score: 0.6230 - val_loss: 1.2815 - val_f1_score: 0.6284
Epoch 206/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2003 -
f1_score: 0.6269 - val_loss: 1.3222 - val_f1_score: 0.6236
Epoch 207/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2624 -
f1_score: 0.6104 - val_loss: 1.2386 - val_f1_score: 0.6473
Epoch 208/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2450 -
f1_score: 0.6257 - val_loss: 1.3543 - val_f1_score: 0.6317
Epoch 209/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2262 -
f1_score: 0.6189 - val_loss: 1.2616 - val_f1_score: 0.6547
Epoch 210/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2080 -
f1_score: 0.6239 - val_loss: 1.3124 - val_f1_score: 0.6372
Epoch 211/500
28/28 [==============================] - 3s 112ms/step - loss: 1.2263 -
f1_score: 0.6145 - val_loss: 1.2967 - val_f1_score: 0.6363
Epoch 212/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2017 -
f1_score: 0.6323 - val_loss: 1.2879 - val_f1_score: 0.6543
Epoch 213/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1976 -
f1_score: 0.6378 - val_loss: 1.2397 - val_f1_score: 0.6406
Epoch 214/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2211 -
f1_score: 0.6289 - val_loss: 1.2733 - val_f1_score: 0.6543
Epoch 215/500
28/28 [==============================] - 3s 112ms/step - loss: 1.2078 -
f1_score: 0.6302 - val_loss: 1.2195 - val_f1_score: 0.6593
Epoch 216/500
28/28 [==============================] - ETA: 0s - loss: 1.2064 - f1_score:
0.6343

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 454ms/step - loss: 1.2064 -
f1_score: 0.6343 - val_loss: 1.2266 - val_f1_score: 0.6743
Epoch 217/500
28/28 [==============================] - 3s 110ms/step - loss: 1.2193 -
f1_score: 0.6218 - val_loss: 1.2072 - val_f1_score: 0.6582
Epoch 218/500
28/28 [==============================] - 3s 111ms/step - loss: 1.2593 -
f1_score: 0.6122 - val_loss: 1.2705 - val_f1_score: 0.6528
Epoch 219/500
28/28 [==============================] - 3s 110ms/step - loss: 1.2012 -
f1_score: 0.6228 - val_loss: 1.2165 - val_f1_score: 0.6539
Epoch 220/500
28/28 [==============================] - 3s 110ms/step - loss: 1.1853 -
f1_score: 0.6305 - val_loss: 1.2322 - val_f1_score: 0.6422
Epoch 221/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1643 -
f1_score: 0.6423 - val_loss: 1.1862 - val_f1_score: 0.6653
Epoch 222/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1639 -
f1_score: 0.6378 - val_loss: 1.2794 - val_f1_score: 0.6473
Epoch 223/500
28/28 [==============================] - ETA: 0s - loss: 1.1401 - f1_score:
0.6545

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 415ms/step - loss: 1.1401 -
f1_score: 0.6545 - val_loss: 1.1657 - val_f1_score: 0.6790
Epoch 224/500
28/28 [==============================] - 3s 110ms/step - loss: 1.2005 -
f1_score: 0.6294 - val_loss: 1.2300 - val_f1_score: 0.6603
Epoch 225/500
28/28 [==============================] - ETA: 0s - loss: 1.1424 - f1_score:
0.6487

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 413ms/step - loss: 1.1424 -
f1_score: 0.6487 - val_loss: 1.1911 - val_f1_score: 0.6850
Epoch 226/500
28/28 [==============================] - 3s 109ms/step - loss: 1.1532 -
f1_score: 0.6446 - val_loss: 1.2906 - val_f1_score: 0.6513
Epoch 227/500
28/28 [==============================] - 3s 110ms/step - loss: 1.1470 -
f1_score: 0.6389 - val_loss: 1.2122 - val_f1_score: 0.6676
Epoch 228/500
28/28 [==============================] - 3s 110ms/step - loss: 1.1606 -
f1_score: 0.6441 - val_loss: 1.2662 - val_f1_score: 0.6462
Epoch 229/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1324 -
f1_score: 0.6443 - val_loss: 1.1966 - val_f1_score: 0.6550
Epoch 230/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1105 -
f1_score: 0.6601 - val_loss: 1.2582 - val_f1_score: 0.6676
Epoch 231/500
28/28 [==============================] - 3s 110ms/step - loss: 1.1186 -
f1_score: 0.6517 - val_loss: 1.1981 - val_f1_score: 0.6652
Epoch 232/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1134 -
f1_score: 0.6485 - val_loss: 1.1833 - val_f1_score: 0.6513
Epoch 233/500
28/28 [==============================] - 3s 112ms/step - loss: 1.1174 -
f1_score: 0.6693 - val_loss: 1.1551 - val_f1_score: 0.6848
Epoch 234/500
28/28 [==============================] - 3s 113ms/step - loss: 1.1248 -
f1_score: 0.6510 - val_loss: 1.1719 - val_f1_score: 0.6727
Epoch 235/500
28/28 [==============================] - 3s 111ms/step - loss: 1.1017 -
f1_score: 0.6521 - val_loss: 1.1978 - val_f1_score: 0.6792
Epoch 236/500
28/28 [==============================] - 3s 113ms/step - loss: 1.0915 -
f1_score: 0.6617 - val_loss: 1.2757 - val_f1_score: 0.6347
Epoch 237/500
28/28 [==============================] - 3s 112ms/step - loss: 1.0863 -
f1_score: 0.6707 - val_loss: 1.2721 - val_f1_score: 0.6464
Epoch 238/500
28/28 [==============================] - 3s 113ms/step - loss: 1.1068 -
f1_score: 0.6560 - val_loss: 1.2375 - val_f1_score: 0.6429
Epoch 239/500
28/28 [==============================] - ETA: 0s - loss: 1.0907 - f1_score:
0.6565

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
```

```
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 451ms/step - loss: 1.0907 -
f1_score: 0.6565 - val_loss: 1.1684 - val_f1_score: 0.6960
Epoch 240/500
28/28 [==============================] - 3s 109ms/step - loss: 1.0764 -
f1_score: 0.6650 - val_loss: 1.1611 - val_f1_score: 0.6847
Epoch 241/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0952 -
f1_score: 0.6637 - val_loss: 1.2429 - val_f1_score: 0.6872
Epoch 242/500
28/28 [==============================] - 3s 111ms/step - loss: 1.0866 -
f1_score: 0.6578 - val_loss: 1.1820 - val_f1_score: 0.6688
Epoch 243/500
28/28 [==============================] - ETA: 0s - loss: 1.0815 - f1_score:
0.6579

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 15s 553ms/step - loss: 1.0815 -
f1_score: 0.6579 - val_loss: 1.1464 - val_f1_score: 0.6993
Epoch 244/500
28/28 [==============================] - 3s 109ms/step - loss: 1.0699 -
f1_score: 0.6644 - val_loss: 1.1681 - val_f1_score: 0.6883
Epoch 245/500
28/28 [==============================] - 3s 109ms/step - loss: 1.0339 -
f1_score: 0.6849 - val_loss: 1.1737 - val_f1_score: 0.6887
Epoch 246/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0577 -
f1_score: 0.6741 - val_loss: 1.1852 - val_f1_score: 0.6746
Epoch 247/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0367 -
f1_score: 0.6844 - val_loss: 1.2528 - val_f1_score: 0.6644
Epoch 248/500
28/28 [==============================] - 3s 111ms/step - loss: 1.0325 -
f1_score: 0.6796 - val_loss: 1.2167 - val_f1_score: 0.6631
Epoch 249/500
28/28 [==============================] - 3s 111ms/step - loss: 1.0528 -
f1_score: 0.6708 - val_loss: 1.1206 - val_f1_score: 0.6972
```

```
Epoch 250/500
28/28 [==============================] - ETA: 0s - loss: 1.0164 - f1_score:
0.6826

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 12s 452ms/step - loss: 1.0164 -
f1_score: 0.6826 - val_loss: 1.1012 - val_f1_score: 0.7071
Epoch 251/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0041 -
f1_score: 0.6932 - val_loss: 1.1321 - val_f1_score: 0.6858
Epoch 252/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0066 -
f1_score: 0.6889 - val_loss: 1.2482 - val_f1_score: 0.6463
Epoch 253/500
28/28 [==============================] - 3s 110ms/step - loss: 1.0213 -
f1_score: 0.6779 - val_loss: 1.1264 - val_f1_score: 0.6712
Epoch 254/500
28/28 [==============================] - 3s 113ms/step - loss: 1.0073 -
f1_score: 0.6902 - val_loss: 1.1494 - val_f1_score: 0.7057
Epoch 255/500
28/28 [==============================] - 3s 120ms/step - loss: 1.0349 -
f1_score: 0.6854 - val_loss: 1.1554 - val_f1_score: 0.6733
Epoch 256/500
28/28 [==============================] - 3s 112ms/step - loss: 1.0028 -
f1_score: 0.6869 - val_loss: 1.2468 - val_f1_score: 0.6454
Epoch 257/500
28/28 [==============================] - 3s 114ms/step - loss: 1.0078 -
f1_score: 0.6838 - val_loss: 1.1643 - val_f1_score: 0.7010
Epoch 258/500
28/28 [==============================] - 3s 112ms/step - loss: 1.0143 -
f1_score: 0.6814 - val_loss: 1.1204 - val_f1_score: 0.6868
Epoch 259/500
28/28 [==============================] - 3s 120ms/step - loss: 1.0020 -
f1_score: 0.6896 - val_loss: 1.2716 - val_f1_score: 0.6341
Epoch 260/500
28/28 [==============================] - 3s 112ms/step - loss: 1.0518 -
f1_score: 0.6765 - val_loss: 1.1765 - val_f1_score: 0.6762
Epoch 261/500
28/28 [==============================] - 3s 114ms/step - loss: 1.0047 -
f1_score: 0.6943 - val_loss: 1.1317 - val_f1_score: 0.6963
Epoch 262/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9808 -
```

```
f1_score: 0.7021 - val_loss: 1.2364 - val_f1_score: 0.6476
Epoch 263/500
28/28 [==============================] - 3s 112ms/step - loss: 0.9856 -
f1_score: 0.6905 - val_loss: 1.1009 - val_f1_score: 0.6893
Epoch 264/500
28/28 [==============================] - 3s 112ms/step - loss: 0.9958 -
f1_score: 0.6953 - val_loss: 1.1317 - val_f1_score: 0.6806
Epoch 265/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9605 -
f1_score: 0.6942 - val_loss: 1.1578 - val_f1_score: 0.6785
Epoch 266/500
28/28 [==============================] - 3s 118ms/step - loss: 0.9706 -
f1_score: 0.7046 - val_loss: 1.2137 - val_f1_score: 0.6583
Epoch 267/500
28/28 [==============================] - 3s 113ms/step - loss: 1.0022 -
f1_score: 0.6937 - val_loss: 1.1315 - val_f1_score: 0.6944
Epoch 268/500
28/28 [==============================] - 3s 116ms/step - loss: 1.0097 -
f1_score: 0.6902 - val_loss: 1.1630 - val_f1_score: 0.6645
Epoch 269/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9788 -
f1_score: 0.6877 - val_loss: 1.1980 - val_f1_score: 0.6700
Epoch 270/500
28/28 [==============================] - 3s 116ms/step - loss: 0.9455 -
f1_score: 0.7046 - val_loss: 1.1146 - val_f1_score: 0.6796
Epoch 271/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9219 -
f1_score: 0.7164 - val_loss: 1.1562 - val_f1_score: 0.6629
Epoch 272/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9693 -
f1_score: 0.7010 - val_loss: 1.1594 - val_f1_score: 0.6725
Epoch 273/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9361 -
f1_score: 0.7090 - val_loss: 1.1586 - val_f1_score: 0.6465
Epoch 274/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8969 -
f1_score: 0.7167 - val_loss: 1.1518 - val_f1_score: 0.6588
Epoch 275/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9009 -
f1_score: 0.7157 - val_loss: 1.1623 - val_f1_score: 0.6894
Epoch 276/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9239 -
f1_score: 0.7203 - val_loss: 1.1867 - val_f1_score: 0.6629
Epoch 277/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9108 -
f1_score: 0.7250 - val_loss: 1.1229 - val_f1_score: 0.7042
Epoch 278/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9428 -
```

```
f1_score: 0.7069 - val_loss: 1.0921 - val_f1_score: 0.6950
Epoch 279/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8915 -
f1_score: 0.7256 - val_loss: 1.1463 - val_f1_score: 0.6833
Epoch 280/500
28/28 [==============================] - 3s 114ms/step - loss: 0.9229 -
f1_score: 0.7155 - val_loss: 1.1023 - val_f1_score: 0.6940
Epoch 281/500
28/28 [==============================] - 3s 113ms/step - loss: 0.9147 -
f1_score: 0.7105 - val_loss: 1.1211 - val_f1_score: 0.7025
Epoch 282/500
28/28 [==============================] - 3s 119ms/step - loss: 0.9164 -
f1_score: 0.7121 - val_loss: 1.1561 - val_f1_score: 0.6375
Epoch 283/500
28/28 [==============================] - 3s 118ms/step - loss: 0.8750 -
f1_score: 0.7338 - val_loss: 1.1582 - val_f1_score: 0.6971
Epoch 284/500
28/28 [==============================] - 3s 115ms/step - loss: 0.8849 -
f1_score: 0.7262 - val_loss: 1.0853 - val_f1_score: 0.6950
Epoch 285/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8908 -
f1_score: 0.7237 - val_loss: 1.0750 - val_f1_score: 0.6901
Epoch 286/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8763 -
f1_score: 0.7257 - val_loss: 1.1192 - val_f1_score: 0.6944
Epoch 287/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8928 -
f1_score: 0.7170 - val_loss: 1.1131 - val_f1_score: 0.7026
Epoch 288/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8668 -
f1_score: 0.7261 - val_loss: 1.1442 - val_f1_score: 0.6806
Epoch 289/500
28/28 [==============================] - 3s 117ms/step - loss: 0.8818 -
f1_score: 0.7203 - val_loss: 1.1914 - val_f1_score: 0.6691
Epoch 290/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8567 -
f1_score: 0.7299 - val_loss: 1.1250 - val_f1_score: 0.7067
Epoch 291/500
28/28 [==============================] - ETA: 0s - loss: 0.8600 - f1_score:
0.7310

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets
```

```
28/28 [==============================] - 13s 467ms/step - loss: 0.8600 -
f1_score: 0.7310 - val_loss: 1.0467 - val_f1_score: 0.7265
Epoch 292/500
28/28 [==============================] - 3s 109ms/step - loss: 0.8304 -
f1_score: 0.7337 - val_loss: 1.1625 - val_f1_score: 0.6697
Epoch 293/500
28/28 [==============================] - 3s 111ms/step - loss: 0.8476 -
f1_score: 0.7347 - val_loss: 1.1650 - val_f1_score: 0.6962
Epoch 294/500
28/28 [==============================] - 3s 110ms/step - loss: 0.8629 -
f1_score: 0.7456 - val_loss: 1.1314 - val_f1_score: 0.6867
Epoch 295/500
28/28 [==============================] - 3s 112ms/step - loss: 0.8443 -
f1_score: 0.7350 - val_loss: 1.0835 - val_f1_score: 0.7130
Epoch 296/500
28/28 [==============================] - ETA: 0s - loss: 0.8358 - f1_score:
0.7548

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 11s 402ms/step - loss: 0.8358 -
f1_score: 0.7548 - val_loss: 1.0503 - val_f1_score: 0.7350
Epoch 297/500
28/28 [==============================] - 3s 109ms/step - loss: 0.8213 -
f1_score: 0.7534 - val_loss: 1.0717 - val_f1_score: 0.7127
Epoch 298/500
28/28 [==============================] - 3s 111ms/step - loss: 0.8451 -
f1_score: 0.7416 - val_loss: 1.1610 - val_f1_score: 0.6669
Epoch 299/500
28/28 [==============================] - 3s 116ms/step - loss: 0.8201 -
f1_score: 0.7374 - val_loss: 1.2170 - val_f1_score: 0.6410
Epoch 300/500
28/28 [==============================] - 3s 111ms/step - loss: 0.8318 -
f1_score: 0.7342 - val_loss: 1.0611 - val_f1_score: 0.6930
Epoch 301/500
28/28 [==============================] - 3s 112ms/step - loss: 0.8503 -
f1_score: 0.7405 - val_loss: 1.0656 - val_f1_score: 0.7040
Epoch 302/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8472 -
f1_score: 0.7419 - val_loss: 1.0660 - val_f1_score: 0.6986
Epoch 303/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8278 -
f1_score: 0.7430 - val_loss: 1.1596 - val_f1_score: 0.6736
```

```
Epoch 304/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8389 -
f1_score: 0.7399 - val_loss: 1.0904 - val_f1_score: 0.6913
Epoch 305/500
28/28 [==============================] - 3s 112ms/step - loss: 0.8139 -
f1_score: 0.7449 - val_loss: 1.1601 - val_f1_score: 0.6838
Epoch 306/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8184 -
f1_score: 0.7395 - val_loss: 1.0951 - val_f1_score: 0.7039
Epoch 307/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7966 -
f1_score: 0.7496 - val_loss: 1.0759 - val_f1_score: 0.6923
Epoch 308/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7909 -
f1_score: 0.7571 - val_loss: 1.1255 - val_f1_score: 0.6917
Epoch 309/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7970 -
f1_score: 0.7608 - val_loss: 1.1156 - val_f1_score: 0.7047
Epoch 310/500
28/28 [==============================] - 3s 115ms/step - loss: 0.8057 -
f1_score: 0.7577 - val_loss: 1.1096 - val_f1_score: 0.6861
Epoch 311/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7775 -
f1_score: 0.7680 - val_loss: 1.0119 - val_f1_score: 0.7110
Epoch 312/500
28/28 [==============================] - 3s 115ms/step - loss: 0.7740 -
f1_score: 0.7563 - val_loss: 1.1639 - val_f1_score: 0.6976
Epoch 313/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7879 -
f1_score: 0.7582 - val_loss: 1.1296 - val_f1_score: 0.7006
Epoch 314/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7938 -
f1_score: 0.7480 - val_loss: 1.0734 - val_f1_score: 0.6984
Epoch 315/500
28/28 [==============================] - 3s 112ms/step - loss: 0.7583 -
f1_score: 0.7665 - val_loss: 1.0516 - val_f1_score: 0.7194
Epoch 316/500
28/28 [==============================] - 3s 114ms/step - loss: 0.8177 -
f1_score: 0.7429 - val_loss: 1.1234 - val_f1_score: 0.6939
Epoch 317/500
28/28 [==============================] - 3s 113ms/step - loss: 0.8145 -
f1_score: 0.7507 - val_loss: 1.1428 - val_f1_score: 0.6930
Epoch 318/500
28/28 [==============================] - 3s 112ms/step - loss: 0.7868 -
f1_score: 0.7572 - val_loss: 1.1406 - val_f1_score: 0.6856
Epoch 319/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7533 -
f1_score: 0.7615 - val_loss: 1.1002 - val_f1_score: 0.7085
```

```
Epoch 320/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7848 -
f1_score: 0.7572 - val_loss: 1.1690 - val_f1_score: 0.6775
Epoch 321/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7360 -
f1_score: 0.7687 - val_loss: 1.0633 - val_f1_score: 0.7122
Epoch 322/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7678 -
f1_score: 0.7525 - val_loss: 1.0593 - val_f1_score: 0.7161
Epoch 323/500
28/28 [==============================] - 3s 117ms/step - loss: 0.7462 -
f1_score: 0.7641 - val_loss: 1.0944 - val_f1_score: 0.6893
Epoch 324/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7829 -
f1_score: 0.7662 - val_loss: 1.0680 - val_f1_score: 0.7057
Epoch 325/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7478 -
f1_score: 0.7599 - val_loss: 1.0985 - val_f1_score: 0.6848
Epoch 326/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7151 -
f1_score: 0.7741 - val_loss: 1.0808 - val_f1_score: 0.7017
Epoch 327/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7151 -
f1_score: 0.7748 - val_loss: 1.0857 - val_f1_score: 0.6924
Epoch 328/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7717 -
f1_score: 0.7595 - val_loss: 1.0673 - val_f1_score: 0.6906
Epoch 329/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7322 -
f1_score: 0.7650 - val_loss: 1.1266 - val_f1_score: 0.6795
Epoch 330/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7322 -
f1_score: 0.7651 - val_loss: 1.1013 - val_f1_score: 0.6729
Epoch 331/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7340 -
f1_score: 0.7740 - val_loss: 1.1070 - val_f1_score: 0.6973
Epoch 332/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7361 -
f1_score: 0.7626 - val_loss: 1.1145 - val_f1_score: 0.6901
Epoch 333/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7433 -
f1_score: 0.7675 - val_loss: 1.0146 - val_f1_score: 0.7052
Epoch 334/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7349 -
f1_score: 0.7758 - val_loss: 1.1016 - val_f1_score: 0.6982
Epoch 335/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7258 -
f1_score: 0.7694 - val_loss: 1.0751 - val_f1_score: 0.6918
```

```
Epoch 336/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7180 -
f1_score: 0.7836 - val_loss: 1.0273 - val_f1_score: 0.7107
Epoch 337/500
28/28 [==============================] - 3s 117ms/step - loss: 0.6954 -
f1_score: 0.7816 - val_loss: 1.0787 - val_f1_score: 0.7081
Epoch 338/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7052 -
f1_score: 0.7768 - val_loss: 1.0847 - val_f1_score: 0.7065
Epoch 339/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7135 -
f1_score: 0.7790 - val_loss: 1.0827 - val_f1_score: 0.6779
Epoch 340/500
28/28 [==============================] - 3s 118ms/step - loss: 0.6867 -
f1_score: 0.7905 - val_loss: 1.1165 - val_f1_score: 0.7041
Epoch 341/500
28/28 [==============================] - 3s 114ms/step - loss: 0.7117 -
f1_score: 0.7835 - val_loss: 1.1078 - val_f1_score: 0.6757
Epoch 342/500
28/28 [==============================] - 3s 113ms/step - loss: 0.7044 -
f1_score: 0.7778 - val_loss: 1.0823 - val_f1_score: 0.6944
Epoch 343/500
28/28 [==============================] - 3s 118ms/step - loss: 0.7050 -
f1_score: 0.7783 - val_loss: 1.0573 - val_f1_score: 0.6998
Epoch 344/500
28/28 [==============================] - 3s 123ms/step - loss: 0.6909 -
f1_score: 0.7876 - val_loss: 1.0227 - val_f1_score: 0.7191
Epoch 345/500
28/28 [==============================] - 3s 115ms/step - loss: 0.7122 -
f1_score: 0.7693 - val_loss: 1.0492 - val_f1_score: 0.6994
Epoch 346/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6903 -
f1_score: 0.7833 - val_loss: 1.0412 - val_f1_score: 0.6856
Epoch 347/500
28/28 [==============================] - 3s 116ms/step - loss: 0.7098 -
f1_score: 0.7881 - val_loss: 1.1415 - val_f1_score: 0.6924
Epoch 348/500
28/28 [==============================] - 3s 117ms/step - loss: 0.7017 -
f1_score: 0.7772 - val_loss: 1.0288 - val_f1_score: 0.7271
Epoch 349/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6917 -
f1_score: 0.7830 - val_loss: 1.0744 - val_f1_score: 0.7220
Epoch 350/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6399 -
f1_score: 0.8069 - val_loss: 1.0838 - val_f1_score: 0.6850
Epoch 351/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6782 -
f1_score: 0.7898 - val_loss: 1.0080 - val_f1_score: 0.7018
```

```
Epoch 352/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6757 -
f1_score: 0.7903 - val_loss: 1.1510 - val_f1_score: 0.6702
Epoch 353/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6719 -
f1_score: 0.7944 - val_loss: 1.1214 - val_f1_score: 0.6823
Epoch 354/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6515 -
f1_score: 0.7943 - val_loss: 1.0240 - val_f1_score: 0.7207
Epoch 355/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6739 -
f1_score: 0.7850 - val_loss: 1.0896 - val_f1_score: 0.7086
Epoch 356/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6712 -
f1_score: 0.7844 - val_loss: 1.0556 - val_f1_score: 0.7192
Epoch 357/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6834 -
f1_score: 0.7848 - val_loss: 1.0672 - val_f1_score: 0.7031
Epoch 358/500
28/28 [==============================] - 3s 122ms/step - loss: 0.6874 -
f1_score: 0.7859 - val_loss: 1.0544 - val_f1_score: 0.7164
Epoch 359/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6821 -
f1_score: 0.7892 - val_loss: 1.1289 - val_f1_score: 0.6750
Epoch 360/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6598 -
f1_score: 0.7973 - val_loss: 1.0817 - val_f1_score: 0.6858
Epoch 361/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6446 -
f1_score: 0.8002 - val_loss: 1.1192 - val_f1_score: 0.6845
Epoch 362/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6707 -
f1_score: 0.7909 - val_loss: 1.1210 - val_f1_score: 0.6995
Epoch 363/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6205 -
f1_score: 0.8070 - val_loss: 1.0657 - val_f1_score: 0.7009
Epoch 364/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6684 -
f1_score: 0.7962 - val_loss: 1.0788 - val_f1_score: 0.6848
Epoch 365/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6265 -
f1_score: 0.8120 - val_loss: 1.0926 - val_f1_score: 0.6884
Epoch 366/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6287 -
f1_score: 0.8073 - val_loss: 0.9990 - val_f1_score: 0.6922
Epoch 367/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6822 -
f1_score: 0.7905 - val_loss: 1.1229 - val_f1_score: 0.6976
```

```
Epoch 368/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6162 -
f1_score: 0.8057 - val_loss: 0.9896 - val_f1_score: 0.7138
Epoch 369/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6484 -
f1_score: 0.7990 - val_loss: 1.1237 - val_f1_score: 0.6996
Epoch 370/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6379 -
f1_score: 0.7954 - val_loss: 1.1038 - val_f1_score: 0.7086
Epoch 371/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6129 -
f1_score: 0.8137 - val_loss: 1.1354 - val_f1_score: 0.7059
Epoch 372/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6011 -
f1_score: 0.8134 - val_loss: 1.1479 - val_f1_score: 0.6724
Epoch 373/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6564 -
f1_score: 0.7986 - val_loss: 1.1402 - val_f1_score: 0.7036
Epoch 374/500
28/28 [==============================] - 3s 118ms/step - loss: 0.6084 -
f1_score: 0.8127 - val_loss: 1.0893 - val_f1_score: 0.7109
Epoch 375/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6030 -
f1_score: 0.8181 - val_loss: 1.0832 - val_f1_score: 0.7180
Epoch 376/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6338 -
f1_score: 0.8092 - val_loss: 1.0400 - val_f1_score: 0.7194
Epoch 377/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6260 -
f1_score: 0.8037 - val_loss: 1.0679 - val_f1_score: 0.7071
Epoch 378/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6085 -
f1_score: 0.8122 - val_loss: 1.0541 - val_f1_score: 0.7086
Epoch 379/500
28/28 [==============================] - 3s 116ms/step - loss: 0.6267 -
f1_score: 0.8100 - val_loss: 1.0491 - val_f1_score: 0.7087
Epoch 380/500
28/28 [==============================] - 3s 114ms/step - loss: 0.6160 -
f1_score: 0.8124 - val_loss: 1.0713 - val_f1_score: 0.7067
Epoch 381/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5901 -
f1_score: 0.8081 - val_loss: 0.9913 - val_f1_score: 0.7067
Epoch 382/500
28/28 [==============================] - 3s 113ms/step - loss: 0.6116 -
f1_score: 0.8063 - val_loss: 1.0351 - val_f1_score: 0.7104
Epoch 383/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5917 -
f1_score: 0.8187 - val_loss: 1.1094 - val_f1_score: 0.6957
```

```
Epoch 384/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5830 -
f1_score: 0.8219 - val_loss: 1.0851 - val_f1_score: 0.7073
Epoch 385/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6006 -
f1_score: 0.8095 - val_loss: 0.9871 - val_f1_score: 0.7156
Epoch 386/500
28/28 [==============================] - 3s 115ms/step - loss: 0.6041 -
f1_score: 0.8199 - val_loss: 1.1447 - val_f1_score: 0.6791
Epoch 387/500
28/28 [==============================] - 3s 118ms/step - loss: 0.6064 -
f1_score: 0.8095 - val_loss: 0.9998 - val_f1_score: 0.7115
Epoch 388/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5917 -
f1_score: 0.8183 - val_loss: 0.9850 - val_f1_score: 0.7199
Epoch 389/500
28/28 [==============================] - 4s 126ms/step - loss: 0.5991 -
f1_score: 0.8132 - val_loss: 1.0870 - val_f1_score: 0.6891
Epoch 390/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5658 -
f1_score: 0.8230 - val_loss: 1.0438 - val_f1_score: 0.7102
Epoch 391/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5785 -
f1_score: 0.8175 - val_loss: 1.0277 - val_f1_score: 0.6969
Epoch 392/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5859 -
f1_score: 0.8096 - val_loss: 1.1317 - val_f1_score: 0.6648
Epoch 393/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5833 -
f1_score: 0.8212 - val_loss: 1.1080 - val_f1_score: 0.6777
Epoch 394/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5685 -
f1_score: 0.8247 - val_loss: 1.1334 - val_f1_score: 0.6720
Epoch 395/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5902 -
f1_score: 0.8260 - val_loss: 1.1487 - val_f1_score: 0.6759
Epoch 396/500
28/28 [==============================] - 3s 118ms/step - loss: 0.5895 -
f1_score: 0.8134 - val_loss: 1.0013 - val_f1_score: 0.7247
Epoch 397/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5675 -
f1_score: 0.8234 - val_loss: 1.0197 - val_f1_score: 0.7151
Epoch 398/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5918 -
f1_score: 0.8159 - val_loss: 1.0240 - val_f1_score: 0.7112
Epoch 399/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5457 -
f1_score: 0.8321 - val_loss: 1.0451 - val_f1_score: 0.7097
```

```
Epoch 400/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5707 -
f1_score: 0.8244 - val_loss: 1.0302 - val_f1_score: 0.7195
Epoch 401/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5337 -
f1_score: 0.8386 - val_loss: 1.1236 - val_f1_score: 0.6845
Epoch 402/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5719 -
f1_score: 0.8223 - val_loss: 1.0741 - val_f1_score: 0.6963
Epoch 403/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5371 -
f1_score: 0.8428 - val_loss: 0.9755 - val_f1_score: 0.7280
Epoch 404/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5929 -
f1_score: 0.8237 - val_loss: 1.1175 - val_f1_score: 0.6866
Epoch 405/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5664 -
f1_score: 0.8190 - val_loss: 1.0901 - val_f1_score: 0.6966
Epoch 406/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5979 -
f1_score: 0.8039 - val_loss: 1.1165 - val_f1_score: 0.7034
Epoch 407/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5660 -
f1_score: 0.8360 - val_loss: 1.1611 - val_f1_score: 0.6791
Epoch 408/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5636 -
f1_score: 0.8200 - val_loss: 1.0805 - val_f1_score: 0.7131
Epoch 409/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5595 -
f1_score: 0.8285 - val_loss: 1.0476 - val_f1_score: 0.6933
Epoch 410/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5434 -
f1_score: 0.8351 - val_loss: 0.9981 - val_f1_score: 0.7150
Epoch 411/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5776 -
f1_score: 0.8209 - val_loss: 1.0430 - val_f1_score: 0.6969
Epoch 412/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5046 -
f1_score: 0.8518 - val_loss: 1.1508 - val_f1_score: 0.6825
Epoch 413/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5259 -
f1_score: 0.8315 - val_loss: 1.0936 - val_f1_score: 0.6939
Epoch 414/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5297 -
f1_score: 0.8354 - val_loss: 1.0896 - val_f1_score: 0.6839
Epoch 415/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5667 -
f1_score: 0.8309 - val_loss: 1.0207 - val_f1_score: 0.7212
```

```
Epoch 416/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5304 -
f1_score: 0.8357 - val_loss: 1.0345 - val_f1_score: 0.6998
Epoch 417/500
28/28 [==============================] - 3s 116ms/step - loss: 0.5161 -
f1_score: 0.8364 - val_loss: 1.1046 - val_f1_score: 0.6996
Epoch 418/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5411 -
f1_score: 0.8327 - val_loss: 1.0068 - val_f1_score: 0.7162
Epoch 419/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5339 -
f1_score: 0.8331 - val_loss: 0.9963 - val_f1_score: 0.6967
Epoch 420/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5330 -
f1_score: 0.8347 - val_loss: 1.1657 - val_f1_score: 0.6731
Epoch 421/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4962 -
f1_score: 0.8466 - val_loss: 1.1206 - val_f1_score: 0.6642
Epoch 422/500
28/28 [==============================] - 3s 118ms/step - loss: 0.5076 -
f1_score: 0.8367 - val_loss: 1.0637 - val_f1_score: 0.7073
Epoch 423/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5117 -
f1_score: 0.8371 - val_loss: 1.0963 - val_f1_score: 0.6907
Epoch 424/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5288 -
f1_score: 0.8364 - val_loss: 1.0199 - val_f1_score: 0.7309
Epoch 425/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5218 -
f1_score: 0.8282 - val_loss: 1.0131 - val_f1_score: 0.7183
Epoch 426/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5157 -
f1_score: 0.8420 - val_loss: 1.1657 - val_f1_score: 0.6822
Epoch 427/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4904 -
f1_score: 0.8491 - val_loss: 1.0187 - val_f1_score: 0.7336
Epoch 428/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4961 -
f1_score: 0.8569 - val_loss: 1.0715 - val_f1_score: 0.6981
Epoch 429/500
28/28 [==============================] - 3s 124ms/step - loss: 0.5096 -
f1_score: 0.8449 - val_loss: 1.0838 - val_f1_score: 0.6943
Epoch 430/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5169 -
f1_score: 0.8410 - val_loss: 1.1090 - val_f1_score: 0.6672
Epoch 431/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4989 -
f1_score: 0.8489 - val_loss: 1.0800 - val_f1_score: 0.6902
```

```
Epoch 432/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5254 -
f1_score: 0.8407 - val_loss: 1.0203 - val_f1_score: 0.7031
Epoch 433/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5037 -
f1_score: 0.8455 - val_loss: 1.0516 - val_f1_score: 0.6983
Epoch 434/500
28/28 [==============================] - 3s 125ms/step - loss: 0.4900 -
f1_score: 0.8434 - val_loss: 1.1442 - val_f1_score: 0.6882
Epoch 435/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4930 -
f1_score: 0.8409 - val_loss: 1.0342 - val_f1_score: 0.7166
Epoch 436/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4784 -
f1_score: 0.8516 - val_loss: 1.0512 - val_f1_score: 0.7079
Epoch 437/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5127 -
f1_score: 0.8359 - val_loss: 1.0894 - val_f1_score: 0.6994
Epoch 438/500
28/28 [==============================] - 3s 115ms/step - loss: 0.5020 -
f1_score: 0.8418 - val_loss: 1.1486 - val_f1_score: 0.6868
Epoch 439/500
28/28 [==============================] - 3s 118ms/step - loss: 0.4958 -
f1_score: 0.8447 - val_loss: 1.1485 - val_f1_score: 0.7018
Epoch 440/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4688 -
f1_score: 0.8538 - val_loss: 1.1372 - val_f1_score: 0.6731
Epoch 441/500
28/28 [==============================] - 3s 114ms/step - loss: 0.5065 -
f1_score: 0.8431 - val_loss: 1.1062 - val_f1_score: 0.6928
Epoch 442/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4988 -
f1_score: 0.8491 - val_loss: 1.1254 - val_f1_score: 0.6922
Epoch 443/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4932 -
f1_score: 0.8368 - val_loss: 1.1057 - val_f1_score: 0.6627
Epoch 444/500
28/28 [==============================] - ETA: 0s - loss: 0.4529 - f1_score:
0.8651

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_1_layer_call_fn, gru_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722/assets

28/28 [==============================] - 13s 480ms/step - loss: 0.4529 -
```

```
f1_score: 0.8651 - val_loss: 0.9942 - val_f1_score: 0.7561
Epoch 445/500
28/28 [==============================] - 3s 110ms/step - loss: 0.5020 -
f1_score: 0.8395 - val_loss: 1.0434 - val_f1_score: 0.7130
Epoch 446/500
28/28 [==============================] - 3s 112ms/step - loss: 0.4814 -
f1_score: 0.8520 - val_loss: 1.0269 - val_f1_score: 0.7035
Epoch 447/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4788 -
f1_score: 0.8603 - val_loss: 1.0961 - val_f1_score: 0.6920
Epoch 448/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4828 -
f1_score: 0.8477 - val_loss: 1.0577 - val_f1_score: 0.6876
Epoch 449/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4654 -
f1_score: 0.8569 - val_loss: 0.9775 - val_f1_score: 0.7329
Epoch 450/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4444 -
f1_score: 0.8676 - val_loss: 1.0575 - val_f1_score: 0.6936
Epoch 451/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4747 -
f1_score: 0.8537 - val_loss: 1.0108 - val_f1_score: 0.6948
Epoch 452/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4726 -
f1_score: 0.8599 - val_loss: 1.1005 - val_f1_score: 0.7081
Epoch 453/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4795 -
f1_score: 0.8506 - val_loss: 1.2315 - val_f1_score: 0.6761
Epoch 454/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4764 -
f1_score: 0.8583 - val_loss: 1.0829 - val_f1_score: 0.7014
Epoch 455/500
28/28 [==============================] - 3s 112ms/step - loss: 0.4456 -
f1_score: 0.8638 - val_loss: 1.1003 - val_f1_score: 0.6912
Epoch 456/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4721 -
f1_score: 0.8563 - val_loss: 1.0569 - val_f1_score: 0.7115
Epoch 457/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4602 -
f1_score: 0.8617 - val_loss: 1.1067 - val_f1_score: 0.7061
Epoch 458/500
28/28 [==============================] - 3s 123ms/step - loss: 0.4929 -
f1_score: 0.8466 - val_loss: 1.0588 - val_f1_score: 0.7362
Epoch 459/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4480 -
f1_score: 0.8608 - val_loss: 1.1854 - val_f1_score: 0.6869
Epoch 460/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4603 -
```

```
f1_score: 0.8582 - val_loss: 1.1231 - val_f1_score: 0.7173
Epoch 461/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4899 -
f1_score: 0.8480 - val_loss: 1.1298 - val_f1_score: 0.6918
Epoch 462/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4770 -
f1_score: 0.8590 - val_loss: 1.0042 - val_f1_score: 0.7282
Epoch 463/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4420 -
f1_score: 0.8626 - val_loss: 1.2807 - val_f1_score: 0.6703
Epoch 464/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4582 -
f1_score: 0.8642 - val_loss: 1.1311 - val_f1_score: 0.6997
Epoch 465/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4407 -
f1_score: 0.8643 - val_loss: 1.0560 - val_f1_score: 0.7368
Epoch 466/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4617 -
f1_score: 0.8621 - val_loss: 1.0762 - val_f1_score: 0.7073
Epoch 467/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4617 -
f1_score: 0.8565 - val_loss: 1.0957 - val_f1_score: 0.6980
Epoch 468/500
28/28 [==============================] - 3s 118ms/step - loss: 0.4864 -
f1_score: 0.8527 - val_loss: 1.1138 - val_f1_score: 0.6969
Epoch 469/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4493 -
f1_score: 0.8649 - val_loss: 1.0631 - val_f1_score: 0.7213
Epoch 470/500
28/28 [==============================] - 3s 113ms/step - loss: 0.5232 -
f1_score: 0.8362 - val_loss: 1.0558 - val_f1_score: 0.7050
Epoch 471/500
28/28 [==============================] - 3s 122ms/step - loss: 0.4532 -
f1_score: 0.8585 - val_loss: 1.0790 - val_f1_score: 0.7371
Epoch 472/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4670 -
f1_score: 0.8597 - val_loss: 1.0700 - val_f1_score: 0.7186
Epoch 473/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4516 -
f1_score: 0.8635 - val_loss: 1.0367 - val_f1_score: 0.7111
Epoch 474/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4227 -
f1_score: 0.8634 - val_loss: 1.0590 - val_f1_score: 0.7014
Epoch 475/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4633 -
f1_score: 0.8574 - val_loss: 1.0590 - val_f1_score: 0.7007
Epoch 476/500
28/28 [==============================] - 3s 125ms/step - loss: 0.4398 -
```

```
f1_score: 0.8663 - val_loss: 1.0558 - val_f1_score: 0.7080
Epoch 477/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4225 -
f1_score: 0.8698 - val_loss: 0.9605 - val_f1_score: 0.7151
Epoch 478/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4484 -
f1_score: 0.8608 - val_loss: 1.0631 - val_f1_score: 0.7099
Epoch 479/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4971 -
f1_score: 0.8377 - val_loss: 1.1228 - val_f1_score: 0.6945
Epoch 480/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4708 -
f1_score: 0.8535 - val_loss: 1.1137 - val_f1_score: 0.7145
Epoch 481/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4346 -
f1_score: 0.8670 - val_loss: 1.0618 - val_f1_score: 0.7022
Epoch 482/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4617 -
f1_score: 0.8664 - val_loss: 1.0804 - val_f1_score: 0.6940
Epoch 483/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4289 -
f1_score: 0.8782 - val_loss: 0.9940 - val_f1_score: 0.7271
Epoch 484/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4099 -
f1_score: 0.8760 - val_loss: 1.0538 - val_f1_score: 0.7138
Epoch 485/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4339 -
f1_score: 0.8686 - val_loss: 1.0888 - val_f1_score: 0.7016
Epoch 486/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4060 -
f1_score: 0.8739 - val_loss: 1.0470 - val_f1_score: 0.7338
Epoch 487/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4371 -
f1_score: 0.8604 - val_loss: 1.0731 - val_f1_score: 0.6777
Epoch 488/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4547 -
f1_score: 0.8535 - val_loss: 1.0255 - val_f1_score: 0.7307
Epoch 489/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4213 -
f1_score: 0.8685 - val_loss: 1.0976 - val_f1_score: 0.6945
Epoch 490/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4329 -
f1_score: 0.8666 - val_loss: 1.0619 - val_f1_score: 0.6967
Epoch 491/500
28/28 [==============================] - 3s 122ms/step - loss: 0.4228 -
f1_score: 0.8722 - val_loss: 1.0083 - val_f1_score: 0.7177
Epoch 492/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4282 -
```

```
f1_score: 0.8729 - val_loss: 1.0438 - val_f1_score: 0.6928
Epoch 493/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4191 -
f1_score: 0.8722 - val_loss: 0.9987 - val_f1_score: 0.7269
Epoch 494/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4287 -
f1_score: 0.8694 - val_loss: 1.0546 - val_f1_score: 0.7205
Epoch 495/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4134 -
f1_score: 0.8740 - val_loss: 1.0958 - val_f1_score: 0.6974
Epoch 496/500
28/28 [==============================] - 3s 116ms/step - loss: 0.4190 -
f1_score: 0.8650 - val_loss: 1.0258 - val_f1_score: 0.7242
Epoch 497/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4259 -
f1_score: 0.8709 - val_loss: 1.1005 - val_f1_score: 0.7172
Epoch 498/500
28/28 [==============================] - 3s 114ms/step - loss: 0.4389 -
f1_score: 0.8679 - val_loss: 1.0778 - val_f1_score: 0.7004
Epoch 499/500
28/28 [==============================] - 3s 115ms/step - loss: 0.4090 -
f1_score: 0.8744 - val_loss: 1.1336 - val_f1_score: 0.7150
Epoch 500/500
28/28 [==============================] - 3s 113ms/step - loss: 0.4264 -
f1_score: 0.8720 - val_loss: 1.0093 - val_f1_score: 0.7279
```

[128]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 13ms/step
              precision    recall  f1-score   support

         AXE      0.800     1.000     0.889         8
    BACKPACK      0.556     0.833     0.667         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.769     1.000     0.870        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.250     0.400         8
   BREAKFAST      0.500     0.500     0.500         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      0.800     1.000     0.889         4
        DEAF      0.250     0.333     0.286         6
      DECIDE      0.800     0.667     0.727         6
```

```
      DEMAND      0.750     0.750     0.750         8
     DEVELOP      0.571     0.667     0.615         6
      DINNER      1.000     1.000     1.000         8
         DOG      0.714     0.833     0.769         6
    DOWNSIZE      0.857     0.750     0.800         8
        DRAG      1.000     0.250     0.400         4
         EAT      1.000     1.000     1.000         6
        EDIT      1.000     0.833     0.909         6
    ELEVATOR      0.500     0.625     0.556         8
        FINE      0.600     0.750     0.667         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.538     0.875     0.667         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.500     0.667         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.667     0.500     0.571         4
        LOCK      0.727     1.000     0.842         8
       LUNCH      1.000     0.500     0.667         8
       MAPLE      1.000     0.750     0.857         4
        MEAT      0.667     1.000     0.800         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     1.000     1.000         8
       MOVIE      0.875     0.875     0.875         8
        NOON      0.857     0.750     0.800         8
       PARTY      0.857     0.750     0.800         8
     PATIENT      1.000     0.333     0.500         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      1.000     0.667     0.800         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.571     0.800     0.667        10
        SINK      0.500     0.333     0.400         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.727     1.000     0.842         8
     WHATFOR      1.000     0.700     0.824        10

    accuracy                          0.762       324
   macro avg      0.776     0.734     0.728       324
weighted avg      0.786     0.762     0.748       324
```

[129]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1D-CNN + 1 GRU Trial 722/history.csv'
```

```
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[130]:
```
hist_df = pd.read_csv('1 1D-CNN + 1 GRU Trial 722/history.csv', index_col=0)
hist_df.tail()
```

[130]:

	loss	f1_score	val_loss	val_f1_score
495	0.418954	0.864984	1.025758	0.724187
496	0.425857	0.870909	1.100504	0.717211
497	0.438872	0.867914	1.077797	0.700437
498	0.409045	0.874394	1.133550	0.715011
499	0.426372	0.871953	1.009258	0.727857

[131]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[132]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[133]:
```
reconstructed_model = tf.keras.models.load_model("1 1D-CNN + 1 GRU Trial 722")
```

[134]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_1 (Conv1D)           (None, 116, 150)          897900

 max_pooling1d_1 (MaxPooling  (None, 11, 150)          0
 1D)

 dropout_2 (Dropout)         (None, 11, 150)           0

 gru_1 (GRU)                 (None, 150)               135900
```

```
 dropout_3 (Dropout)         (None, 150)               0

 dense_2 (Dense)             (None, 110)               16610

 dense_3 (Dense)             (None, 50)                5550

=================================================================
Total params: 1,055,960
Trainable params: 1,055,960
Non-trainable params: 0
_________________________________________________________________
```

[135]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[135]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 116, 150)
MaxPooling1D
input:
(None, 116, 150)
output:
(None, 11, 150)
Dropout
input:
(None, 11, 150)
output:
(None, 11, 150)
GRU
input:
(None, 11, 150)
output:
(None, 150)
Dropout
input:
(None, 150)
output:
(None, 150)
Dense
input:
(None, 150)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[136]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[136]:

Conv1D
MaxPooling1D
Dropout
GRU
Dense

[137]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 15ms/step - loss: 0.9942 - f1_score:
0.7561
```

[137]:
```
[0.9941567182540894, 0.7561458349227905]
```

[138]:
```
reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)
```

```
28/28 [==============================] - 1s 32ms/step - loss: 0.1065 - f1_score:
0.9830
```

[138]:
```
[0.10654260963201523, 0.9830050468444824]
```

[140]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 14ms/step
              precision    recall  f1-score   support

         AXE      0.800     1.000     0.889         8
    BACKPACK      0.625     0.833     0.714         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.769     1.000     0.870        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.375     0.545         8
   BREAKFAST      0.600     0.500     0.545         6
      CANCER      0.800     1.000     0.889         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.300     0.500     0.375         6
      DECIDE      1.000     0.833     0.909         6
      DEMAND      0.857     0.750     0.800         8
     DEVELOP      1.000     0.500     0.667         6
      DINNER      0.889     1.000     0.941         8
         DOG      0.714     0.833     0.769         6
    DOWNSIZE      0.875     0.875     0.875         8
        DRAG      1.000     0.500     0.667         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.667     1.000     0.800         8
        FINE      0.667     0.500     0.571         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      0.583     0.875     0.700         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.500     0.667         6
 HURDLE/TRIP      0.500     0.250     0.333         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.636     0.875     0.737         8
       LUNCH      1.000     0.500     0.667         8
       MAPLE      1.000     0.750     0.857         4
        MEAT      0.750     1.000     0.857         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.778     0.875     0.824         8
        NOON      1.000     0.750     0.857         8
       PARTY      0.857     0.750     0.800         8
     PATIENT      0.429     0.500     0.462         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.833     0.833     0.833         6
ROCKINGCHAIR      0.727     1.000     0.842         8
       SHAVE      0.571     0.800     0.667        10
        SINK      0.500     0.333     0.400         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.800     1.000     0.889         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.781       324
   macro avg      0.809     0.756     0.756       324
weighted avg      0.808     0.781     0.769       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[119]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1D-CNN + 1 GRU Trial 722 Mish/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[120]:
```
act_function = 'mish'

model = Sequential()
model.add(
    Conv1D(filters=150,
           kernel_size=15,
           activation=act_function,
           input_shape=(130, 399)))
model.add(MaxPooling1D(pool_size=10))
model.add(Dropout(.55))
model.add(
    GRU(units=150,
        return_sequences=False,
        kernel_regularizer=regularizers.l2(.00043122634871936203)))
model.add(Dropout(.7))
model.add(Dense(units=110, activation=act_function))
model.add(Dense(50, activation='softmax'))

model.compile(tf.optimizers.experimental.Nadam(.00021882052801027956),
              loss='categorical_crossentropy',
              metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
model.summary()
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
2023-09-11 23:43:23.010449: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-11 23:43:23.095320: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1739 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

```
Model: "sequential"
```

```
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 116, 150)          897900

 max_pooling1d (MaxPooling1D  (None, 11, 150)          0
 )

 dropout (Dropout)           (None, 11, 150)           0

 gru (GRU)                   (None, 150)               135900

 dropout_1 (Dropout)         (None, 150)               0

 dense (Dense)               (None, 110)               16610

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 1,055,960
Trainable params: 1,055,960
Non-trainable params: 0
_________________________________________________________________
Epoch 1/500

2023-09-11 23:43:28.029730: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
2023-09-11 23:43:28.719223: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x7f3ff80a7e90 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
2023-09-11 23:43:28.719274: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-11 23:43:28.732911: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-11 23:43:28.891387: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.

28/28 [==============================] - ETA: 0s - loss: 4.1241 - f1_score:
0.0167

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
```

```
28/28 [==============================] - 19s 532ms/step - loss: 4.1241 -
f1_score: 0.0167 - val_loss: 4.0085 - val_f1_score: 0.0023
Epoch 2/500
28/28 [==============================] - 3s 109ms/step - loss: 4.0314 -
f1_score: 0.0162 - val_loss: 4.0070 - val_f1_score: 0.0011
Epoch 3/500
28/28 [==============================] - 3s 109ms/step - loss: 4.0162 -
f1_score: 0.0201 - val_loss: 3.9963 - val_f1_score: 9.6970e-04
Epoch 4/500
28/28 [==============================] - 3s 110ms/step - loss: 4.0074 -
f1_score: 0.0136 - val_loss: 3.9977 - val_f1_score: 5.0000e-04
Epoch 5/500
28/28 [==============================] - ETA: 0s - loss: 3.9960 - f1_score:
0.0227

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 362ms/step - loss: 3.9960 -
f1_score: 0.0227 - val_loss: 3.9865 - val_f1_score: 0.0043
Epoch 6/500
28/28 [==============================] - ETA: 0s - loss: 3.9896 - f1_score:
0.0145

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 375ms/step - loss: 3.9896 -
f1_score: 0.0145 - val_loss: 3.9780 - val_f1_score: 0.0104
Epoch 7/500
28/28 [==============================] - 3s 110ms/step - loss: 3.9804 -
f1_score: 0.0204 - val_loss: 3.9680 - val_f1_score: 0.0068
Epoch 8/500
28/28 [==============================] - 3s 113ms/step - loss: 3.9608 -
f1_score: 0.0206 - val_loss: 3.9422 - val_f1_score: 0.0089
Epoch 9/500
28/28 [==============================] - 3s 110ms/step - loss: 3.9421 -
f1_score: 0.0224 - val_loss: 3.9103 - val_f1_score: 0.0059
Epoch 10/500
```

```
28/28 [==============================] - ETA: 0s - loss: 3.9025 - f1_score:
0.0307

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 396ms/step - loss: 3.9025 -
f1_score: 0.0307 - val_loss: 3.8368 - val_f1_score: 0.0179
Epoch 11/500
28/28 [==============================] - 3s 110ms/step - loss: 3.8408 -
f1_score: 0.0312 - val_loss: 3.7403 - val_f1_score: 0.0070
Epoch 12/500
28/28 [==============================] - 3s 110ms/step - loss: 3.7638 -
f1_score: 0.0301 - val_loss: 3.6390 - val_f1_score: 0.0112
Epoch 13/500
28/28 [==============================] - 3s 111ms/step - loss: 3.7119 -
f1_score: 0.0279 - val_loss: 3.5612 - val_f1_score: 0.0068
Epoch 14/500
28/28 [==============================] - ETA: 0s - loss: 3.6482 - f1_score:
0.0423

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 13s 463ms/step - loss: 3.6482 -
f1_score: 0.0423 - val_loss: 3.5167 - val_f1_score: 0.0225
Epoch 15/500
28/28 [==============================] - ETA: 0s - loss: 3.6238 - f1_score:
0.0405

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 365ms/step - loss: 3.6238 -
f1_score: 0.0405 - val_loss: 3.4501 - val_f1_score: 0.0343
Epoch 16/500
```

```
28/28 [==============================] - 3s 110ms/step - loss: 3.5713 -
f1_score: 0.0471 - val_loss: 3.3867 - val_f1_score: 0.0257
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 3.5245 - f1_score:
0.0473

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 363ms/step - loss: 3.5245 -
f1_score: 0.0473 - val_loss: 3.3033 - val_f1_score: 0.0492
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 3.4902 - f1_score:
0.0485

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 361ms/step - loss: 3.4902 -
f1_score: 0.0485 - val_loss: 3.2648 - val_f1_score: 0.0665
Epoch 19/500
28/28 [==============================] - 3s 110ms/step - loss: 3.4269 -
f1_score: 0.0645 - val_loss: 3.2122 - val_f1_score: 0.0622
Epoch 20/500
28/28 [==============================] - ETA: 0s - loss: 3.3929 - f1_score:
0.0658

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 425ms/step - loss: 3.3929 -
f1_score: 0.0658 - val_loss: 3.1325 - val_f1_score: 0.0843
Epoch 21/500
28/28 [==============================] - 3s 110ms/step - loss: 3.3524 -
f1_score: 0.0742 - val_loss: 3.1051 - val_f1_score: 0.0766
Epoch 22/500
```

```
28/28 [==============================] - ETA: 0s - loss: 3.3085 - f1_score:
0.0688

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 373ms/step - loss: 3.3085 -
f1_score: 0.0688 - val_loss: 3.0723 - val_f1_score: 0.0882
Epoch 23/500
28/28 [==============================] - 3s 110ms/step - loss: 3.2931 -
f1_score: 0.0730 - val_loss: 3.0355 - val_f1_score: 0.0778
Epoch 24/500
28/28 [==============================] - ETA: 0s - loss: 3.2743 - f1_score:
0.0745

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 364ms/step - loss: 3.2743 -
f1_score: 0.0745 - val_loss: 3.0109 - val_f1_score: 0.0929
Epoch 25/500
28/28 [==============================] - ETA: 0s - loss: 3.2616 - f1_score:
0.0827

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 402ms/step - loss: 3.2616 -
f1_score: 0.0827 - val_loss: 2.9637 - val_f1_score: 0.1025
Epoch 26/500
28/28 [==============================] - ETA: 0s - loss: 3.2141 - f1_score:
0.0798

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
```

```
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 361ms/step - loss: 3.2141 -
f1_score: 0.0798 - val_loss: 2.9374 - val_f1_score: 0.1082
Epoch 27/500
28/28 [==============================] - ETA: 0s - loss: 3.2029 - f1_score:
0.0760

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 383ms/step - loss: 3.2029 -
f1_score: 0.0760 - val_loss: 2.9019 - val_f1_score: 0.1084
Epoch 28/500
28/28 [==============================] - 3s 110ms/step - loss: 3.1535 -
f1_score: 0.0930 - val_loss: 2.8625 - val_f1_score: 0.1027
Epoch 29/500
28/28 [==============================] - ETA: 0s - loss: 3.1535 - f1_score:
0.0986

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 397ms/step - loss: 3.1535 -
f1_score: 0.0986 - val_loss: 2.8378 - val_f1_score: 0.1165
Epoch 30/500
28/28 [==============================] - ETA: 0s - loss: 3.1166 - f1_score:
0.0916

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
```

```
28/28 [==============================] - 10s 352ms/step - loss: 3.1166 -
f1_score: 0.0916 - val_loss: 2.7980 - val_f1_score: 0.1235
Epoch 31/500
28/28 [==============================] - ETA: 0s - loss: 3.1147 - f1_score:
0.0980

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 10s 355ms/step - loss: 3.1147 -
f1_score: 0.0980 - val_loss: 2.8082 - val_f1_score: 0.1285
Epoch 32/500
28/28 [==============================] - ETA: 0s - loss: 3.0795 - f1_score:
0.1012

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 408ms/step - loss: 3.0795 -
f1_score: 0.1012 - val_loss: 2.7565 - val_f1_score: 0.1384
Epoch 33/500
28/28 [==============================] - 3s 110ms/step - loss: 3.0747 -
f1_score: 0.0965 - val_loss: 2.7598 - val_f1_score: 0.1135
Epoch 34/500
28/28 [==============================] - 3s 110ms/step - loss: 3.0479 -
f1_score: 0.1121 - val_loss: 2.7006 - val_f1_score: 0.1329
Epoch 35/500
28/28 [==============================] - 3s 110ms/step - loss: 3.0130 -
f1_score: 0.1157 - val_loss: 2.7352 - val_f1_score: 0.1288
Epoch 36/500
28/28 [==============================] - 3s 110ms/step - loss: 3.0119 -
f1_score: 0.1100 - val_loss: 2.6682 - val_f1_score: 0.1287
Epoch 37/500
28/28 [==============================] - 3s 110ms/step - loss: 2.9557 -
f1_score: 0.1224 - val_loss: 2.7244 - val_f1_score: 0.1055
Epoch 38/500
28/28 [==============================] - 3s 110ms/step - loss: 2.9651 -
f1_score: 0.1278 - val_loss: 2.7081 - val_f1_score: 0.1177
Epoch 39/500
28/28 [==============================] - 3s 111ms/step - loss: 2.9312 -
```

```
f1_score: 0.1274 - val_loss: 2.6637 - val_f1_score: 0.1237
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 2.9162 - f1_score:
0.1368

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 446ms/step - loss: 2.9162 -
f1_score: 0.1368 - val_loss: 2.5660 - val_f1_score: 0.1595
Epoch 41/500
28/28 [==============================] - 3s 110ms/step - loss: 2.8875 -
f1_score: 0.1309 - val_loss: 2.6080 - val_f1_score: 0.1328
Epoch 42/500
28/28 [==============================] - ETA: 0s - loss: 2.9275 - f1_score:
0.1248

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 415ms/step - loss: 2.9275 -
f1_score: 0.1248 - val_loss: 2.5910 - val_f1_score: 0.1734
Epoch 43/500
28/28 [==============================] - 3s 110ms/step - loss: 2.9010 -
f1_score: 0.1404 - val_loss: 2.6950 - val_f1_score: 0.1195
Epoch 44/500
28/28 [==============================] - 3s 111ms/step - loss: 2.8674 -
f1_score: 0.1332 - val_loss: 2.6066 - val_f1_score: 0.1576
Epoch 45/500
28/28 [==============================] - 3s 110ms/step - loss: 2.8533 -
f1_score: 0.1408 - val_loss: 2.6277 - val_f1_score: 0.1227
Epoch 46/500
28/28 [==============================] - 3s 110ms/step - loss: 2.8481 -
f1_score: 0.1456 - val_loss: 2.5130 - val_f1_score: 0.1491
Epoch 47/500
28/28 [==============================] - ETA: 0s - loss: 2.8281 - f1_score:
0.1437

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
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saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 15s 542ms/step - loss: 2.8281 -
f1_score: 0.1437 - val_loss: 2.5439 - val_f1_score: 0.1775
Epoch 48/500
28/28 [==============================] - 3s 111ms/step - loss: 2.8197 -
f1_score: 0.1452 - val_loss: 2.5806 - val_f1_score: 0.1482
Epoch 49/500
28/28 [==============================] - ETA: 0s - loss: 2.7937 - f1_score:
0.1479

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 429ms/step - loss: 2.7937 -
f1_score: 0.1479 - val_loss: 2.5184 - val_f1_score: 0.1775
Epoch 50/500
28/28 [==============================] - 3s 111ms/step - loss: 2.7974 -
f1_score: 0.1422 - val_loss: 2.5666 - val_f1_score: 0.1514
Epoch 51/500
28/28 [==============================] - ETA: 0s - loss: 2.7565 - f1_score:
0.1558

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 396ms/step - loss: 2.7565 -
f1_score: 0.1558 - val_loss: 2.5334 - val_f1_score: 0.1818
Epoch 52/500
28/28 [==============================] - 3s 111ms/step - loss: 2.7858 -
f1_score: 0.1533 - val_loss: 2.5428 - val_f1_score: 0.1774
Epoch 53/500
28/28 [==============================] - ETA: 0s - loss: 2.7396 - f1_score:
0.1635

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
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saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 418ms/step - loss: 2.7396 -
f1_score: 0.1635 - val_loss: 2.4765 - val_f1_score: 0.1994
Epoch 54/500
28/28 [==============================] - ETA: 0s - loss: 2.7175 - f1_score:
0.1643

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 445ms/step - loss: 2.7175 -
f1_score: 0.1643 - val_loss: 2.5038 - val_f1_score: 0.2138
Epoch 55/500
28/28 [==============================] - 3s 111ms/step - loss: 2.7142 -
f1_score: 0.1621 - val_loss: 2.4862 - val_f1_score: 0.2036
Epoch 56/500
28/28 [==============================] - 3s 111ms/step - loss: 2.7149 -
f1_score: 0.1750 - val_loss: 2.4934 - val_f1_score: 0.1867
Epoch 57/500
28/28 [==============================] - 3s 112ms/step - loss: 2.6948 -
f1_score: 0.1706 - val_loss: 2.4923 - val_f1_score: 0.1831
Epoch 58/500
28/28 [==============================] - 3s 112ms/step - loss: 2.6801 -
f1_score: 0.1843 - val_loss: 2.4521 - val_f1_score: 0.2028
Epoch 59/500
28/28 [==============================] - 3s 112ms/step - loss: 2.6860 -
f1_score: 0.1877 - val_loss: 2.4405 - val_f1_score: 0.2014
Epoch 60/500
28/28 [==============================] - 3s 113ms/step - loss: 2.6780 -
f1_score: 0.1902 - val_loss: 2.4400 - val_f1_score: 0.2072
Epoch 61/500
28/28 [==============================] - ETA: 0s - loss: 2.6591 - f1_score:
0.1779

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 13s 465ms/step - loss: 2.6591 -
f1_score: 0.1779 - val_loss: 2.4050 - val_f1_score: 0.2278
Epoch 62/500
28/28 [==============================] - ETA: 0s - loss: 2.6541 - f1_score:
0.1808

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 430ms/step - loss: 2.6541 -
f1_score: 0.1808 - val_loss: 2.3935 - val_f1_score: 0.2284
Epoch 63/500
28/28 [==============================] - ETA: 0s - loss: 2.6623 - f1_score:
0.1774

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 428ms/step - loss: 2.6623 -
f1_score: 0.1774 - val_loss: 2.3793 - val_f1_score: 0.2376
Epoch 64/500
28/28 [==============================] - ETA: 0s - loss: 2.6147 - f1_score:
0.1998

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 13s 460ms/step - loss: 2.6147 -
f1_score: 0.1998 - val_loss: 2.3684 - val_f1_score: 0.2423
Epoch 65/500
28/28 [==============================] - 3s 111ms/step - loss: 2.6266 -
f1_score: 0.1905 - val_loss: 2.3988 - val_f1_score: 0.2252
Epoch 66/500
28/28 [==============================] - 3s 113ms/step - loss: 2.6384 -
```

```
f1_score: 0.1841 - val_loss: 2.3856 - val_f1_score: 0.2198
Epoch 67/500
28/28 [==============================] - ETA: 0s - loss: 2.6290 - f1_score:
0.1966

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 427ms/step - loss: 2.6290 -
f1_score: 0.1966 - val_loss: 2.3913 - val_f1_score: 0.2565
Epoch 68/500
28/28 [==============================] - 3s 110ms/step - loss: 2.6239 -
f1_score: 0.1928 - val_loss: 2.3921 - val_f1_score: 0.2271
Epoch 69/500
28/28 [==============================] - ETA: 0s - loss: 2.5670 - f1_score:
0.1911

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 388ms/step - loss: 2.5670 -
f1_score: 0.1911 - val_loss: 2.3338 - val_f1_score: 0.2734
Epoch 70/500
28/28 [==============================] - 3s 110ms/step - loss: 2.6017 -
f1_score: 0.1932 - val_loss: 2.3591 - val_f1_score: 0.2479
Epoch 71/500
28/28 [==============================] - 3s 112ms/step - loss: 2.5418 -
f1_score: 0.2011 - val_loss: 2.3501 - val_f1_score: 0.2480
Epoch 72/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5912 -
f1_score: 0.2017 - val_loss: 2.4458 - val_f1_score: 0.2097
Epoch 73/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5817 -
f1_score: 0.2024 - val_loss: 2.3817 - val_f1_score: 0.2445
Epoch 74/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5464 -
f1_score: 0.2117 - val_loss: 2.3364 - val_f1_score: 0.2466
Epoch 75/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5309 -
f1_score: 0.2212 - val_loss: 2.3170 - val_f1_score: 0.2532
```

```
Epoch 76/500
28/28 [==============================] - 3s 112ms/step - loss: 2.5367 -
f1_score: 0.2109 - val_loss: 2.3555 - val_f1_score: 0.2559
Epoch 77/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5363 -
f1_score: 0.2069 - val_loss: 2.4279 - val_f1_score: 0.2213
Epoch 78/500
28/28 [==============================] - ETA: 0s - loss: 2.5162 - f1_score:
0.2092

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 453ms/step - loss: 2.5162 -
f1_score: 0.2092 - val_loss: 2.2678 - val_f1_score: 0.3070
Epoch 79/500
28/28 [==============================] - 3s 111ms/step - loss: 2.5088 -
f1_score: 0.2067 - val_loss: 2.3098 - val_f1_score: 0.2499
Epoch 80/500
28/28 [==============================] - 3s 111ms/step - loss: 2.4824 -
f1_score: 0.2191 - val_loss: 2.3032 - val_f1_score: 0.2693
Epoch 81/500
28/28 [==============================] - 3s 112ms/step - loss: 2.4868 -
f1_score: 0.2174 - val_loss: 2.3202 - val_f1_score: 0.2465
Epoch 82/500
28/28 [==============================] - ETA: 0s - loss: 2.5349 - f1_score:
0.2090

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 427ms/step - loss: 2.5349 -
f1_score: 0.2090 - val_loss: 2.2852 - val_f1_score: 0.3159
Epoch 83/500
28/28 [==============================] - 3s 111ms/step - loss: 2.4631 -
f1_score: 0.2253 - val_loss: 2.2276 - val_f1_score: 0.3003
Epoch 84/500
28/28 [==============================] - 3s 111ms/step - loss: 2.4478 -
f1_score: 0.2306 - val_loss: 2.2570 - val_f1_score: 0.2647
Epoch 85/500
```

```
28/28 [==============================] - 3s 111ms/step - loss: 2.4685 -
f1_score: 0.2214 - val_loss: 2.2518 - val_f1_score: 0.2846
Epoch 86/500
28/28 [==============================] - 3s 111ms/step - loss: 2.4736 -
f1_score: 0.2244 - val_loss: 2.2805 - val_f1_score: 0.2559
Epoch 87/500
28/28 [==============================] - 3s 113ms/step - loss: 2.4370 -
f1_score: 0.2290 - val_loss: 2.2333 - val_f1_score: 0.2960
Epoch 88/500
28/28 [==============================] - 3s 113ms/step - loss: 2.4427 -
f1_score: 0.2314 - val_loss: 2.2386 - val_f1_score: 0.2949
Epoch 89/500
28/28 [==============================] - 3s 113ms/step - loss: 2.4446 -
f1_score: 0.2325 - val_loss: 2.2169 - val_f1_score: 0.3040
Epoch 90/500
28/28 [==============================] - 3s 112ms/step - loss: 2.4378 -
f1_score: 0.2405 - val_loss: 2.2385 - val_f1_score: 0.2490
Epoch 91/500
28/28 [==============================] - ETA: 0s - loss: 2.4239 - f1_score:
0.2390

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 13s 469ms/step - loss: 2.4239 -
f1_score: 0.2390 - val_loss: 2.2369 - val_f1_score: 0.3245
Epoch 92/500
28/28 [==============================] - 3s 111ms/step - loss: 2.3824 -
f1_score: 0.2551 - val_loss: 2.2103 - val_f1_score: 0.3160
Epoch 93/500
28/28 [==============================] - 3s 111ms/step - loss: 2.4063 -
f1_score: 0.2452 - val_loss: 2.2056 - val_f1_score: 0.3011
Epoch 94/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3736 -
f1_score: 0.2527 - val_loss: 2.2335 - val_f1_score: 0.3012
Epoch 95/500
28/28 [==============================] - 3s 115ms/step - loss: 2.3837 -
f1_score: 0.2468 - val_loss: 2.2738 - val_f1_score: 0.2951
Epoch 96/500
28/28 [==============================] - ETA: 0s - loss: 2.3770 - f1_score:
0.2553

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
```

```
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 445ms/step - loss: 2.3770 -
f1_score: 0.2553 - val_loss: 2.2116 - val_f1_score: 0.3249
Epoch 97/500
28/28 [==============================] - 3s 111ms/step - loss: 2.3721 -
f1_score: 0.2503 - val_loss: 2.2149 - val_f1_score: 0.3025
Epoch 98/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3615 -
f1_score: 0.2538 - val_loss: 2.2819 - val_f1_score: 0.2834
Epoch 99/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3956 -
f1_score: 0.2440 - val_loss: 2.2009 - val_f1_score: 0.3081
Epoch 100/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3225 -
f1_score: 0.2687 - val_loss: 2.1866 - val_f1_score: 0.3160
Epoch 101/500
28/28 [==============================] - 3s 111ms/step - loss: 2.3495 -
f1_score: 0.2540 - val_loss: 2.2283 - val_f1_score: 0.2860
Epoch 102/500
28/28 [==============================] - 3s 111ms/step - loss: 2.3372 -
f1_score: 0.2606 - val_loss: 2.2133 - val_f1_score: 0.3018
Epoch 103/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3868 -
f1_score: 0.2588 - val_loss: 2.2266 - val_f1_score: 0.3022
Epoch 104/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3374 -
f1_score: 0.2697 - val_loss: 2.1748 - val_f1_score: 0.3023
Epoch 105/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3551 -
f1_score: 0.2589 - val_loss: 2.1429 - val_f1_score: 0.3196
Epoch 106/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3480 -
f1_score: 0.2615 - val_loss: 2.2596 - val_f1_score: 0.3059
Epoch 107/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3470 -
f1_score: 0.2658 - val_loss: 2.1783 - val_f1_score: 0.2998
Epoch 108/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3086 -
f1_score: 0.2771 - val_loss: 2.1543 - val_f1_score: 0.3053
Epoch 109/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3262 -
f1_score: 0.2739 - val_loss: 2.2035 - val_f1_score: 0.3000
Epoch 110/500
```

```
28/28 [==============================] - 3s 112ms/step - loss: 2.3380 -
f1_score: 0.2689 - val_loss: 2.1672 - val_f1_score: 0.2904
Epoch 111/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3058 -
f1_score: 0.2751 - val_loss: 2.1559 - val_f1_score: 0.3085
Epoch 112/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3066 -
f1_score: 0.2701 - val_loss: 2.1760 - val_f1_score: 0.2923
Epoch 113/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3285 -
f1_score: 0.2703 - val_loss: 2.2677 - val_f1_score: 0.2781
Epoch 114/500
28/28 [==============================] - 3s 112ms/step - loss: 2.3185 -
f1_score: 0.2750 - val_loss: 2.1484 - val_f1_score: 0.3166
Epoch 115/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2708 -
f1_score: 0.2791 - val_loss: 2.1474 - val_f1_score: 0.3022
Epoch 116/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2616 -
f1_score: 0.2855 - val_loss: 2.1101 - val_f1_score: 0.3199
Epoch 117/500
28/28 [==============================] - 3s 113ms/step - loss: 2.3191 -
f1_score: 0.2706 - val_loss: 2.1569 - val_f1_score: 0.2976
Epoch 118/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2763 -
f1_score: 0.2771 - val_loss: 2.2043 - val_f1_score: 0.2902
Epoch 119/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2935 -
f1_score: 0.2841 - val_loss: 2.1629 - val_f1_score: 0.3067
Epoch 120/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2806 -
f1_score: 0.2734 - val_loss: 2.1346 - val_f1_score: 0.2851
Epoch 121/500
28/28 [==============================] - ETA: 0s - loss: 2.2817 - f1_score:
0.2828

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 452ms/step - loss: 2.2817 -
f1_score: 0.2828 - val_loss: 2.1135 - val_f1_score: 0.3449
Epoch 122/500
28/28 [==============================] - ETA: 0s - loss: 2.2958 - f1_score:
0.2721
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 403ms/step - loss: 2.2958 -
f1_score: 0.2721 - val_loss: 2.1002 - val_f1_score: 0.3460
Epoch 123/500
28/28 [==============================] - ETA: 0s - loss: 2.2341 - f1_score:
0.2947

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 421ms/step - loss: 2.2341 -
f1_score: 0.2947 - val_loss: 2.1302 - val_f1_score: 0.3553
Epoch 124/500
28/28 [==============================] - 3s 111ms/step - loss: 2.2418 -
f1_score: 0.2931 - val_loss: 2.1111 - val_f1_score: 0.3453
Epoch 125/500
28/28 [==============================] - 3s 111ms/step - loss: 2.2506 -
f1_score: 0.2829 - val_loss: 2.1035 - val_f1_score: 0.3202
Epoch 126/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2381 -
f1_score: 0.2903 - val_loss: 2.1061 - val_f1_score: 0.3426
Epoch 127/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2418 -
f1_score: 0.2812 - val_loss: 2.1447 - val_f1_score: 0.3184
Epoch 128/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2051 -
f1_score: 0.3051 - val_loss: 2.1990 - val_f1_score: 0.2871
Epoch 129/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2703 -
f1_score: 0.2833 - val_loss: 2.1120 - val_f1_score: 0.3358
Epoch 130/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2078 -
f1_score: 0.3020 - val_loss: 2.0873 - val_f1_score: 0.3464
Epoch 131/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2207 -
f1_score: 0.3058 - val_loss: 2.0610 - val_f1_score: 0.3469
Epoch 132/500
```

```
28/28 [==============================] - 3s 117ms/step - loss: 2.2277 -
f1_score: 0.3037 - val_loss: 2.1445 - val_f1_score: 0.3073
Epoch 133/500
28/28 [==============================] - 3s 112ms/step - loss: 2.2242 -
f1_score: 0.3066 - val_loss: 2.1967 - val_f1_score: 0.2933
Epoch 134/500
28/28 [==============================] - 3s 113ms/step - loss: 2.1890 -
f1_score: 0.3157 - val_loss: 2.0954 - val_f1_score: 0.3331
Epoch 135/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2372 -
f1_score: 0.3021 - val_loss: 2.1478 - val_f1_score: 0.3094
Epoch 136/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2101 -
f1_score: 0.3066 - val_loss: 2.0345 - val_f1_score: 0.3493
Epoch 137/500
28/28 [==============================] - 3s 113ms/step - loss: 2.2131 -
f1_score: 0.2968 - val_loss: 2.0981 - val_f1_score: 0.3115
Epoch 138/500
28/28 [==============================] - ETA: 0s - loss: 2.2075 - f1_score:
0.2923

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 458ms/step - loss: 2.2075 -
f1_score: 0.2923 - val_loss: 2.0852 - val_f1_score: 0.3572
Epoch 139/500
28/28 [==============================] - ETA: 0s - loss: 2.1816 - f1_score:
0.3172

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 418ms/step - loss: 2.1816 -
f1_score: 0.3172 - val_loss: 2.0601 - val_f1_score: 0.3596
Epoch 140/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1640 -
f1_score: 0.3107 - val_loss: 2.0838 - val_f1_score: 0.3315
Epoch 141/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1851 -
```

```
f1_score: 0.3089 - val_loss: 2.0159 - val_f1_score: 0.3586
Epoch 142/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1647 -
f1_score: 0.3160 - val_loss: 2.0952 - val_f1_score: 0.3192
Epoch 143/500
28/28 [==============================] - ETA: 0s - loss: 2.1882 - f1_score:
0.3233

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 389ms/step - loss: 2.1882 -
f1_score: 0.3233 - val_loss: 2.0601 - val_f1_score: 0.3617
Epoch 144/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1344 -
f1_score: 0.3212 - val_loss: 2.0763 - val_f1_score: 0.3434
Epoch 145/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1024 -
f1_score: 0.3290 - val_loss: 2.0051 - val_f1_score: 0.3424
Epoch 146/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1087 -
f1_score: 0.3277 - val_loss: 2.0233 - val_f1_score: 0.3505
Epoch 147/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1414 -
f1_score: 0.3253 - val_loss: 2.0585 - val_f1_score: 0.3529
Epoch 148/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1385 -
f1_score: 0.3197 - val_loss: 2.0480 - val_f1_score: 0.3488
Epoch 149/500
28/28 [==============================] - ETA: 0s - loss: 2.1096 - f1_score:
0.3274

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 431ms/step - loss: 2.1096 -
f1_score: 0.3274 - val_loss: 2.0597 - val_f1_score: 0.3641
Epoch 150/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1235 -
f1_score: 0.3209 - val_loss: 2.0658 - val_f1_score: 0.3392
```

```
Epoch 151/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1433 -
f1_score: 0.3147 - val_loss: 2.0240 - val_f1_score: 0.3612
Epoch 152/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1254 -
f1_score: 0.3260 - val_loss: 2.1578 - val_f1_score: 0.2926
Epoch 153/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1180 -
f1_score: 0.3296 - val_loss: 2.0261 - val_f1_score: 0.3186
Epoch 154/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1059 -
f1_score: 0.3376 - val_loss: 2.0399 - val_f1_score: 0.3615
Epoch 155/500
28/28 [==============================] - 3s 113ms/step - loss: 2.1270 -
f1_score: 0.3202 - val_loss: 2.0788 - val_f1_score: 0.3455
Epoch 156/500
28/28 [==============================] - 3s 112ms/step - loss: 2.1303 -
f1_score: 0.3188 - val_loss: 2.2226 - val_f1_score: 0.3164
Epoch 157/500
28/28 [==============================] - 3s 113ms/step - loss: 2.1302 -
f1_score: 0.3300 - val_loss: 2.0463 - val_f1_score: 0.3440
Epoch 158/500
28/28 [==============================] - ETA: 0s - loss: 2.1075 - f1_score:
0.3322

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 424ms/step - loss: 2.1075 -
f1_score: 0.3322 - val_loss: 2.0083 - val_f1_score: 0.3658
Epoch 159/500
28/28 [==============================] - 3s 111ms/step - loss: 2.1094 -
f1_score: 0.3289 - val_loss: 2.0567 - val_f1_score: 0.3603
Epoch 160/500
28/28 [==============================] - ETA: 0s - loss: 2.0797 - f1_score:
0.3405

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
```

```
28/28 [==============================] - 12s 449ms/step - loss: 2.0797 -
f1_score: 0.3405 - val_loss: 1.9669 - val_f1_score: 0.3855
Epoch 161/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0797 -
f1_score: 0.3449 - val_loss: 2.0152 - val_f1_score: 0.3661
Epoch 162/500
28/28 [==============================] - ETA: 0s - loss: 2.0498 - f1_score:
0.3448

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 11s 410ms/step - loss: 2.0498 -
f1_score: 0.3448 - val_loss: 1.9747 - val_f1_score: 0.3904
Epoch 163/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0940 -
f1_score: 0.3351 - val_loss: 2.0247 - val_f1_score: 0.3495
Epoch 164/500
28/28 [==============================] - 3s 110ms/step - loss: 2.0637 -
f1_score: 0.3506 - val_loss: 2.0300 - val_f1_score: 0.3587
Epoch 165/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0729 -
f1_score: 0.3397 - val_loss: 1.9742 - val_f1_score: 0.3776
Epoch 166/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0903 -
f1_score: 0.3313 - val_loss: 2.0375 - val_f1_score: 0.3551
Epoch 167/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0657 -
f1_score: 0.3354 - val_loss: 1.9985 - val_f1_score: 0.3702
Epoch 168/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0889 -
f1_score: 0.3425 - val_loss: 1.9821 - val_f1_score: 0.3803
Epoch 169/500
28/28 [==============================] - 3s 113ms/step - loss: 2.0388 -
f1_score: 0.3489 - val_loss: 1.9968 - val_f1_score: 0.3743
Epoch 170/500
28/28 [==============================] - ETA: 0s - loss: 2.0501 - f1_score:
0.3483

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
```

```
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
28/28 [==============================] - 12s 456ms/step - loss: 2.0501 -
f1_score: 0.3483 - val_loss: 1.9701 - val_f1_score: 0.4131
Epoch 171/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0606 -
f1_score: 0.3484 - val_loss: 1.9471 - val_f1_score: 0.3925
Epoch 172/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0331 -
f1_score: 0.3546 - val_loss: 2.0405 - val_f1_score: 0.4037
Epoch 173/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0444 -
f1_score: 0.3451 - val_loss: 2.0493 - val_f1_score: 0.3573
Epoch 174/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0057 -
f1_score: 0.3528 - val_loss: 2.0160 - val_f1_score: 0.3743
Epoch 175/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0320 -
f1_score: 0.3490 - val_loss: 2.0025 - val_f1_score: 0.3754
Epoch 176/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0274 -
f1_score: 0.3592 - val_loss: 2.1204 - val_f1_score: 0.3913
Epoch 177/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0211 -
f1_score: 0.3625 - val_loss: 2.0248 - val_f1_score: 0.3635
Epoch 178/500
28/28 [==============================] - 3s 113ms/step - loss: 2.0156 -
f1_score: 0.3692 - val_loss: 1.9627 - val_f1_score: 0.3969
Epoch 179/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0194 -
f1_score: 0.3631 - val_loss: 1.9621 - val_f1_score: 0.4079
Epoch 180/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0165 -
f1_score: 0.3639 - val_loss: 1.9812 - val_f1_score: 0.3742
Epoch 181/500
28/28 [==============================] - 3s 113ms/step - loss: 2.0410 -
f1_score: 0.3586 - val_loss: 2.0278 - val_f1_score: 0.3678
Epoch 182/500
28/28 [==============================] - 3s 113ms/step - loss: 1.9970 -
f1_score: 0.3641 - val_loss: 1.9631 - val_f1_score: 0.3729
Epoch 183/500
28/28 [==============================] - 3s 114ms/step - loss: 1.9975 -
f1_score: 0.3622 - val_loss: 2.0344 - val_f1_score: 0.3674
Epoch 184/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0149 -
f1_score: 0.3569 - val_loss: 1.9797 - val_f1_score: 0.3872
Epoch 185/500
28/28 [==============================] - 3s 113ms/step - loss: 2.0170 -
```

```
f1_score: 0.3660 - val_loss: 2.0492 - val_f1_score: 0.3544
Epoch 186/500
28/28 [==============================] - ETA: 0s - loss: 2.0142 - f1_score:
0.3684

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 449ms/step - loss: 2.0142 -
f1_score: 0.3684 - val_loss: 1.9566 - val_f1_score: 0.4224
Epoch 187/500
28/28 [==============================] - 3s 111ms/step - loss: 2.0275 -
f1_score: 0.3479 - val_loss: 1.9450 - val_f1_score: 0.4135
Epoch 188/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9583 -
f1_score: 0.3749 - val_loss: 1.9451 - val_f1_score: 0.4055
Epoch 189/500
28/28 [==============================] - ETA: 0s - loss: 1.9940 - f1_score:
0.3684

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 12s 439ms/step - loss: 1.9940 -
f1_score: 0.3684 - val_loss: 1.9144 - val_f1_score: 0.4235
Epoch 190/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0429 -
f1_score: 0.3451 - val_loss: 1.9194 - val_f1_score: 0.4042
Epoch 191/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9984 -
f1_score: 0.3700 - val_loss: 1.9070 - val_f1_score: 0.3843
Epoch 192/500
28/28 [==============================] - 3s 116ms/step - loss: 1.9873 -
f1_score: 0.3714 - val_loss: 1.9736 - val_f1_score: 0.3869
Epoch 193/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9718 -
f1_score: 0.3684 - val_loss: 2.0701 - val_f1_score: 0.3487
Epoch 194/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9844 -
f1_score: 0.3690 - val_loss: 1.9672 - val_f1_score: 0.3979
```

```
Epoch 195/500
28/28 [==============================] - 3s 112ms/step - loss: 2.0022 -
f1_score: 0.3677 - val_loss: 2.0443 - val_f1_score: 0.3624
Epoch 196/500
28/28 [==============================] - ETA: 0s - loss: 1.9989 - f1_score:
0.3648

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

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28/28 [==============================] - 29s 1s/step - loss: 1.9989 - f1_score:
0.3648 - val_loss: 1.9033 - val_f1_score: 0.4252
Epoch 197/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9620 -
f1_score: 0.3741 - val_loss: 1.9578 - val_f1_score: 0.4065
Epoch 198/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9870 -
f1_score: 0.3752 - val_loss: 1.9391 - val_f1_score: 0.4053
Epoch 199/500
28/28 [==============================] - ETA: 0s - loss: 1.9998 - f1_score:
0.3635

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
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28/28 [==============================] - 11s 415ms/step - loss: 1.9998 -
f1_score: 0.3635 - val_loss: 1.9113 - val_f1_score: 0.4264
Epoch 200/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9635 -
f1_score: 0.3914 - val_loss: 1.9346 - val_f1_score: 0.4042
Epoch 201/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9597 -
f1_score: 0.3751 - val_loss: 1.9557 - val_f1_score: 0.3875
Epoch 202/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9762 -
f1_score: 0.3724 - val_loss: 1.9948 - val_f1_score: 0.3951
Epoch 203/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9634 -
f1_score: 0.3738 - val_loss: 2.0046 - val_f1_score: 0.3899
Epoch 204/500
```

```
28/28 [==============================] - 3s 111ms/step - loss: 1.9886 -
f1_score: 0.3653 - val_loss: 2.0649 - val_f1_score: 0.3672
Epoch 205/500
28/28 [==============================] - ETA: 0s - loss: 1.9346 - f1_score:
0.3788

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28/28 [==============================] - 20s 722ms/step - loss: 1.9346 -
f1_score: 0.3788 - val_loss: 1.9009 - val_f1_score: 0.4373
Epoch 206/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9296 -
f1_score: 0.4040 - val_loss: 1.9223 - val_f1_score: 0.4220
Epoch 207/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9593 -
f1_score: 0.3703 - val_loss: 1.9705 - val_f1_score: 0.4154
Epoch 208/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9367 -
f1_score: 0.3930 - val_loss: 1.9292 - val_f1_score: 0.4160
Epoch 209/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9327 -
f1_score: 0.3772 - val_loss: 2.0620 - val_f1_score: 0.3570
Epoch 210/500
28/28 [==============================] - 3s 110ms/step - loss: 1.9042 -
f1_score: 0.4015 - val_loss: 1.9802 - val_f1_score: 0.3952
Epoch 211/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9319 -
f1_score: 0.3860 - val_loss: 2.0652 - val_f1_score: 0.3489
Epoch 212/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9240 -
f1_score: 0.4062 - val_loss: 1.9792 - val_f1_score: 0.4118
Epoch 213/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9262 -
f1_score: 0.3794 - val_loss: 1.9406 - val_f1_score: 0.4085
Epoch 214/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9438 -
f1_score: 0.3809 - val_loss: 2.0797 - val_f1_score: 0.3600
Epoch 215/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9150 -
f1_score: 0.3936 - val_loss: 1.9514 - val_f1_score: 0.4085
Epoch 216/500
28/28 [==============================] - 3s 114ms/step - loss: 1.8744 -
f1_score: 0.4091 - val_loss: 1.9378 - val_f1_score: 0.3934
```

```
Epoch 217/500
28/28 [==============================] - 3s 113ms/step - loss: 1.9047 -
f1_score: 0.4025 - val_loss: 1.9245 - val_f1_score: 0.4041
Epoch 218/500
28/28 [==============================] - 3s 114ms/step - loss: 1.9078 -
f1_score: 0.4070 - val_loss: 1.9470 - val_f1_score: 0.3862
Epoch 219/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9054 -
f1_score: 0.4036 - val_loss: 1.9395 - val_f1_score: 0.4226
Epoch 220/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9094 -
f1_score: 0.3874 - val_loss: 1.9214 - val_f1_score: 0.4187
Epoch 221/500
28/28 [==============================] - 3s 113ms/step - loss: 1.9021 -
f1_score: 0.4010 - val_loss: 2.0147 - val_f1_score: 0.3724
Epoch 222/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8881 -
f1_score: 0.3944 - val_loss: 1.8882 - val_f1_score: 0.4218
Epoch 223/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8697 -
f1_score: 0.4187 - val_loss: 1.9797 - val_f1_score: 0.4302
Epoch 224/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8971 -
f1_score: 0.4103 - val_loss: 1.9750 - val_f1_score: 0.4010
Epoch 225/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9207 -
f1_score: 0.3864 - val_loss: 1.8842 - val_f1_score: 0.4292
Epoch 226/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8774 -
f1_score: 0.4151 - val_loss: 1.9407 - val_f1_score: 0.4128
Epoch 227/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8956 -
f1_score: 0.3990 - val_loss: 1.9726 - val_f1_score: 0.3882
Epoch 228/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8564 -
f1_score: 0.4141 - val_loss: 1.9091 - val_f1_score: 0.4250
Epoch 229/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8653 -
f1_score: 0.4087 - val_loss: 1.9485 - val_f1_score: 0.4248
Epoch 230/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8736 -
f1_score: 0.4084 - val_loss: 2.0607 - val_f1_score: 0.3499
Epoch 231/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8626 -
f1_score: 0.4185 - val_loss: 1.9452 - val_f1_score: 0.3925
Epoch 232/500
28/28 [==============================] - ETA: 0s - loss: 1.8601 - f1_score:
0.4249
```

```
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28/28 [==============================] - 13s 485ms/step - loss: 1.8601 -
f1_score: 0.4249 - val_loss: 1.8635 - val_f1_score: 0.4561
Epoch 233/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8297 -
f1_score: 0.4100 - val_loss: 1.8540 - val_f1_score: 0.4320
Epoch 234/500
28/28 [==============================] - 3s 112ms/step - loss: 1.9066 -
f1_score: 0.4049 - val_loss: 2.0368 - val_f1_score: 0.3866
Epoch 235/500
28/28 [==============================] - 3s 111ms/step - loss: 1.9100 -
f1_score: 0.3980 - val_loss: 1.8944 - val_f1_score: 0.4164
Epoch 236/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8974 -
f1_score: 0.4018 - val_loss: 2.0048 - val_f1_score: 0.3723
Epoch 237/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8491 -
f1_score: 0.4072 - val_loss: 1.8427 - val_f1_score: 0.4315
Epoch 238/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8539 -
f1_score: 0.4051 - val_loss: 1.9917 - val_f1_score: 0.3912
Epoch 239/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8407 -
f1_score: 0.4179 - val_loss: 1.9155 - val_f1_score: 0.4087
Epoch 240/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8931 -
f1_score: 0.4015 - val_loss: 1.9422 - val_f1_score: 0.4085
Epoch 241/500
28/28 [==============================] - 3s 114ms/step - loss: 1.8625 -
f1_score: 0.4017 - val_loss: 1.9633 - val_f1_score: 0.4228
Epoch 242/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8387 -
f1_score: 0.4177 - val_loss: 1.9465 - val_f1_score: 0.3810
Epoch 243/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8438 -
f1_score: 0.4251 - val_loss: 1.9639 - val_f1_score: 0.3966
Epoch 244/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8324 -
f1_score: 0.4169 - val_loss: 1.8798 - val_f1_score: 0.4250
Epoch 245/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8427 -
```

```
f1_score: 0.4176 - val_loss: 1.8556 - val_f1_score: 0.4076
Epoch 246/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8414 -
f1_score: 0.4243 - val_loss: 1.8991 - val_f1_score: 0.3906
Epoch 247/500
28/28 [==============================] - 3s 114ms/step - loss: 1.8552 -
f1_score: 0.4154 - val_loss: 1.8325 - val_f1_score: 0.4400
Epoch 248/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7913 -
f1_score: 0.4302 - val_loss: 1.8515 - val_f1_score: 0.4416
Epoch 249/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7952 -
f1_score: 0.4242 - val_loss: 1.8370 - val_f1_score: 0.4306
Epoch 250/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7961 -
f1_score: 0.4255 - val_loss: 1.9215 - val_f1_score: 0.3974
Epoch 251/500
28/28 [==============================] - 3s 114ms/step - loss: 1.8349 -
f1_score: 0.4299 - val_loss: 1.8481 - val_f1_score: 0.4549
Epoch 252/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8359 -
f1_score: 0.4101 - val_loss: 1.9534 - val_f1_score: 0.4018
Epoch 253/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7674 -
f1_score: 0.4334 - val_loss: 1.8761 - val_f1_score: 0.4165
Epoch 254/500
28/28 [==============================] - 3s 115ms/step - loss: 1.7830 -
f1_score: 0.4282 - val_loss: 2.0111 - val_f1_score: 0.3717
Epoch 255/500
28/28 [==============================] - 3s 113ms/step - loss: 1.8207 -
f1_score: 0.4240 - val_loss: 1.9083 - val_f1_score: 0.4105
Epoch 256/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7835 -
f1_score: 0.4315 - val_loss: 1.8709 - val_f1_score: 0.4297
Epoch 257/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7590 -
f1_score: 0.4369 - val_loss: 1.8670 - val_f1_score: 0.4150
Epoch 258/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7993 -
f1_score: 0.4258 - val_loss: 1.8374 - val_f1_score: 0.4137
Epoch 259/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7685 -
f1_score: 0.4367 - val_loss: 1.9279 - val_f1_score: 0.4165
Epoch 260/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8144 -
f1_score: 0.4228 - val_loss: 1.8906 - val_f1_score: 0.4248
Epoch 261/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7901 -
```

```
f1_score: 0.4304 - val_loss: 1.8837 - val_f1_score: 0.4071
Epoch 262/500
28/28 [==============================] - 3s 116ms/step - loss: 1.8043 -
f1_score: 0.4322 - val_loss: 1.8851 - val_f1_score: 0.4155
Epoch 263/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7957 -
f1_score: 0.4251 - val_loss: 1.9624 - val_f1_score: 0.3901
Epoch 264/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7485 -
f1_score: 0.4464 - val_loss: 1.9621 - val_f1_score: 0.4136
Epoch 265/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7647 -
f1_score: 0.4373 - val_loss: 1.8058 - val_f1_score: 0.4550
Epoch 266/500
28/28 [==============================] - ETA: 0s - loss: 1.7843 - f1_score:
0.4247

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28/28 [==============================] - 14s 514ms/step - loss: 1.7843 -
f1_score: 0.4247 - val_loss: 1.7947 - val_f1_score: 0.4572
Epoch 267/500
28/28 [==============================] - 3s 111ms/step - loss: 1.7288 -
f1_score: 0.4601 - val_loss: 1.8757 - val_f1_score: 0.4408
Epoch 268/500
28/28 [==============================] - 3s 112ms/step - loss: 1.8096 -
f1_score: 0.4255 - val_loss: 1.9551 - val_f1_score: 0.4040
Epoch 269/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7827 -
f1_score: 0.4329 - val_loss: 1.8919 - val_f1_score: 0.4267
Epoch 270/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7489 -
f1_score: 0.4517 - val_loss: 1.9112 - val_f1_score: 0.4317
Epoch 271/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7752 -
f1_score: 0.4278 - val_loss: 2.0063 - val_f1_score: 0.4004
Epoch 272/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7590 -
f1_score: 0.4378 - val_loss: 1.9032 - val_f1_score: 0.4165
Epoch 273/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7426 -
f1_score: 0.4523 - val_loss: 1.9352 - val_f1_score: 0.4338
Epoch 274/500
```

```
28/28 [==============================] - 3s 115ms/step - loss: 1.7335 -
f1_score: 0.4440 - val_loss: 1.8899 - val_f1_score: 0.4325
Epoch 275/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7231 -
f1_score: 0.4475 - val_loss: 1.8451 - val_f1_score: 0.4466
Epoch 276/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7745 -
f1_score: 0.4337 - val_loss: 1.9503 - val_f1_score: 0.4013
Epoch 277/500
28/28 [==============================] - 3s 117ms/step - loss: 1.7282 -
f1_score: 0.4559 - val_loss: 1.8565 - val_f1_score: 0.4216
Epoch 278/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7974 -
f1_score: 0.4378 - val_loss: 1.8588 - val_f1_score: 0.4290
Epoch 279/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7574 -
f1_score: 0.4331 - val_loss: 1.8729 - val_f1_score: 0.4087
Epoch 280/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7511 -
f1_score: 0.4475 - val_loss: 1.9414 - val_f1_score: 0.3854
Epoch 281/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7365 -
f1_score: 0.4385 - val_loss: 1.9246 - val_f1_score: 0.4192
Epoch 282/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7289 -
f1_score: 0.4589 - val_loss: 1.8935 - val_f1_score: 0.4239
Epoch 283/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7497 -
f1_score: 0.4487 - val_loss: 1.8746 - val_f1_score: 0.4245
Epoch 284/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7482 -
f1_score: 0.4424 - val_loss: 1.8664 - val_f1_score: 0.4293
Epoch 285/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7109 -
f1_score: 0.4677 - val_loss: 1.9266 - val_f1_score: 0.4206
Epoch 286/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7283 -
f1_score: 0.4424 - val_loss: 1.8733 - val_f1_score: 0.4343
Epoch 287/500
28/28 [==============================] - 3s 114ms/step - loss: 1.7363 -
f1_score: 0.4548 - val_loss: 1.9298 - val_f1_score: 0.4136
Epoch 288/500
28/28 [==============================] - 3s 116ms/step - loss: 1.7108 -
f1_score: 0.4459 - val_loss: 2.0153 - val_f1_score: 0.3780
Epoch 289/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7576 -
f1_score: 0.4455 - val_loss: 1.9757 - val_f1_score: 0.3894
Epoch 290/500
```

```
28/28 [==============================] - 3s 113ms/step - loss: 1.7647 -
f1_score: 0.4404 - val_loss: 1.9458 - val_f1_score: 0.4160
Epoch 291/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7348 -
f1_score: 0.4507 - val_loss: 1.8806 - val_f1_score: 0.4049
Epoch 292/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7493 -
f1_score: 0.4529 - val_loss: 1.8645 - val_f1_score: 0.4380
Epoch 293/500
28/28 [==============================] - ETA: 0s - loss: 1.7140 - f1_score:
0.4642

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28/28 [==============================] - 12s 458ms/step - loss: 1.7140 -
f1_score: 0.4642 - val_loss: 1.8632 - val_f1_score: 0.4598
Epoch 294/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7268 -
f1_score: 0.4515 - val_loss: 1.8373 - val_f1_score: 0.4217
Epoch 295/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7038 -
f1_score: 0.4730 - val_loss: 1.8231 - val_f1_score: 0.4386
Epoch 296/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7428 -
f1_score: 0.4425 - val_loss: 1.9209 - val_f1_score: 0.3804
Epoch 297/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7438 -
f1_score: 0.4433 - val_loss: 1.8241 - val_f1_score: 0.4194
Epoch 298/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7360 -
f1_score: 0.4543 - val_loss: 1.8481 - val_f1_score: 0.4020
Epoch 299/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7320 -
f1_score: 0.4524 - val_loss: 1.9408 - val_f1_score: 0.4096
Epoch 300/500
28/28 [==============================] - 3s 112ms/step - loss: 1.6901 -
f1_score: 0.4585 - val_loss: 1.8571 - val_f1_score: 0.4208
Epoch 301/500
28/28 [==============================] - 3s 112ms/step - loss: 1.6850 -
f1_score: 0.4715 - val_loss: 1.8718 - val_f1_score: 0.4200
Epoch 302/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7123 -
f1_score: 0.4619 - val_loss: 1.8796 - val_f1_score: 0.3990
```

```
Epoch 303/500
28/28 [==============================] - 3s 116ms/step - loss: 1.7065 -
f1_score: 0.4617 - val_loss: 1.8447 - val_f1_score: 0.4138
Epoch 304/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6765 -
f1_score: 0.4542 - val_loss: 1.9618 - val_f1_score: 0.3862
Epoch 305/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7113 -
f1_score: 0.4547 - val_loss: 1.9007 - val_f1_score: 0.3949
Epoch 306/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6957 -
f1_score: 0.4601 - val_loss: 1.9915 - val_f1_score: 0.3672
Epoch 307/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6815 -
f1_score: 0.4715 - val_loss: 1.9081 - val_f1_score: 0.4378
Epoch 308/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7420 -
f1_score: 0.4583 - val_loss: 1.8897 - val_f1_score: 0.3996
Epoch 309/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6842 -
f1_score: 0.4662 - val_loss: 1.9023 - val_f1_score: 0.4195
Epoch 310/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7070 -
f1_score: 0.4569 - val_loss: 1.7580 - val_f1_score: 0.4405
Epoch 311/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7070 -
f1_score: 0.4508 - val_loss: 1.8274 - val_f1_score: 0.4223
Epoch 312/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6634 -
f1_score: 0.4728 - val_loss: 1.9009 - val_f1_score: 0.4095
Epoch 313/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7237 -
f1_score: 0.4610 - val_loss: 1.9125 - val_f1_score: 0.3839
Epoch 314/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6728 -
f1_score: 0.4700 - val_loss: 1.9013 - val_f1_score: 0.4046
Epoch 315/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6944 -
f1_score: 0.4614 - val_loss: 1.8611 - val_f1_score: 0.4168
Epoch 316/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6927 -
f1_score: 0.4680 - val_loss: 1.9257 - val_f1_score: 0.4228
Epoch 317/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6834 -
f1_score: 0.4786 - val_loss: 1.8318 - val_f1_score: 0.4402
Epoch 318/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6352 -
f1_score: 0.4748 - val_loss: 1.9642 - val_f1_score: 0.4070
```

```
Epoch 319/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6953 -
f1_score: 0.4673 - val_loss: 1.8902 - val_f1_score: 0.3957
Epoch 320/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6663 -
f1_score: 0.4741 - val_loss: 1.8091 - val_f1_score: 0.4410
Epoch 321/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6217 -
f1_score: 0.4784 - val_loss: 1.9146 - val_f1_score: 0.4240
Epoch 322/500
28/28 [==============================] - 3s 118ms/step - loss: 1.6677 -
f1_score: 0.4806 - val_loss: 1.9059 - val_f1_score: 0.4200
Epoch 323/500
28/28 [==============================] - 3s 121ms/step - loss: 1.6416 -
f1_score: 0.4821 - val_loss: 1.8256 - val_f1_score: 0.4376
Epoch 324/500
28/28 [==============================] - 3s 117ms/step - loss: 1.6304 -
f1_score: 0.4813 - val_loss: 1.9115 - val_f1_score: 0.4062
Epoch 325/500
28/28 [==============================] - 3s 123ms/step - loss: 1.6457 -
f1_score: 0.4764 - val_loss: 1.8516 - val_f1_score: 0.4096
Epoch 326/500
28/28 [==============================] - 3s 117ms/step - loss: 1.6472 -
f1_score: 0.4610 - val_loss: 1.8636 - val_f1_score: 0.4344
Epoch 327/500
28/28 [==============================] - 3s 119ms/step - loss: 1.6894 -
f1_score: 0.4680 - val_loss: 1.8612 - val_f1_score: 0.4348
Epoch 328/500
28/28 [==============================] - 3s 119ms/step - loss: 1.6849 -
f1_score: 0.4683 - val_loss: 1.9092 - val_f1_score: 0.4140
Epoch 329/500
28/28 [==============================] - 3s 116ms/step - loss: 1.6478 -
f1_score: 0.4882 - val_loss: 1.8431 - val_f1_score: 0.4362
Epoch 330/500
28/28 [==============================] - 3s 115ms/step - loss: 1.6566 -
f1_score: 0.4846 - val_loss: 1.8458 - val_f1_score: 0.4285
Epoch 331/500
28/28 [==============================] - 3s 113ms/step - loss: 1.7019 -
f1_score: 0.4673 - val_loss: 1.9945 - val_f1_score: 0.3671
Epoch 332/500
28/28 [==============================] - 3s 116ms/step - loss: 1.6308 -
f1_score: 0.4796 - val_loss: 1.8881 - val_f1_score: 0.4225
Epoch 333/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6562 -
f1_score: 0.4674 - val_loss: 1.9660 - val_f1_score: 0.3970
Epoch 334/500
28/28 [==============================] - ETA: 0s - loss: 1.6308 - f1_score:
0.4941
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

28/28 [==============================] - 14s 512ms/step - loss: 1.6308 -
f1_score: 0.4941 - val_loss: 1.8266 - val_f1_score: 0.4651
Epoch 335/500
28/28 [==============================] - 3s 115ms/step - loss: 1.6025 -
f1_score: 0.4990 - val_loss: 1.8361 - val_f1_score: 0.4224
Epoch 336/500
28/28 [==============================] - ETA: 0s - loss: 1.6571 - f1_score:
0.4831

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
saving (showing 3 of 3). These functions will not be directly callable after
loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

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28/28 [==============================] - 12s 427ms/step - loss: 1.6571 -
f1_score: 0.4831 - val_loss: 1.7681 - val_f1_score: 0.4658
Epoch 337/500
28/28 [==============================] - 3s 112ms/step - loss: 1.6344 -
f1_score: 0.4806 - val_loss: 1.8774 - val_f1_score: 0.4311
Epoch 338/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7075 -
f1_score: 0.4483 - val_loss: 1.8228 - val_f1_score: 0.4272
Epoch 339/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7003 -
f1_score: 0.4568 - val_loss: 1.8529 - val_f1_score: 0.4375
Epoch 340/500
28/28 [==============================] - 3s 112ms/step - loss: 1.6819 -
f1_score: 0.4657 - val_loss: 1.9169 - val_f1_score: 0.4054
Epoch 341/500
28/28 [==============================] - 3s 112ms/step - loss: 1.7030 -
f1_score: 0.4596 - val_loss: 1.8426 - val_f1_score: 0.4336
Epoch 342/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6437 -
f1_score: 0.4884 - val_loss: 1.8695 - val_f1_score: 0.4084
Epoch 343/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6647 -
f1_score: 0.4726 - val_loss: 1.9378 - val_f1_score: 0.4099
Epoch 344/500
```

```
28/28 [==============================] - 3s 113ms/step - loss: 1.6939 -
f1_score: 0.4582 - val_loss: 1.8003 - val_f1_score: 0.4430
Epoch 345/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6926 -
f1_score: 0.4691 - val_loss: 1.9165 - val_f1_score: 0.4299
Epoch 346/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6324 -
f1_score: 0.4844 - val_loss: 1.8989 - val_f1_score: 0.4144
Epoch 347/500
28/28 [==============================] - 3s 116ms/step - loss: 1.6527 -
f1_score: 0.4757 - val_loss: 1.9347 - val_f1_score: 0.4251
Epoch 348/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6252 -
f1_score: 0.4846 - val_loss: 2.0415 - val_f1_score: 0.3803
Epoch 349/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6037 -
f1_score: 0.4989 - val_loss: 1.9871 - val_f1_score: 0.3720
Epoch 350/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6332 -
f1_score: 0.4972 - val_loss: 1.8355 - val_f1_score: 0.4204
Epoch 351/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6128 -
f1_score: 0.4845 - val_loss: 1.8775 - val_f1_score: 0.4135
Epoch 352/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6118 -
f1_score: 0.4835 - val_loss: 1.8067 - val_f1_score: 0.4295
Epoch 353/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6073 -
f1_score: 0.4946 - val_loss: 1.9313 - val_f1_score: 0.3914
Epoch 354/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6286 -
f1_score: 0.4863 - val_loss: 1.9447 - val_f1_score: 0.4133
Epoch 355/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5999 -
f1_score: 0.4949 - val_loss: 1.9092 - val_f1_score: 0.4200
Epoch 356/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6173 -
f1_score: 0.4832 - val_loss: 1.8851 - val_f1_score: 0.4443
Epoch 357/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6317 -
f1_score: 0.4827 - val_loss: 1.8674 - val_f1_score: 0.4215
Epoch 358/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6178 -
f1_score: 0.4868 - val_loss: 1.8782 - val_f1_score: 0.4150
Epoch 359/500
28/28 [==============================] - 3s 115ms/step - loss: 1.6443 -
f1_score: 0.4792 - val_loss: 1.8216 - val_f1_score: 0.4282
Epoch 360/500
```

```
28/28 [==============================] - 3s 114ms/step - loss: 1.6041 -
f1_score: 0.4908 - val_loss: 1.8618 - val_f1_score: 0.4057
Epoch 361/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5923 -
f1_score: 0.4887 - val_loss: 1.8996 - val_f1_score: 0.4457
Epoch 362/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5848 -
f1_score: 0.4931 - val_loss: 1.8498 - val_f1_score: 0.4573
Epoch 363/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6010 -
f1_score: 0.4841 - val_loss: 1.8171 - val_f1_score: 0.4421
Epoch 364/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6096 -
f1_score: 0.4859 - val_loss: 1.9825 - val_f1_score: 0.4101
Epoch 365/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5965 -
f1_score: 0.4970 - val_loss: 2.0148 - val_f1_score: 0.3923
Epoch 366/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5933 -
f1_score: 0.4958 - val_loss: 1.9349 - val_f1_score: 0.4151
Epoch 367/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5889 -
f1_score: 0.4960 - val_loss: 1.8453 - val_f1_score: 0.4392
Epoch 368/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6135 -
f1_score: 0.4871 - val_loss: 1.8865 - val_f1_score: 0.4343
Epoch 369/500
28/28 [==============================] - 3s 116ms/step - loss: 1.6400 -
f1_score: 0.4762 - val_loss: 1.8582 - val_f1_score: 0.4376
Epoch 370/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6166 -
f1_score: 0.4835 - val_loss: 1.9660 - val_f1_score: 0.4327
Epoch 371/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6126 -
f1_score: 0.4995 - val_loss: 1.8640 - val_f1_score: 0.4600
Epoch 372/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6127 -
f1_score: 0.4891 - val_loss: 1.8000 - val_f1_score: 0.4258
Epoch 373/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5719 -
f1_score: 0.4906 - val_loss: 1.8764 - val_f1_score: 0.4246
Epoch 374/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5910 -
f1_score: 0.4928 - val_loss: 1.8840 - val_f1_score: 0.4277
Epoch 375/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5913 -
f1_score: 0.4959 - val_loss: 1.8075 - val_f1_score: 0.4421
Epoch 376/500
```

```
28/28 [==============================] - 3s 113ms/step - loss: 1.5850 -
f1_score: 0.4972 - val_loss: 1.8200 - val_f1_score: 0.4425
Epoch 377/500
28/28 [==============================] - 3s 116ms/step - loss: 1.5592 -
f1_score: 0.4980 - val_loss: 1.8221 - val_f1_score: 0.4547
Epoch 378/500
28/28 [==============================] - 3s 115ms/step - loss: 1.6165 -
f1_score: 0.4849 - val_loss: 1.8042 - val_f1_score: 0.4290
Epoch 379/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5579 -
f1_score: 0.4881 - val_loss: 1.8370 - val_f1_score: 0.4334
Epoch 380/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6078 -
f1_score: 0.5001 - val_loss: 1.7637 - val_f1_score: 0.4494
Epoch 381/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6057 -
f1_score: 0.4934 - val_loss: 1.7664 - val_f1_score: 0.4453
Epoch 382/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5731 -
f1_score: 0.4996 - val_loss: 1.8778 - val_f1_score: 0.4206
Epoch 383/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5906 -
f1_score: 0.4924 - val_loss: 1.8816 - val_f1_score: 0.4274
Epoch 384/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5442 -
f1_score: 0.5120 - val_loss: 1.9186 - val_f1_score: 0.4248
Epoch 385/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5551 -
f1_score: 0.4958 - val_loss: 1.8318 - val_f1_score: 0.4521
Epoch 386/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5937 -
f1_score: 0.4866 - val_loss: 1.9082 - val_f1_score: 0.4567
Epoch 387/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5467 -
f1_score: 0.5040 - val_loss: 1.8395 - val_f1_score: 0.4122
Epoch 388/500
28/28 [==============================] - 3s 116ms/step - loss: 1.6057 -
f1_score: 0.4903 - val_loss: 1.8110 - val_f1_score: 0.4560
Epoch 389/500
28/28 [==============================] - 3s 114ms/step - loss: 1.6081 -
f1_score: 0.4912 - val_loss: 1.8540 - val_f1_score: 0.4296
Epoch 390/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5366 -
f1_score: 0.5149 - val_loss: 1.9472 - val_f1_score: 0.4263
Epoch 391/500
28/28 [==============================] - 3s 116ms/step - loss: 1.5678 -
f1_score: 0.5108 - val_loss: 1.7941 - val_f1_score: 0.4477
Epoch 392/500
```

```
28/28 [==============================] - 3s 113ms/step - loss: 1.5653 -
f1_score: 0.5106 - val_loss: 1.9095 - val_f1_score: 0.4041
Epoch 393/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5353 -
f1_score: 0.5112 - val_loss: 1.8132 - val_f1_score: 0.4405
Epoch 394/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5759 -
f1_score: 0.5013 - val_loss: 1.8814 - val_f1_score: 0.4212
Epoch 395/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5347 -
f1_score: 0.5037 - val_loss: 1.8713 - val_f1_score: 0.4268
Epoch 396/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5391 -
f1_score: 0.5166 - val_loss: 1.8100 - val_f1_score: 0.4552
Epoch 397/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5090 -
f1_score: 0.5221 - val_loss: 1.8697 - val_f1_score: 0.4417
Epoch 398/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5627 -
f1_score: 0.5037 - val_loss: 1.8200 - val_f1_score: 0.4412
Epoch 399/500
28/28 [==============================] - ETA: 0s - loss: 1.5322 - f1_score:
0.5121

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
gru_cell_layer_call_fn, gru_cell_layer_call_and_return_conditional_losses while
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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets

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28/28 [==============================] - 13s 492ms/step - loss: 1.5322 -
f1_score: 0.5121 - val_loss: 1.7120 - val_f1_score: 0.4892
Epoch 400/500
28/28 [==============================] - 3s 112ms/step - loss: 1.5676 -
f1_score: 0.5071 - val_loss: 1.7687 - val_f1_score: 0.4520
Epoch 401/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5635 -
f1_score: 0.5111 - val_loss: 1.8214 - val_f1_score: 0.4437
Epoch 402/500
28/28 [==============================] - 3s 113ms/step - loss: 1.6313 -
f1_score: 0.4880 - val_loss: 1.9231 - val_f1_score: 0.4329
Epoch 403/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5303 -
f1_score: 0.5315 - val_loss: 1.7382 - val_f1_score: 0.4445
Epoch 404/500
28/28 [==============================] - 3s 112ms/step - loss: 1.5763 -
f1_score: 0.4915 - val_loss: 1.9196 - val_f1_score: 0.4084
```

```
Epoch 405/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5526 -
f1_score: 0.5122 - val_loss: 1.9050 - val_f1_score: 0.4391
Epoch 406/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4994 -
f1_score: 0.5263 - val_loss: 1.8333 - val_f1_score: 0.4391
Epoch 407/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5450 -
f1_score: 0.5068 - val_loss: 1.8544 - val_f1_score: 0.4223
Epoch 408/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5405 -
f1_score: 0.5098 - val_loss: 1.9959 - val_f1_score: 0.3886
Epoch 409/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5751 -
f1_score: 0.5103 - val_loss: 1.9297 - val_f1_score: 0.4170
Epoch 410/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5481 -
f1_score: 0.5091 - val_loss: 1.8994 - val_f1_score: 0.4487
Epoch 411/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5078 -
f1_score: 0.5217 - val_loss: 1.8195 - val_f1_score: 0.4645
Epoch 412/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5461 -
f1_score: 0.5143 - val_loss: 1.8379 - val_f1_score: 0.4686
Epoch 413/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5746 -
f1_score: 0.5040 - val_loss: 1.9343 - val_f1_score: 0.4239
Epoch 414/500
28/28 [==============================] - 3s 121ms/step - loss: 1.5347 -
f1_score: 0.5200 - val_loss: 1.9246 - val_f1_score: 0.4162
Epoch 415/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5275 -
f1_score: 0.5234 - val_loss: 1.8542 - val_f1_score: 0.4329
Epoch 416/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4948 -
f1_score: 0.5290 - val_loss: 1.9035 - val_f1_score: 0.4303
Epoch 417/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5299 -
f1_score: 0.5069 - val_loss: 1.9069 - val_f1_score: 0.4140
Epoch 418/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5227 -
f1_score: 0.5219 - val_loss: 1.7545 - val_f1_score: 0.4808
Epoch 419/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5393 -
f1_score: 0.5171 - val_loss: 1.9715 - val_f1_score: 0.4356
Epoch 420/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5389 -
f1_score: 0.5079 - val_loss: 1.9605 - val_f1_score: 0.3946
```

```
Epoch 421/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5345 -
f1_score: 0.5193 - val_loss: 1.9272 - val_f1_score: 0.4368
Epoch 422/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5494 -
f1_score: 0.5084 - val_loss: 1.8384 - val_f1_score: 0.4518
Epoch 423/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5052 -
f1_score: 0.5231 - val_loss: 1.7269 - val_f1_score: 0.4592
Epoch 424/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5162 -
f1_score: 0.5195 - val_loss: 1.8290 - val_f1_score: 0.4471
Epoch 425/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5288 -
f1_score: 0.5240 - val_loss: 1.8641 - val_f1_score: 0.4336
Epoch 426/500
28/28 [==============================] - 3s 115ms/step - loss: 1.5495 -
f1_score: 0.5101 - val_loss: 1.8700 - val_f1_score: 0.4223
Epoch 427/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5317 -
f1_score: 0.5208 - val_loss: 1.8232 - val_f1_score: 0.4234
Epoch 428/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4963 -
f1_score: 0.5335 - val_loss: 1.8629 - val_f1_score: 0.4323
Epoch 429/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5219 -
f1_score: 0.5178 - val_loss: 1.8410 - val_f1_score: 0.4583
Epoch 430/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4958 -
f1_score: 0.5315 - val_loss: 1.8222 - val_f1_score: 0.4513
Epoch 431/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4999 -
f1_score: 0.5231 - val_loss: 1.7204 - val_f1_score: 0.4702
Epoch 432/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4899 -
f1_score: 0.5202 - val_loss: 1.8316 - val_f1_score: 0.4654
Epoch 433/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5184 -
f1_score: 0.5154 - val_loss: 1.8381 - val_f1_score: 0.4271
Epoch 434/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5012 -
f1_score: 0.5196 - val_loss: 1.9520 - val_f1_score: 0.4081
Epoch 435/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4771 -
f1_score: 0.5309 - val_loss: 1.7848 - val_f1_score: 0.4534
Epoch 436/500
28/28 [==============================] - 3s 113ms/step - loss: 1.5167 -
f1_score: 0.5127 - val_loss: 1.7852 - val_f1_score: 0.4684
```

```
Epoch 437/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4933 -
f1_score: 0.5371 - val_loss: 1.8335 - val_f1_score: 0.4531
Epoch 438/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5357 -
f1_score: 0.5165 - val_loss: 1.8398 - val_f1_score: 0.4424
Epoch 439/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5041 -
f1_score: 0.5230 - val_loss: 1.8894 - val_f1_score: 0.4257
Epoch 440/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4815 -
f1_score: 0.5364 - val_loss: 1.9473 - val_f1_score: 0.4235
Epoch 441/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4818 -
f1_score: 0.5231 - val_loss: 1.8255 - val_f1_score: 0.4518
Epoch 442/500
28/28 [==============================] - 3s 114ms/step - loss: 1.5056 -
f1_score: 0.5257 - val_loss: 1.8633 - val_f1_score: 0.4332
Epoch 443/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4769 -
f1_score: 0.5396 - val_loss: 1.8544 - val_f1_score: 0.4379
Epoch 444/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4787 -
f1_score: 0.5110 - val_loss: 1.8136 - val_f1_score: 0.4621
Epoch 445/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4824 -
f1_score: 0.5272 - val_loss: 1.8537 - val_f1_score: 0.4516
Epoch 446/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4606 -
f1_score: 0.5403 - val_loss: 1.9284 - val_f1_score: 0.4352
Epoch 447/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4646 -
f1_score: 0.5506 - val_loss: 1.8240 - val_f1_score: 0.4445
Epoch 448/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4761 -
f1_score: 0.5225 - val_loss: 1.8413 - val_f1_score: 0.4352
Epoch 449/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4793 -
f1_score: 0.5210 - val_loss: 1.8117 - val_f1_score: 0.4689
Epoch 450/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4482 -
f1_score: 0.5354 - val_loss: 1.7799 - val_f1_score: 0.4656
Epoch 451/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4627 -
f1_score: 0.5340 - val_loss: 1.8843 - val_f1_score: 0.4250
Epoch 452/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4942 -
f1_score: 0.5144 - val_loss: 1.8552 - val_f1_score: 0.4283
```

```
Epoch 453/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4706 -
f1_score: 0.5360 - val_loss: 1.9461 - val_f1_score: 0.3997
Epoch 454/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4187 -
f1_score: 0.5514 - val_loss: 1.8706 - val_f1_score: 0.4337
Epoch 455/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4636 -
f1_score: 0.5268 - val_loss: 1.8123 - val_f1_score: 0.4661
Epoch 456/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4722 -
f1_score: 0.5387 - val_loss: 1.9401 - val_f1_score: 0.4366
Epoch 457/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4584 -
f1_score: 0.5404 - val_loss: 1.8224 - val_f1_score: 0.4624
Epoch 458/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4594 -
f1_score: 0.5404 - val_loss: 1.8682 - val_f1_score: 0.4566
Epoch 459/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4550 -
f1_score: 0.5474 - val_loss: 1.8957 - val_f1_score: 0.4334
Epoch 460/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4437 -
f1_score: 0.5405 - val_loss: 1.7900 - val_f1_score: 0.4636
Epoch 461/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4524 -
f1_score: 0.5393 - val_loss: 1.8114 - val_f1_score: 0.4454
Epoch 462/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4482 -
f1_score: 0.5369 - val_loss: 1.9073 - val_f1_score: 0.4260
Epoch 463/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4113 -
f1_score: 0.5501 - val_loss: 1.7941 - val_f1_score: 0.4496
Epoch 464/500
28/28 [==============================] - 3s 117ms/step - loss: 1.4815 -
f1_score: 0.5491 - val_loss: 2.1262 - val_f1_score: 0.4073
Epoch 465/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4533 -
f1_score: 0.5391 - val_loss: 1.8488 - val_f1_score: 0.4385
Epoch 466/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4766 -
f1_score: 0.5192 - val_loss: 1.7817 - val_f1_score: 0.4578
Epoch 467/500
28/28 [==============================] - 3s 112ms/step - loss: 1.4831 -
f1_score: 0.5236 - val_loss: 1.9168 - val_f1_score: 0.4233
Epoch 468/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4835 -
f1_score: 0.5180 - val_loss: 1.9088 - val_f1_score: 0.4230
```

```
Epoch 469/500
28/28 [==============================] - 3s 119ms/step - loss: 1.4545 -
f1_score: 0.5299 - val_loss: 1.8506 - val_f1_score: 0.4528
Epoch 470/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4335 -
f1_score: 0.5407 - val_loss: 1.9993 - val_f1_score: 0.4345
Epoch 471/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4576 -
f1_score: 0.5468 - val_loss: 1.8607 - val_f1_score: 0.4412
Epoch 472/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4275 -
f1_score: 0.5595 - val_loss: 1.9930 - val_f1_score: 0.4245
Epoch 473/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4641 -
f1_score: 0.5488 - val_loss: 1.9719 - val_f1_score: 0.4270
Epoch 474/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4514 -
f1_score: 0.5345 - val_loss: 1.9059 - val_f1_score: 0.4307
Epoch 475/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4113 -
f1_score: 0.5459 - val_loss: 2.0187 - val_f1_score: 0.4321
Epoch 476/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4383 -
f1_score: 0.5424 - val_loss: 2.1144 - val_f1_score: 0.4047
Epoch 477/500
28/28 [==============================] - 3s 117ms/step - loss: 1.5104 -
f1_score: 0.5274 - val_loss: 1.9454 - val_f1_score: 0.4272
Epoch 478/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4630 -
f1_score: 0.5340 - val_loss: 1.8660 - val_f1_score: 0.4118
Epoch 479/500
28/28 [==============================] - 3s 116ms/step - loss: 1.4386 -
f1_score: 0.5339 - val_loss: 1.7895 - val_f1_score: 0.4493
Epoch 480/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4349 -
f1_score: 0.5339 - val_loss: 1.8652 - val_f1_score: 0.4548
Epoch 481/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4288 -
f1_score: 0.5546 - val_loss: 1.9970 - val_f1_score: 0.4075
Epoch 482/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4333 -
f1_score: 0.5590 - val_loss: 1.8455 - val_f1_score: 0.4499
Epoch 483/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4544 -
f1_score: 0.5338 - val_loss: 1.8676 - val_f1_score: 0.4539
Epoch 484/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4349 -
f1_score: 0.5489 - val_loss: 2.0588 - val_f1_score: 0.4063
```

```
Epoch 485/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4911 -
f1_score: 0.5361 - val_loss: 1.9145 - val_f1_score: 0.4201
Epoch 486/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4728 -
f1_score: 0.5309 - val_loss: 1.9100 - val_f1_score: 0.4320
Epoch 487/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4712 -
f1_score: 0.5507 - val_loss: 2.0377 - val_f1_score: 0.4169
Epoch 488/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4935 -
f1_score: 0.5273 - val_loss: 1.8389 - val_f1_score: 0.4117
Epoch 489/500
28/28 [==============================] - 3s 116ms/step - loss: 1.5102 -
f1_score: 0.5445 - val_loss: 1.8770 - val_f1_score: 0.4193
Epoch 490/500
28/28 [==============================] - 3s 115ms/step - loss: 1.4428 -
f1_score: 0.5351 - val_loss: 1.8216 - val_f1_score: 0.4430
Epoch 491/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4674 -
f1_score: 0.5401 - val_loss: 1.8873 - val_f1_score: 0.4463
Epoch 492/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4247 -
f1_score: 0.5482 - val_loss: 2.0866 - val_f1_score: 0.4011
Epoch 493/500
28/28 [==============================] - 3s 117ms/step - loss: 1.4139 -
f1_score: 0.5483 - val_loss: 1.9789 - val_f1_score: 0.4362
Epoch 494/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4396 -
f1_score: 0.5499 - val_loss: 1.9579 - val_f1_score: 0.4446
Epoch 495/500
28/28 [==============================] - 3s 116ms/step - loss: 1.4648 -
f1_score: 0.5494 - val_loss: 1.9225 - val_f1_score: 0.4209
Epoch 496/500
28/28 [==============================] - 3s 118ms/step - loss: 1.4401 -
f1_score: 0.5436 - val_loss: 1.8805 - val_f1_score: 0.4361
Epoch 497/500
28/28 [==============================] - 3s 113ms/step - loss: 1.4432 -
f1_score: 0.5440 - val_loss: 1.9570 - val_f1_score: 0.4322
Epoch 498/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4810 -
f1_score: 0.5434 - val_loss: 1.9868 - val_f1_score: 0.4206
Epoch 499/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4617 -
f1_score: 0.5366 - val_loss: 1.9251 - val_f1_score: 0.4383
Epoch 500/500
28/28 [==============================] - 3s 114ms/step - loss: 1.4583 -
f1_score: 0.5464 - val_loss: 1.9101 - val_f1_score: 0.4289
```

[121]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1D-CNN + 1 GRU Trial 722 Mish/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[122]:
```
hist_df = pd.read_csv('1 1D-CNN + 1 GRU Trial 722 Mish/history.csv',
                      index_col=0)
hist_df.tail()
```

[122]:

	loss	f1_score	val_loss	val_f1_score
495	1.440097	0.543593	1.880525	0.436142
496	1.443164	0.543976	1.956989	0.432248
497	1.480997	0.543414	1.986798	0.420552
498	1.461682	0.536560	1.925142	0.438339
499	1.458318	0.546422	1.910057	0.428913

[123]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
```

```
plt.show()
```

[124]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
```

```
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')

plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[125]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 17ms/step
              precision    recall  f1-score   support

         AXE      0.429     0.375     0.400         8
    BACKPACK      0.200     0.167     0.182         6
  BASKETBALL      0.818     0.900     0.857        10
         BEE      0.571     0.400     0.471        10
        BELT      0.667     1.000     0.800         4
```

BITE	0.200	0.125	0.154	8
BREAKFAST	0.444	0.667	0.533	6
CANCER	0.667	0.250	0.364	8
CHRISTMAS	0.500	0.667	0.571	6
CONFUSED	0.235	0.667	0.348	6
DARK	1.000	0.750	0.857	4
DEAF	0.000	0.000	0.000	6
DECIDE	0.364	0.667	0.471	6
DEMAND	0.750	0.375	0.500	8
DEVELOP	0.286	0.667	0.400	6
DINNER	0.429	0.375	0.400	8
DOG	0.143	0.167	0.154	6
DOWNSIZE	1.000	0.125	0.222	8
DRAG	0.500	0.750	0.600	4
EAT	0.333	0.333	0.333	6
EDIT	1.000	0.667	0.800	6
ELEVATOR	0.200	0.125	0.154	8
FINE	0.182	0.500	0.267	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	1.000	0.333	0.500	6
GUESS	0.833	0.625	0.714	8
HALLOWEEN	1.000	0.500	0.667	8
HOSPITAL	0.000	0.000	0.000	6
HURDLE/TRIP	0.444	1.000	0.615	4
JEWELRY	0.333	0.500	0.400	4
KNIGHT	1.000	0.250	0.400	4
LOCK	0.462	0.750	0.571	8
LUNCH	1.000	0.125	0.222	8
MAPLE	0.500	0.500	0.500	4
MEAT	0.500	0.500	0.500	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	0.000	0.000	0.000	8
MOVIE	0.300	0.750	0.429	8
NOON	0.857	0.750	0.800	8
PARTY	0.714	0.625	0.667	8
PATIENT	0.167	0.167	0.167	6
RAZOR	0.000	0.000	0.000	4
RIVER	0.500	0.667	0.571	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.200	0.200	0.200	10
SINK	1.000	0.167	0.286	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.364	1.000	0.533	4
TWINS	0.000	0.000	0.000	8
WHATFOR	0.714	0.500	0.588	10
accuracy			0.448	324
macro avg	0.498	0.462	0.429	324

```
weighted avg      0.510     0.448     0.428       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[134]:
```
reconstructed_model = tf.keras.models.load_model(
    "1 1D-CNN + 1 GRU Trial 722 Mish")
```

[135]:
```
reconstructed_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 116, 150)          897900

 max_pooling1d (MaxPooling1D  (None, 11, 150)          0
 )

 dropout (Dropout)           (None, 11, 150)           0

 gru (GRU)                   (None, 150)               135900

 dropout_1 (Dropout)         (None, 150)               0

 dense (Dense)               (None, 110)               16610

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 1,055,960
Trainable params: 1,055,960
Non-trainable params: 0
_________________________________________________________________
```

[136]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```
[136]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 116, 150)
MaxPooling1D
input: (None, 116, 150)
output: (None, 11, 150)
Dropout
input: (None, 11, 150)
output: (None, 11, 150)
GRU
input: (None, 11, 150)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[137]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[137]:

Conv1D
MaxPooling1D
Dropout
GRU
Dense

[138]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 2s 20ms/step - loss: 1.7120 - f1_score:
0.4892
```

[138]:
```
[1.7119686603546143, 0.4891718626022339]
```

[139]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-23 11:45:16.176598: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
2023-09-23 11:45:16.738108: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
```

```
84/84 [==============================] - 2s 18ms/step - loss: 1.1024 - f1_score:
0.6544
```

[139]:
```
[1.1024389266967773, 0.6543626189231873]
```

[140]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 16ms/step
              precision    recall  f1-score   support

         AXE      0.375     0.375     0.375         8
    BACKPACK      0.333     0.500     0.400         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.667     0.400     0.500        10
        BELT      0.500     0.500     0.500         4
        BITE      0.000     0.000     0.000         8
   BREAKFAST      0.500     0.667     0.571         6
      CANCER      0.400     0.250     0.308         8
   CHRISTMAS      0.571     0.667     0.615         6
    CONFUSED      0.286     0.667     0.400         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.182     0.333     0.235         6
      DECIDE      0.444     0.667     0.533         6
      DEMAND      1.000     0.500     0.667         8
     DEVELOP      0.316     1.000     0.480         6
      DINNER      0.429     0.375     0.400         8
         DOG      0.500     0.500     0.500         6
```

```
    DOWNSIZE      1.000     0.250     0.400         8
        DRAG      0.750     0.750     0.750         4
         EAT      0.571     0.667     0.615         6
        EDIT      1.000     0.667     0.800         6
    ELEVATOR      0.143     0.125     0.133         8
        FINE      0.200     0.500     0.286         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      0.538     0.875     0.667         8
   HALLOWEEN      0.750     0.750     0.750         8
    HOSPITAL      0.000     0.000     0.000         6
 HURDLE/TRIP      0.500     0.500     0.500         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      1.000     0.250     0.400         4
        LOCK      0.400     0.500     0.444         8
       LUNCH      1.000     0.125     0.222         8
       MAPLE      1.000     0.250     0.400         4
        MEAT      1.000     0.500     0.667         6
    MECHANIC      0.667     1.000     0.800         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.300     0.750     0.429         8
        NOON      0.750     0.750     0.750         8
       PARTY      1.000     0.625     0.769         8
     PATIENT      0.125     0.167     0.143         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.556     0.833     0.667         6
ROCKINGCHAIR      0.667     1.000     0.800         8
       SHAVE      0.333     0.200     0.250        10
        SINK      0.800     0.667     0.727         6
     SQUEEZE      0.000     0.000     0.000         4
        THEY      0.600     0.750     0.667         4
       TWINS      0.000     0.000     0.000         8
     WHATFOR      0.545     0.600     0.571        10

    accuracy                          0.503       324
   macro avg      0.564     0.507     0.489       324
weighted avg      0.566     0.503     0.488       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
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Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
```

```
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

3.8 Hyperparameter Tuning 2 1D CNN Layer + 1 GRU

[119]:
```
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_979728/1222377179.py:2: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='elu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[3, 4, 5, 6, 7, 8, 9, 10],
```

```
                    default=5,
                ),
                activation=act_function,
                input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
                values=[3, 4, 5, 6, 7, 8, 9, 10],
                default=5,
            )))
        model.add(
            Conv1D(filters=hp.Int('filters_2',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                kernel_size=hp.Choice(
                    'kernel_2',
                    values=[1, 2, 3, 4, 5],
                    default=5,
                ),
                activation=act_function,
                input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_2',
                values=[1, 2, 3, 4, 5],
                default=5,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(
            GRU(units=hp.Int('units_1',
                             min_value=50,
                             max_value=200,
                             step=25,
                             default=100),
                return_sequences=False,
                kernel_regularizer=regularizers.l2(
                    hp.Float('regularizer',
                             min_value=1e-4,
```

```
                            max_value=1e-2,
                            sampling='LOG',
                            default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))
        model.add(
            Dense(units=hp.Int('units_2',
                               min_value=70,
                               max_value=120,
                               step=10,
                               default=80),
                  activation=act_function))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.00062198175395800846)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

```
The history saving thread hit an unexpected error (OperationalError('database is
locked')).History will not be written to the database.
```

[121]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
```

```
    project_name='2_1D_CNN+1_GRU',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN+1_GRU/tuner0.json
```

[122]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 13
dense_activation (Choice)
{'default': 'elu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 5, 'conditions': [], 'values': [3, 4, 5, 6, 7, 8, 9, 10], 'ordered':
True}
pool_1 (Choice)
{'default': 5, 'conditions': [], 'values': [3, 4, 5, 6, 7, 8, 9, 10], 'ordered':
True}
filters_2 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_2 (Choice)
{'default': 5, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
pool_2 (Choice)
{'default': 5, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
dropout_1 (Float)
{'default': 0.8, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0006219817539580085, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[123]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[125]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 06m 29s]
val_f1_score: 0.6204818487167358

Best val_f1_score So Far: 0.7420923709869385
Total elapsed time: 04h 23m 21s
INFO:tensorflow:Oracle triggered exit
```

[126]:
```
best_model = tuner.get_best_models(num_models=10)[0]
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
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object: (root).optimizer._u_product
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object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```

```
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```

```
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
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object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.17
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
```

```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

[127]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 122, 100)          359200

 max_pooling1d (MaxPooling1D  (None, 13, 100)          0
 )

 conv1d_1 (Conv1D)           (None, 13, 125)           12625

 max_pooling1d_1 (MaxPooling  (None, 13, 125)          0
 1D)

 dropout (Dropout)           (None, 13, 125)           0

 gru (GRU)                   (None, 75)                45450

 dropout_1 (Dropout)         (None, 75)                0

 dense (Dense)               (None, 100)               7600

 dense_1 (Dense)             (None, 50)                5050

=================================================================
Total params: 429,925
Trainable params: 429,925
Non-trainable params: 0
_________________________________________________________________
```

[128]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[128]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 122, 100)
MaxPooling1D
input: (None, 122, 100)
output: (None, 13, 100)
Conv1D
input: (None, 13, 100)
output: (None, 13, 125)
MaxPooling1D
input: (None, 13, 125)
output: (None, 13, 125)
Dropout
input: (None, 13, 125)
output: (None, 13, 125)
GRU
input: (None, 13, 125)
output: (None, 75)
Dropout
input: (None, 75)
output: (None, 75)
Dense
input: (None, 75)
output: (None, 100)
Dense
input: (None, 100)
output: (None, 50)

[129]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN+1_GRU
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0719 summary
Hyperparameters:
dense_activation: selu
filters_1: 100
kernel_1: 9
pool_1: 9
filters_2: 125
kernel_2: 1
pool_2: 1
dropout_1: 0.7000000000000001
units_1: 75
regularizer: 0.0023285010665210285
dropout_2: 0.5
units_2: 100
learning_rate: 0.0003730278430367326
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.7420923709869385

Trial 0715 summary
Hyperparameters:
dense_activation: mish
filters_1: 200
kernel_1: 4
pool_1: 8
filters_2: 200
kernel_2: 2
pool_2: 1
dropout_1: 0.30000000000000004
units_1: 175
regularizer: 0.001308287664940752
dropout_2: 0.6000000000000001
units_2: 100
learning_rate: 0.00016060165691337782
tuner/epochs: 300
tuner/initial_epoch: 100
```

```
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0712
Score: 0.7399027943611145

Trial 0714 summary
Hyperparameters:
dense_activation: selu
filters_1: 125
kernel_1: 9
pool_1: 3
filters_2: 150
kernel_2: 5
pool_2: 3
dropout_1: 0.15000000000000002
units_1: 175
regularizer: 0.00014882201555231845
dropout_2: 0.35000000000000003
units_2: 100
learning_rate: 0.00022221143188447883
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0706
Score: 0.7319249510765076

Trial 0700 summary
Hyperparameters:
dense_activation: selu
filters_1: 150
kernel_1: 6
pool_1: 7
filters_2: 100
kernel_2: 2
pool_2: 1
dropout_1: 0.35000000000000003
units_1: 125
regularizer: 0.002197630899930565
dropout_2: 0.0
units_2: 120
learning_rate: 0.0002903688512467194
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.7288557291030884
```

```
Trial 0671 summary
Hyperparameters:
dense_activation: selu
filters_1: 175
kernel_1: 4
pool_1: 7
filters_2: 125
kernel_2: 1
pool_2: 1
dropout_1: 0.2
units_1: 150
regularizer: 0.0020776644996253492
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0006261461260984394
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.7269015610218048

Trial 0670 summary
Hyperparameters:
dense_activation: elu
filters_1: 175
kernel_1: 6
pool_1: 7
filters_2: 125
kernel_2: 3
pool_2: 3
dropout_1: 0.25
units_1: 50
regularizer: 0.002564987986358073
dropout_2: 0.4
units_2: 120
learning_rate: 0.00046473111837957846
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.7232721745967865

Trial 0665 summary
Hyperparameters:
dense_activation: elu
```

```
filters_1: 175
kernel_1: 6
pool_1: 7
filters_2: 125
kernel_2: 3
pool_2: 3
dropout_1: 0.25
units_1: 50
regularizer: 0.002564987986358073
dropout_2: 0.4
units_2: 120
learning_rate: 0.00046473111837957846
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0653
Score: 0.7096219658851624

Trial 0693 summary
Hyperparameters:
dense_activation: selu
filters_1: 150
kernel_1: 6
pool_1: 7
filters_2: 100
kernel_2: 2
pool_2: 1
dropout_1: 0.35000000000000003
units_1: 125
regularizer: 0.002197630899930565
dropout_2: 0.0
units_2: 120
learning_rate: 0.0002903688512467194
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0673
Score: 0.7073644995689392

Trial 0664 summary
Hyperparameters:
dense_activation: selu
filters_1: 175
kernel_1: 4
pool_1: 7
filters_2: 125
```

```
kernel_2: 1
pool_2: 1
dropout_1: 0.2
units_1: 150
regularizer: 0.0020776644996253492
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0006261461260984394
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0652
Score: 0.705234944820404

Trial 0706 summary
Hyperparameters:
dense_activation: selu
filters_1: 125
kernel_1: 9
pool_1: 3
filters_2: 150
kernel_2: 5
pool_2: 3
dropout_1: 0.15000000000000002
units_1: 175
regularizer: 0.00014882201555231845
dropout_2: 0.35000000000000003
units_2: 100
learning_rate: 0.00022221143188447883
tuner/epochs: 100
tuner/initial_epoch: 0
tuner/bracket: 1
tuner/round: 0
Score: 0.6993892788887024
```

[130]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 13ms/step - loss: 1.0145 - f1_score:
0.7642
```

[132]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 11ms/step - loss: 0.2685 - f1_score:
0.9316
```

[133]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
```

```
                                np.argmax(best_model.predict(Xval), axis=1),
                                digits=3,
                                target_names=label_map))
```

```
11/11 [==============================] - 1s 8ms/step
              precision    recall  f1-score   support

         AXE      0.889     1.000     0.941         8
    BACKPACK      0.667     0.667     0.667         6
  BASKETBALL      0.714     1.000     0.833        10
         BEE      0.529     0.900     0.667        10
        BELT      0.667     1.000     0.800         4
        BITE      1.000     0.750     0.857         8
   BREAKFAST      1.000     0.500     0.667         6
      CANCER      1.000     0.625     0.769         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.857     1.000     0.923         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.500     0.333     0.400         6
      DECIDE      0.800     0.667     0.727         6
      DEMAND      0.778     0.875     0.824         8
     DEVELOP      0.500     1.000     0.667         6
      DINNER      1.000     1.000     1.000         8
         DOG      1.000     0.667     0.800         6
    DOWNSIZE      0.750     0.750     0.750         8
        DRAG      1.000     0.500     0.667         4
         EAT      0.833     0.833     0.833         6
        EDIT      1.000     1.000     1.000         6
    ELEVATOR      0.700     0.875     0.778         8
        FINE      0.750     0.750     0.750         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      0.700     0.875     0.778         8
   HALLOWEEN      1.000     0.750     0.857         8
    HOSPITAL      1.000     0.667     0.800         6
 HURDLE/TRIP      1.000     0.500     0.667         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      1.000     0.750     0.857         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.750     0.500     0.600         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     1.000     1.000         8
       MOVIE      0.667     1.000     0.800         8
        NOON      0.727     1.000     0.842         8
       PARTY      0.600     0.750     0.667         8
     PATIENT      0.400     0.667     0.500         6
```

```
       RAZOR      0.000     0.000     0.000         4
       RIVER      1.000     0.667     0.800         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.600     0.600     0.600        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.750     0.750     0.750         8
     WHATFOR      0.600     0.600     0.600        10

    accuracy                          0.775       324
   macro avg      0.825     0.757     0.764       324
weighted avg      0.812     0.775     0.770       324
```

[134]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[135]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 GRU',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[136]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 4.6913 - f1_score:
0.0234

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 14s 394ms/step - loss: 4.6913 -
f1_score: 0.0234 - val_loss: 4.3924 - val_f1_score: 9.6386e-04
Epoch 2/500
```

```
28/28 [==============================] - ETA: 0s - loss: 4.6019 - f1_score:
0.0168

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 274ms/step - loss: 4.6019 -
f1_score: 0.0168 - val_loss: 4.3750 - val_f1_score: 0.0016
Epoch 3/500
28/28 [==============================] - 2s 54ms/step - loss: 4.5267 - f1_score:
0.0226 - val_loss: 4.3292 - val_f1_score: 9.6386e-04
Epoch 4/500
28/28 [==============================] - 2s 54ms/step - loss: 4.4989 - f1_score:
0.0193 - val_loss: 4.2836 - val_f1_score: 0.0012
Epoch 5/500
27/28 [===========================>..] - ETA: 0s - loss: 4.4547 - f1_score:
0.0242

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 248ms/step - loss: 4.4528 -
f1_score: 0.0235 - val_loss: 4.3090 - val_f1_score: 0.0020
Epoch 6/500
28/28 [==============================] - 2s 55ms/step - loss: 4.4197 - f1_score:
0.0190 - val_loss: 4.2391 - val_f1_score: 9.5890e-04
Epoch 7/500
28/28 [==============================] - 2s 55ms/step - loss: 4.3915 - f1_score:
0.0190 - val_loss: 4.2492 - val_f1_score: 7.2727e-04
Epoch 8/500
27/28 [===========================>..] - ETA: 0s - loss: 4.3510 - f1_score:
0.0201

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
28/28 [==============================] - 7s 261ms/step - loss: 4.3511 -
f1_score: 0.0205 - val_loss: 4.2243 - val_f1_score: 0.0024
Epoch 9/500
28/28 [==============================] - ETA: 0s - loss: 4.3165 - f1_score:
0.0206

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 267ms/step - loss: 4.3165 -
f1_score: 0.0206 - val_loss: 4.2002 - val_f1_score: 0.0055
Epoch 10/500
28/28 [==============================] - 2s 55ms/step - loss: 4.2924 - f1_score:
0.0215 - val_loss: 4.1807 - val_f1_score: 0.0011
Epoch 11/500
28/28 [==============================] - 2s 55ms/step - loss: 4.2806 - f1_score:
0.0210 - val_loss: 4.1782 - val_f1_score: 0.0040
Epoch 12/500
27/28 [===========================>..] - ETA: 0s - loss: 4.2568 - f1_score:
0.0143

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 283ms/step - loss: 4.2565 -
f1_score: 0.0145 - val_loss: 4.1717 - val_f1_score: 0.0072
Epoch 13/500
28/28 [==============================] - 2s 56ms/step - loss: 4.2355 - f1_score:
0.0157 - val_loss: 4.1605 - val_f1_score: 0.0066
Epoch 14/500
28/28 [==============================] - 2s 55ms/step - loss: 4.2054 - f1_score:
0.0214 - val_loss: 4.1406 - val_f1_score: 0.0011
Epoch 15/500
28/28 [==============================] - 2s 55ms/step - loss: 4.1909 - f1_score:
0.0232 - val_loss: 4.1309 - val_f1_score: 0.0036
Epoch 16/500
28/28 [==============================] - 2s 55ms/step - loss: 4.1865 - f1_score:
0.0186 - val_loss: 4.1074 - val_f1_score: 0.0027
Epoch 17/500
28/28 [==============================] - 2s 54ms/step - loss: 4.1683 - f1_score:
```

```
0.0221 - val_loss: 4.1060 - val_f1_score: 2.7972e-04
Epoch 18/500
28/28 [==============================] - ETA: 0s - loss: 4.1519 - f1_score:
0.0198

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 284ms/step - loss: 4.1519 -
f1_score: 0.0198 - val_loss: 4.0472 - val_f1_score: 0.0233
Epoch 19/500
28/28 [==============================] - 2s 54ms/step - loss: 4.1191 - f1_score:
0.0225 - val_loss: 4.0035 - val_f1_score: 0.0212
Epoch 20/500
28/28 [==============================] - 2s 54ms/step - loss: 4.0662 - f1_score:
0.0314 - val_loss: 3.9306 - val_f1_score: 0.0125
Epoch 21/500
28/28 [==============================] - 2s 56ms/step - loss: 3.9778 - f1_score:
0.0361 - val_loss: 3.8248 - val_f1_score: 0.0097
Epoch 22/500
27/28 [===========================>..] - ETA: 0s - loss: 3.8693 - f1_score:
0.0368

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 275ms/step - loss: 3.8678 -
f1_score: 0.0363 - val_loss: 3.6539 - val_f1_score: 0.0341
Epoch 23/500
28/28 [==============================] - 2s 54ms/step - loss: 3.7759 - f1_score:
0.0440 - val_loss: 3.5517 - val_f1_score: 0.0234
Epoch 24/500
28/28 [==============================] - 2s 55ms/step - loss: 3.7165 - f1_score:
0.0496 - val_loss: 3.4637 - val_f1_score: 0.0243
Epoch 25/500
28/28 [==============================] - 2s 55ms/step - loss: 3.6423 - f1_score:
0.0539 - val_loss: 3.3910 - val_f1_score: 0.0286
Epoch 26/500
27/28 [===========================>..] - ETA: 0s - loss: 3.5696 - f1_score:
0.0660
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 311ms/step - loss: 3.5625 -
f1_score: 0.0668 - val_loss: 3.2876 - val_f1_score: 0.0388
Epoch 27/500
27/28 [===========================>..] - ETA: 0s - loss: 3.4954 - f1_score:
0.0784

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 277ms/step - loss: 3.4949 -
f1_score: 0.0799 - val_loss: 3.1963 - val_f1_score: 0.0736
Epoch 28/500
28/28 [==============================] - 2s 55ms/step - loss: 3.4135 - f1_score:
0.0860 - val_loss: 3.1936 - val_f1_score: 0.0728
Epoch 29/500
27/28 [===========================>..] - ETA: 0s - loss: 3.3487 - f1_score:
0.1013

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 265ms/step - loss: 3.3476 -
f1_score: 0.1012 - val_loss: 3.0964 - val_f1_score: 0.0879
Epoch 30/500
27/28 [===========================>..] - ETA: 0s - loss: 3.2908 - f1_score:
0.1122

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 302ms/step - loss: 3.2897 -
f1_score: 0.1119 - val_loss: 2.9904 - val_f1_score: 0.1189
Epoch 31/500
28/28 [==============================] - 2s 55ms/step - loss: 3.2073 - f1_score:
0.1162 - val_loss: 2.9514 - val_f1_score: 0.1147
Epoch 32/500
27/28 [===========================>..] - ETA: 0s - loss: 3.1550 - f1_score:
0.1164

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 284ms/step - loss: 3.1488 -
f1_score: 0.1176 - val_loss: 2.8584 - val_f1_score: 0.1506
Epoch 33/500
27/28 [===========================>..] - ETA: 0s - loss: 3.0624 - f1_score:
0.1374

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 285ms/step - loss: 3.0585 -
f1_score: 0.1375 - val_loss: 2.8036 - val_f1_score: 0.1685
Epoch 34/500
27/28 [===========================>..] - ETA: 0s - loss: 3.0154 - f1_score:
0.1531

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 276ms/step - loss: 3.0113 -
f1_score: 0.1546 - val_loss: 2.7360 - val_f1_score: 0.1833
Epoch 35/500
28/28 [==============================] - 2s 55ms/step - loss: 2.9590 - f1_score:
```

```
0.1470 - val_loss: 2.6942 - val_f1_score: 0.1808
Epoch 36/500
28/28 [==============================] - 2s 55ms/step - loss: 2.9250 - f1_score:
0.1716 - val_loss: 2.6658 - val_f1_score: 0.1829
Epoch 37/500
28/28 [==============================] - ETA: 0s - loss: 2.8597 - f1_score:
0.1801

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 293ms/step - loss: 2.8597 -
f1_score: 0.1801 - val_loss: 2.6685 - val_f1_score: 0.2050
Epoch 38/500
27/28 [===========================>..] - ETA: 0s - loss: 2.8308 - f1_score:
0.1917

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 284ms/step - loss: 2.8301 -
f1_score: 0.1915 - val_loss: 2.5612 - val_f1_score: 0.2724
Epoch 39/500
28/28 [==============================] - 2s 55ms/step - loss: 2.7864 - f1_score:
0.1992 - val_loss: 2.6118 - val_f1_score: 0.2442
Epoch 40/500
28/28 [==============================] - 2s 55ms/step - loss: 2.7558 - f1_score:
0.2036 - val_loss: 2.5356 - val_f1_score: 0.2700
Epoch 41/500
27/28 [===========================>..] - ETA: 0s - loss: 2.7204 - f1_score:
0.2082

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
28/28 [==============================] - 8s 278ms/step - loss: 2.7230 -
f1_score: 0.2103 - val_loss: 2.4222 - val_f1_score: 0.2984
Epoch 42/500
27/28 [==========================>..] - ETA: 0s - loss: 2.6967 - f1_score:
0.2244

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 319ms/step - loss: 2.6959 -
f1_score: 0.2231 - val_loss: 2.4102 - val_f1_score: 0.3045
Epoch 43/500
28/28 [==============================] - ETA: 0s - loss: 2.6629 - f1_score:
0.2365

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 282ms/step - loss: 2.6629 -
f1_score: 0.2365 - val_loss: 2.3639 - val_f1_score: 0.3232
Epoch 44/500
28/28 [==============================] - 2s 55ms/step - loss: 2.6119 - f1_score:
0.2378 - val_loss: 2.3797 - val_f1_score: 0.2953
Epoch 45/500
28/28 [==============================] - ETA: 0s - loss: 2.5791 - f1_score:
0.2636

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 7s 265ms/step - loss: 2.5791 -
f1_score: 0.2636 - val_loss: 2.2792 - val_f1_score: 0.3295
Epoch 46/500
28/28 [==============================] - 2s 55ms/step - loss: 2.5283 - f1_score:
0.2729 - val_loss: 2.2762 - val_f1_score: 0.2977
Epoch 47/500
```

```
28/28 [==============================] - 2s 55ms/step - loss: 2.5132 - f1_score:
0.2661 - val_loss: 2.2526 - val_f1_score: 0.3098
Epoch 48/500
27/28 [==========================>..] - ETA: 0s - loss: 2.4858 - f1_score:
0.2861

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 280ms/step - loss: 2.4903 -
f1_score: 0.2854 - val_loss: 2.2072 - val_f1_score: 0.3387
Epoch 49/500
28/28 [==============================] - 2s 56ms/step - loss: 2.4684 - f1_score:
0.2776 - val_loss: 2.2225 - val_f1_score: 0.3272
Epoch 50/500
28/28 [==============================] - ETA: 0s - loss: 2.4174 - f1_score:
0.2861

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 306ms/step - loss: 2.4174 -
f1_score: 0.2861 - val_loss: 2.1661 - val_f1_score: 0.3507
Epoch 51/500
28/28 [==============================] - 2s 55ms/step - loss: 2.3910 - f1_score:
0.2976 - val_loss: 2.2039 - val_f1_score: 0.3113
Epoch 52/500
28/28 [==============================] - 2s 55ms/step - loss: 2.3750 - f1_score:
0.3058 - val_loss: 2.1497 - val_f1_score: 0.3397
Epoch 53/500
27/28 [==========================>..] - ETA: 0s - loss: 2.3294 - f1_score:
0.3148

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
28/28 [==============================] - 8s 288ms/step - loss: 2.3310 -
f1_score: 0.3135 - val_loss: 2.0973 - val_f1_score: 0.3698
Epoch 54/500
28/28 [==============================] - 2s 55ms/step - loss: 2.2988 - f1_score:
0.3192 - val_loss: 2.1135 - val_f1_score: 0.3385
Epoch 55/500
28/28 [==============================] - 2s 56ms/step - loss: 2.3010 - f1_score:
0.3233 - val_loss: 2.0863 - val_f1_score: 0.3411
Epoch 56/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2592 - f1_score:
0.3193

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 310ms/step - loss: 2.2567 -
f1_score: 0.3217 - val_loss: 2.0410 - val_f1_score: 0.3716
Epoch 57/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2433 - f1_score:
0.3293

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 326ms/step - loss: 2.2408 -
f1_score: 0.3339 - val_loss: 2.0149 - val_f1_score: 0.3775
Epoch 58/500
28/28 [==============================] - 2s 56ms/step - loss: 2.2016 - f1_score:
0.3498 - val_loss: 1.9856 - val_f1_score: 0.3714
Epoch 59/500
27/28 [===========================>..] - ETA: 0s - loss: 2.1668 - f1_score:
0.3613

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
28/28 [==============================] - 8s 294ms/step - loss: 2.1789 -
f1_score: 0.3597 - val_loss: 1.9808 - val_f1_score: 0.4032
Epoch 60/500
27/28 [==========================>..] - ETA: 0s - loss: 2.1229 - f1_score:
0.3695

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 286ms/step - loss: 2.1225 -
f1_score: 0.3713 - val_loss: 1.9272 - val_f1_score: 0.4337
Epoch 61/500
28/28 [==============================] - 2s 55ms/step - loss: 2.0996 - f1_score:
0.3821 - val_loss: 1.9422 - val_f1_score: 0.4006
Epoch 62/500
28/28 [==============================] - 2s 57ms/step - loss: 2.0857 - f1_score:
0.3736 - val_loss: 1.9158 - val_f1_score: 0.3958
Epoch 63/500
28/28 [==============================] - 2s 55ms/step - loss: 2.0783 - f1_score:
0.3898 - val_loss: 1.8454 - val_f1_score: 0.4179
Epoch 64/500
28/28 [==============================] - ETA: 0s - loss: 2.0689 - f1_score:
0.3962

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 294ms/step - loss: 2.0689 -
f1_score: 0.3962 - val_loss: 1.8392 - val_f1_score: 0.4363
Epoch 65/500
27/28 [==========================>..] - ETA: 0s - loss: 2.0133 - f1_score:
0.4068

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets
```

```
28/28 [==============================] - 9s 317ms/step - loss: 2.0155 -
f1_score: 0.4045 - val_loss: 1.8630 - val_f1_score: 0.4495
Epoch 66/500
27/28 [===========================>..] - ETA: 0s - loss: 2.0059 - f1_score:
0.4144

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 296ms/step - loss: 2.0026 -
f1_score: 0.4142 - val_loss: 1.8033 - val_f1_score: 0.4537
Epoch 67/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9605 - f1_score:
0.4124

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 315ms/step - loss: 1.9561 -
f1_score: 0.4172 - val_loss: 1.7808 - val_f1_score: 0.4619
Epoch 68/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9514 - f1_score:
0.4204

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 327ms/step - loss: 1.9610 -
f1_score: 0.4188 - val_loss: 1.7537 - val_f1_score: 0.5019
Epoch 69/500
28/28 [==============================] - 2s 55ms/step - loss: 1.9313 - f1_score:
0.4286 - val_loss: 1.7285 - val_f1_score: 0.4746
Epoch 70/500
28/28 [==============================] - 2s 55ms/step - loss: 1.9123 - f1_score:
0.4425 - val_loss: 1.7202 - val_f1_score: 0.4621
Epoch 71/500
```

```
27/28 [==========================>..] - ETA: 0s - loss: 1.8683 - f1_score:
0.4388

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 291ms/step - loss: 1.8765 -
f1_score: 0.4390 - val_loss: 1.6696 - val_f1_score: 0.5027
Epoch 72/500
28/28 [==============================] - 2s 56ms/step - loss: 1.8556 - f1_score:
0.4506 - val_loss: 1.6905 - val_f1_score: 0.4879
Epoch 73/500
27/28 [==========================>..] - ETA: 0s - loss: 1.8220 - f1_score:
0.4578

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 305ms/step - loss: 1.8280 -
f1_score: 0.4576 - val_loss: 1.6446 - val_f1_score: 0.5173
Epoch 74/500
27/28 [==========================>..] - ETA: 0s - loss: 1.8381 - f1_score:
0.4413

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 333ms/step - loss: 1.8312 -
f1_score: 0.4458 - val_loss: 1.6115 - val_f1_score: 0.5201
Epoch 75/500
28/28 [==============================] - 2s 56ms/step - loss: 1.7632 - f1_score:
0.4764 - val_loss: 1.6535 - val_f1_score: 0.5067
Epoch 76/500
27/28 [==========================>..] - ETA: 0s - loss: 1.7437 - f1_score:
0.4896
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 294ms/step - loss: 1.7391 -
f1_score: 0.4902 - val_loss: 1.5861 - val_f1_score: 0.5446
Epoch 77/500
28/28 [==============================] - 2s 55ms/step - loss: 1.7344 - f1_score:
0.4865 - val_loss: 1.6692 - val_f1_score: 0.4982
Epoch 78/500
28/28 [==============================] - 2s 55ms/step - loss: 1.7282 - f1_score:
0.4953 - val_loss: 1.5356 - val_f1_score: 0.5266
Epoch 79/500
27/28 [============================>..] - ETA: 0s - loss: 1.7073 - f1_score:
0.5055

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 315ms/step - loss: 1.7049 -
f1_score: 0.5049 - val_loss: 1.5338 - val_f1_score: 0.5678
Epoch 80/500
28/28 [==============================] - 2s 55ms/step - loss: 1.6998 - f1_score:
0.5029 - val_loss: 1.5504 - val_f1_score: 0.5470
Epoch 81/500
27/28 [============================>..] - ETA: 0s - loss: 1.6803 - f1_score:
0.5010

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 303ms/step - loss: 1.6760 -
f1_score: 0.5012 - val_loss: 1.5355 - val_f1_score: 0.5709
Epoch 82/500
28/28 [==============================] - 2s 55ms/step - loss: 1.6417 - f1_score:
0.5194 - val_loss: 1.6083 - val_f1_score: 0.5706
```

```
Epoch 83/500
28/28 [==============================] - 2s 56ms/step - loss: 1.6207 - f1_score:
0.5214 - val_loss: 1.5026 - val_f1_score: 0.5661
Epoch 84/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6339 - f1_score:
0.5330

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 344ms/step - loss: 1.6294 -
f1_score: 0.5314 - val_loss: 1.4758 - val_f1_score: 0.5884
Epoch 85/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5821 - f1_score:
0.5404

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 284ms/step - loss: 1.5878 -
f1_score: 0.5375 - val_loss: 1.4661 - val_f1_score: 0.6035
Epoch 86/500
28/28 [==============================] - 2s 55ms/step - loss: 1.5717 - f1_score:
0.5317 - val_loss: 1.4995 - val_f1_score: 0.5826
Epoch 87/500
28/28 [==============================] - 2s 55ms/step - loss: 1.5594 - f1_score:
0.5465 - val_loss: 1.4442 - val_f1_score: 0.5792
Epoch 88/500
28/28 [==============================] - 2s 56ms/step - loss: 1.5560 - f1_score:
0.5433 - val_loss: 1.4602 - val_f1_score: 0.5928
Epoch 89/500
28/28 [==============================] - 2s 56ms/step - loss: 1.5186 - f1_score:
0.5458 - val_loss: 1.4404 - val_f1_score: 0.5523
Epoch 90/500
28/28 [==============================] - 2s 56ms/step - loss: 1.5297 - f1_score:
0.5438 - val_loss: 1.4225 - val_f1_score: 0.5518
Epoch 91/500
28/28 [==============================] - 2s 56ms/step - loss: 1.5053 - f1_score:
0.5531 - val_loss: 1.4238 - val_f1_score: 0.5824
Epoch 92/500
```

```
28/28 [==============================] - 2s 56ms/step - loss: 1.4831 - f1_score:
0.5541 - val_loss: 1.4105 - val_f1_score: 0.5887
Epoch 93/500
28/28 [==============================] - 2s 56ms/step - loss: 1.4764 - f1_score:
0.5649 - val_loss: 1.4246 - val_f1_score: 0.5902
Epoch 94/500
28/28 [==============================] - 2s 56ms/step - loss: 1.4728 - f1_score:
0.5626 - val_loss: 1.3835 - val_f1_score: 0.6014
Epoch 95/500
28/28 [==============================] - 2s 56ms/step - loss: 1.4466 - f1_score:
0.5722 - val_loss: 1.3921 - val_f1_score: 0.5956
Epoch 96/500
28/28 [==============================] - 2s 56ms/step - loss: 1.4463 - f1_score:
0.5716 - val_loss: 1.3726 - val_f1_score: 0.6028
Epoch 97/500
27/28 [===========================>..] - ETA: 0s - loss: 1.4337 - f1_score:
0.5734

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 330ms/step - loss: 1.4299 -
f1_score: 0.5754 - val_loss: 1.3656 - val_f1_score: 0.6234
Epoch 98/500
28/28 [==============================] - 2s 56ms/step - loss: 1.4156 - f1_score:
0.5861 - val_loss: 1.4082 - val_f1_score: 0.5986
Epoch 99/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3891 - f1_score:
0.5826 - val_loss: 1.3616 - val_f1_score: 0.5958
Epoch 100/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3687 - f1_score:
0.5928 - val_loss: 1.3786 - val_f1_score: 0.6004
Epoch 101/500
28/28 [==============================] - 2s 57ms/step - loss: 1.3669 - f1_score:
0.5990 - val_loss: 1.3295 - val_f1_score: 0.6132
Epoch 102/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3731 - f1_score:
0.5989 - val_loss: 1.3913 - val_f1_score: 0.6003
Epoch 103/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3055 - f1_score:
0.6094

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
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```
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 329ms/step - loss: 1.3104 -
f1_score: 0.6095 - val_loss: 1.2978 - val_f1_score: 0.6264
Epoch 104/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3417 - f1_score:
0.6006 - val_loss: 1.3157 - val_f1_score: 0.6110
Epoch 105/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3061 - f1_score:
0.6163

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 295ms/step - loss: 1.3079 -
f1_score: 0.6159 - val_loss: 1.2832 - val_f1_score: 0.6363
Epoch 106/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3228 - f1_score:
0.6039 - val_loss: 1.2710 - val_f1_score: 0.6246
Epoch 107/500
28/28 [==============================] - 2s 56ms/step - loss: 1.3158 - f1_score:
0.6009 - val_loss: 1.3505 - val_f1_score: 0.5769
Epoch 108/500
28/28 [==============================] - 2s 57ms/step - loss: 1.3049 - f1_score:
0.6109 - val_loss: 1.3224 - val_f1_score: 0.6215
Epoch 109/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2608 - f1_score:
0.6108 - val_loss: 1.2851 - val_f1_score: 0.6027
Epoch 110/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2574 - f1_score:
0.6236 - val_loss: 1.3131 - val_f1_score: 0.6217
Epoch 111/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2690 - f1_score:
0.6185 - val_loss: 1.2288 - val_f1_score: 0.6154
Epoch 112/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2520 - f1_score:
0.6287

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
```

```
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 298ms/step - loss: 1.2498 -
f1_score: 0.6287 - val_loss: 1.2927 - val_f1_score: 0.6434
Epoch 113/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2300 - f1_score:
0.6318 - val_loss: 1.2578 - val_f1_score: 0.6311
Epoch 114/500
28/28 [==============================] - 2s 57ms/step - loss: 1.2076 - f1_score:
0.6412 - val_loss: 1.2753 - val_f1_score: 0.6275
Epoch 115/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2517 - f1_score:
0.6190 - val_loss: 1.2903 - val_f1_score: 0.6119
Epoch 116/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1890 - f1_score:
0.6540 - val_loss: 1.2231 - val_f1_score: 0.6313
Epoch 117/500
28/28 [==============================] - 2s 56ms/step - loss: 1.2028 - f1_score:
0.6391 - val_loss: 1.2974 - val_f1_score: 0.6325
Epoch 118/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1736 - f1_score:
0.6423

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 339ms/step - loss: 1.1794 -
f1_score: 0.6407 - val_loss: 1.2256 - val_f1_score: 0.6504
Epoch 119/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1689 - f1_score:
0.6578 - val_loss: 1.1972 - val_f1_score: 0.6369
Epoch 120/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1514 - f1_score:
0.6524 - val_loss: 1.2236 - val_f1_score: 0.6422
Epoch 121/500
28/28 [==============================] - 2s 57ms/step - loss: 1.1440 - f1_score:
0.6535 - val_loss: 1.1749 - val_f1_score: 0.6423
Epoch 122/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1262 - f1_score:
0.6728
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 288ms/step - loss: 1.1294 -
f1_score: 0.6717 - val_loss: 1.2059 - val_f1_score: 0.6557
Epoch 123/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1261 - f1_score:
0.6590 - val_loss: 1.3068 - val_f1_score: 0.6120
Epoch 124/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1176 - f1_score:
0.6681 - val_loss: 1.2324 - val_f1_score: 0.6470
Epoch 125/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1350 - f1_score:
0.6672 - val_loss: 1.1831 - val_f1_score: 0.6423
Epoch 126/500
28/28 [==============================] - 2s 58ms/step - loss: 1.1265 - f1_score:
0.6622 - val_loss: 1.1564 - val_f1_score: 0.6344
Epoch 127/500
27/28 [===========================>..] - ETA: 0s - loss: 1.1215 - f1_score:
0.6635

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 310ms/step - loss: 1.1178 -
f1_score: 0.6630 - val_loss: 1.1746 - val_f1_score: 0.6575
Epoch 128/500
28/28 [==============================] - ETA: 0s - loss: 1.0989 - f1_score:
0.6673

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 291ms/step - loss: 1.0989 -
f1_score: 0.6673 - val_loss: 1.2229 - val_f1_score: 0.6665
```

```
Epoch 129/500
28/28 [==============================] - 2s 55ms/step - loss: 1.0847 - f1_score:
0.6724 - val_loss: 1.2085 - val_f1_score: 0.6463
Epoch 130/500
28/28 [==============================] - 2s 56ms/step - loss: 1.1141 - f1_score:
0.6660 - val_loss: 1.2138 - val_f1_score: 0.6540
Epoch 131/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0962 - f1_score:
0.6639 - val_loss: 1.2160 - val_f1_score: 0.6288
Epoch 132/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0986 - f1_score:
0.6642 - val_loss: 1.2587 - val_f1_score: 0.6520
Epoch 133/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0668 - f1_score:
0.6773 - val_loss: 1.1840 - val_f1_score: 0.6471
Epoch 134/500
27/28 [===========================>..] - ETA: 0s - loss: 1.0364 - f1_score:
0.6987

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 326ms/step - loss: 1.0350 -
f1_score: 0.6982 - val_loss: 1.1357 - val_f1_score: 0.6824
Epoch 135/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0430 - f1_score:
0.6809 - val_loss: 1.1998 - val_f1_score: 0.6566
Epoch 136/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0371 - f1_score:
0.6799 - val_loss: 1.1406 - val_f1_score: 0.6731
Epoch 137/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0429 - f1_score:
0.6856 - val_loss: 1.1366 - val_f1_score: 0.6501
Epoch 138/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0305 - f1_score:
0.6862 - val_loss: 1.1704 - val_f1_score: 0.6386
Epoch 139/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9805 - f1_score:
0.7091 - val_loss: 1.0874 - val_f1_score: 0.6781
Epoch 140/500
28/28 [==============================] - 2s 56ms/step - loss: 1.0380 - f1_score:
0.6832 - val_loss: 1.1724 - val_f1_score: 0.6687
Epoch 141/500
28/28 [==============================] - 2s 58ms/step - loss: 0.9821 - f1_score:
```

```
0.6990 - val_loss: 1.1015 - val_f1_score: 0.6605
Epoch 142/500
27/28 [==========================>..] - ETA: 0s - loss: 0.9817 - f1_score:
0.7077

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 306ms/step - loss: 0.9837 -
f1_score: 0.7067 - val_loss: 1.1463 - val_f1_score: 0.6887
Epoch 143/500
28/28 [==============================] - 2s 57ms/step - loss: 1.0099 - f1_score:
0.6919 - val_loss: 1.1459 - val_f1_score: 0.6714
Epoch 144/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9598 - f1_score:
0.7109 - val_loss: 1.0902 - val_f1_score: 0.6526
Epoch 145/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9861 - f1_score:
0.6983 - val_loss: 1.0916 - val_f1_score: 0.6682
Epoch 146/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9707 - f1_score:
0.6961 - val_loss: 1.0887 - val_f1_score: 0.6739
Epoch 147/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9547 - f1_score:
0.7091 - val_loss: 1.1830 - val_f1_score: 0.6684
Epoch 148/500
27/28 [==========================>..] - ETA: 0s - loss: 0.9546 - f1_score:
0.7126

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 296ms/step - loss: 0.9549 -
f1_score: 0.7122 - val_loss: 1.1478 - val_f1_score: 0.7068
Epoch 149/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9211 - f1_score:
0.7270 - val_loss: 1.2438 - val_f1_score: 0.6769
Epoch 150/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9691 - f1_score:
0.7049 - val_loss: 1.1334 - val_f1_score: 0.6874
```

```
Epoch 151/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9459 - f1_score:
0.7121 - val_loss: 1.1245 - val_f1_score: 0.6512
Epoch 152/500
28/28 [==============================] - 2s 59ms/step - loss: 0.9559 - f1_score:
0.7116 - val_loss: 1.0708 - val_f1_score: 0.6855
Epoch 153/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9205 - f1_score:
0.7199 - val_loss: 1.1324 - val_f1_score: 0.6953
Epoch 154/500
27/28 [===========================>..] - ETA: 0s - loss: 0.9265 - f1_score:
0.7183

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 17s 632ms/step - loss: 0.9277 -
f1_score: 0.7184 - val_loss: 1.0633 - val_f1_score: 0.7133
Epoch 155/500
28/28 [==============================] - 2s 55ms/step - loss: 0.9199 - f1_score:
0.7217 - val_loss: 1.1193 - val_f1_score: 0.6671
Epoch 156/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9144 - f1_score:
0.7243 - val_loss: 1.1293 - val_f1_score: 0.6708
Epoch 157/500
28/28 [==============================] - 2s 57ms/step - loss: 0.9289 - f1_score:
0.7131 - val_loss: 1.0543 - val_f1_score: 0.7008
Epoch 158/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8938 - f1_score:
0.7233 - val_loss: 1.0838 - val_f1_score: 0.6739
Epoch 159/500
28/28 [==============================] - 2s 56ms/step - loss: 0.9052 - f1_score:
0.7225 - val_loss: 1.0262 - val_f1_score: 0.7066
Epoch 160/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8909 - f1_score:
0.7200 - val_loss: 1.0383 - val_f1_score: 0.7058
Epoch 161/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8992 - f1_score:
0.7224 - val_loss: 1.0620 - val_f1_score: 0.7104
Epoch 162/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8864 - f1_score:
0.7308 - val_loss: 1.0747 - val_f1_score: 0.6611
Epoch 163/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8697 - f1_score:
```

```
0.7352 - val_loss: 1.0829 - val_f1_score: 0.6815
Epoch 164/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8763 - f1_score:
0.7290 - val_loss: 1.0768 - val_f1_score: 0.6837
Epoch 165/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8688 - f1_score:
0.7446 - val_loss: 1.0699 - val_f1_score: 0.6844
Epoch 166/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8684 - f1_score:
0.7304 - val_loss: 1.0466 - val_f1_score: 0.7056
Epoch 167/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8584 - f1_score:
0.7436 - val_loss: 1.0347 - val_f1_score: 0.7128
Epoch 168/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8205 - f1_score:
0.7552 - val_loss: 1.0368 - val_f1_score: 0.6998
Epoch 169/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8337 - f1_score:
0.7411 - val_loss: 1.1824 - val_f1_score: 0.6500
Epoch 170/500
28/28 [==============================] - 2s 59ms/step - loss: 0.8257 - f1_score:
0.7596 - val_loss: 1.0391 - val_f1_score: 0.7018
Epoch 171/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8265 - f1_score:
0.7426

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 328ms/step - loss: 0.8262 -
f1_score: 0.7429 - val_loss: 1.0482 - val_f1_score: 0.7175
Epoch 172/500
28/28 [==============================] - 2s 56ms/step - loss: 0.8193 - f1_score:
0.7522 - val_loss: 1.1541 - val_f1_score: 0.6644
Epoch 173/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7984 - f1_score:
0.7535 - val_loss: 1.0489 - val_f1_score: 0.6845
Epoch 174/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7877 - f1_score:
0.7585 - val_loss: 1.0512 - val_f1_score: 0.7015
Epoch 175/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8327 - f1_score:
0.7512 - val_loss: 1.1693 - val_f1_score: 0.6687
Epoch 176/500
```

```
28/28 [==============================] - 2s 57ms/step - loss: 0.8415 - f1_score:
0.7371 - val_loss: 1.0122 - val_f1_score: 0.7127
Epoch 177/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8021 - f1_score:
0.7563 - val_loss: 0.9838 - val_f1_score: 0.7174
Epoch 178/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8008 - f1_score:
0.7649 - val_loss: 1.0492 - val_f1_score: 0.7144
Epoch 179/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7748 - f1_score:
0.7720 - val_loss: 1.0569 - val_f1_score: 0.7051
Epoch 180/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7993 - f1_score:
0.7567 - val_loss: 1.0771 - val_f1_score: 0.7096
Epoch 181/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7885 - f1_score:
0.7621 - val_loss: 1.0853 - val_f1_score: 0.7125
Epoch 182/500
28/28 [==============================] - 2s 58ms/step - loss: 0.7695 - f1_score:
0.7597 - val_loss: 1.0113 - val_f1_score: 0.7016
Epoch 183/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7604 - f1_score:
0.7674 - val_loss: 0.9988 - val_f1_score: 0.7136
Epoch 184/500
27/28 [===========================>..] - ETA: 0s - loss: 0.7859 - f1_score:
0.7503

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 353ms/step - loss: 0.7824 -
f1_score: 0.7539 - val_loss: 1.0101 - val_f1_score: 0.7189
Epoch 185/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7813 - f1_score:
0.7633 - val_loss: 1.0616 - val_f1_score: 0.6988
Epoch 186/500
28/28 [==============================] - 2s 57ms/step - loss: 0.8004 - f1_score:
0.7618 - val_loss: 1.0368 - val_f1_score: 0.6943
Epoch 187/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7493 - f1_score:
0.7691 - val_loss: 1.1032 - val_f1_score: 0.6769
Epoch 188/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7746 - f1_score:
0.7626 - val_loss: 1.0108 - val_f1_score: 0.7165
```

```
Epoch 189/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7695 - f1_score:
0.7650 - val_loss: 1.0712 - val_f1_score: 0.7180
Epoch 190/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7093 - f1_score:
0.7812 - val_loss: 1.0243 - val_f1_score: 0.6988
Epoch 191/500
27/28 [===========================>..] - ETA: 0s - loss: 0.7326 - f1_score:
0.7810

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 332ms/step - loss: 0.7301 -
f1_score: 0.7814 - val_loss: 0.9994 - val_f1_score: 0.7292
Epoch 192/500
27/28 [===========================>..] - ETA: 0s - loss: 0.7452 - f1_score:
0.7726

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 8s 306ms/step - loss: 0.7428 -
f1_score: 0.7724 - val_loss: 0.9497 - val_f1_score: 0.7403
Epoch 193/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7298 - f1_score:
0.7786 - val_loss: 1.0136 - val_f1_score: 0.7004
Epoch 194/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7425 - f1_score:
0.7778 - val_loss: 1.0512 - val_f1_score: 0.7051
Epoch 195/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7108 - f1_score:
0.7845 - val_loss: 1.0578 - val_f1_score: 0.7117
Epoch 196/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7450 - f1_score:
0.7683 - val_loss: 1.0357 - val_f1_score: 0.7176
Epoch 197/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6955 - f1_score:
0.7930 - val_loss: 1.0204 - val_f1_score: 0.7181
Epoch 198/500
```

```
28/28 [==============================] - 2s 57ms/step - loss: 0.7082 - f1_score:
0.7798 - val_loss: 1.0201 - val_f1_score: 0.7082
Epoch 199/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7096 - f1_score:
0.7826 - val_loss: 0.9908 - val_f1_score: 0.7298
Epoch 200/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6726 - f1_score:
0.7983 - val_loss: 1.0308 - val_f1_score: 0.6950
Epoch 201/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6861 - f1_score:
0.7946 - val_loss: 1.1306 - val_f1_score: 0.6836
Epoch 202/500
27/28 [============================>..] - ETA: 0s - loss: 0.7005 - f1_score:
0.7884

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 19s 694ms/step - loss: 0.7029 -
f1_score: 0.7879 - val_loss: 1.0239 - val_f1_score: 0.7450
Epoch 203/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7192 - f1_score:
0.7768 - val_loss: 0.9844 - val_f1_score: 0.7407
Epoch 204/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7008 - f1_score:
0.7865 - val_loss: 1.0770 - val_f1_score: 0.6728
Epoch 205/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6898 - f1_score:
0.7885 - val_loss: 1.1362 - val_f1_score: 0.6963
Epoch 206/500
28/28 [==============================] - 2s 56ms/step - loss: 0.7301 - f1_score:
0.7752 - val_loss: 0.9945 - val_f1_score: 0.7152
Epoch 207/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6726 - f1_score:
0.7967 - val_loss: 1.0968 - val_f1_score: 0.6780
Epoch 208/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6809 - f1_score:
0.7949 - val_loss: 1.0128 - val_f1_score: 0.7120
Epoch 209/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6543 - f1_score:
0.7958 - val_loss: 1.1033 - val_f1_score: 0.6934
Epoch 210/500
28/28 [==============================] - 2s 57ms/step - loss: 0.7418 - f1_score:
0.7734 - val_loss: 1.1986 - val_f1_score: 0.6783
```

```
Epoch 211/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6787 - f1_score:
0.7993 - val_loss: 1.1549 - val_f1_score: 0.7188
Epoch 212/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6936 - f1_score:
0.7901 - val_loss: 1.0490 - val_f1_score: 0.6872
Epoch 213/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6335 - f1_score:
0.8040 - val_loss: 0.9828 - val_f1_score: 0.7315
Epoch 214/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6355 - f1_score:
0.8101 - val_loss: 0.9954 - val_f1_score: 0.7094
Epoch 215/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6409 - f1_score:
0.8111 - val_loss: 1.0262 - val_f1_score: 0.7058
Epoch 216/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6280 - f1_score:
0.8178 - val_loss: 1.0196 - val_f1_score: 0.7012
Epoch 217/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6484 - f1_score:
0.8010 - val_loss: 0.9731 - val_f1_score: 0.7068
Epoch 218/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6341 - f1_score:
0.8098 - val_loss: 1.0157 - val_f1_score: 0.7169
Epoch 219/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6505 - f1_score:
0.7990 - val_loss: 1.0710 - val_f1_score: 0.7072
Epoch 220/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6566 - f1_score:
0.7926 - val_loss: 1.0213 - val_f1_score: 0.7297
Epoch 221/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6463 - f1_score:
0.8108 - val_loss: 1.1249 - val_f1_score: 0.7157
Epoch 222/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6659 - f1_score:
0.7897 - val_loss: 0.9773 - val_f1_score: 0.7164
Epoch 223/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6391 - f1_score:
0.8031 - val_loss: 0.9877 - val_f1_score: 0.7037
Epoch 224/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6163 - f1_score:
0.8101 - val_loss: 0.9030 - val_f1_score: 0.7398
Epoch 225/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6194 - f1_score:
0.8105 - val_loss: 0.9673 - val_f1_score: 0.7257
Epoch 226/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6109 - f1_score:
0.8210 - val_loss: 1.0213 - val_f1_score: 0.7073
```

```
Epoch 227/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6608 - f1_score:
0.8017 - val_loss: 0.9926 - val_f1_score: 0.7142
Epoch 228/500
28/28 [==============================] - 2s 62ms/step - loss: 0.6167 - f1_score:
0.8061 - val_loss: 0.9449 - val_f1_score: 0.7354
Epoch 229/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6089 - f1_score:
0.8072 - val_loss: 1.0824 - val_f1_score: 0.7137
Epoch 230/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6186 - f1_score:
0.8078 - val_loss: 1.1017 - val_f1_score: 0.7125
Epoch 231/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5936 - f1_score:
0.8180 - val_loss: 1.1202 - val_f1_score: 0.7236
Epoch 232/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6144 - f1_score:
0.8016 - val_loss: 0.9905 - val_f1_score: 0.7158
Epoch 233/500
28/28 [==============================] - 2s 61ms/step - loss: 0.5767 - f1_score:
0.8233 - val_loss: 0.9162 - val_f1_score: 0.7397
Epoch 234/500
28/28 [==============================] - 2s 60ms/step - loss: 0.6046 - f1_score:
0.8151 - val_loss: 1.0616 - val_f1_score: 0.7024
Epoch 235/500
27/28 [============================>..] - ETA: 0s - loss: 0.5931 - f1_score:
0.8132

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 353ms/step - loss: 0.5921 -
f1_score: 0.8141 - val_loss: 0.9517 - val_f1_score: 0.7500
Epoch 236/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6076 - f1_score:
0.8099 - val_loss: 1.0951 - val_f1_score: 0.7077
Epoch 237/500
28/28 [==============================] - 2s 56ms/step - loss: 0.6002 - f1_score:
0.8143 - val_loss: 1.2394 - val_f1_score: 0.6598
Epoch 238/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5601 - f1_score:
0.8276 - val_loss: 1.0131 - val_f1_score: 0.7317
Epoch 239/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5704 - f1_score:
```

```
0.8253 - val_loss: 1.0513 - val_f1_score: 0.7131
Epoch 240/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5736 - f1_score:
0.8248 - val_loss: 1.0928 - val_f1_score: 0.6954
Epoch 241/500
28/28 [==============================] - 2s 57ms/step - loss: 0.6022 - f1_score:
0.8186 - val_loss: 0.9390 - val_f1_score: 0.7488
Epoch 242/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5478 - f1_score:
0.8380 - val_loss: 0.9486 - val_f1_score: 0.7276
Epoch 243/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5773 - f1_score:
0.8244 - val_loss: 0.9387 - val_f1_score: 0.7384
Epoch 244/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5633 - f1_score:
0.8307 - val_loss: 1.0029 - val_f1_score: 0.7179
Epoch 245/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5929 - f1_score:
0.8220 - val_loss: 1.0036 - val_f1_score: 0.7275
Epoch 246/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5607 - f1_score:
0.8262 - val_loss: 1.0099 - val_f1_score: 0.7363
Epoch 247/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5324 - f1_score:
0.8444 - val_loss: 1.1704 - val_f1_score: 0.6994
Epoch 248/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5739 - f1_score:
0.8181 - val_loss: 1.0638 - val_f1_score: 0.7164
Epoch 249/500
27/28 [============================>..] - ETA: 0s - loss: 0.6038 - f1_score:
0.8041

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 352ms/step - loss: 0.6000 -
f1_score: 0.8041 - val_loss: 0.9563 - val_f1_score: 0.7533
Epoch 250/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5287 - f1_score:
0.8462 - val_loss: 1.0609 - val_f1_score: 0.7315
Epoch 251/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5675 - f1_score:
0.8230 - val_loss: 0.9226 - val_f1_score: 0.7307
Epoch 252/500
```

```
27/28 [==========================>..] - ETA: 0s - loss: 0.4845 - f1_score:
0.8502

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 9s 328ms/step - loss: 0.4885 -
f1_score: 0.8504 - val_loss: 0.9511 - val_f1_score: 0.7570
Epoch 253/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5331 - f1_score:
0.8394 - val_loss: 0.9378 - val_f1_score: 0.7491
Epoch 254/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5535 - f1_score:
0.8328 - val_loss: 1.0042 - val_f1_score: 0.7297
Epoch 255/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5474 - f1_score:
0.8386 - val_loss: 0.9802 - val_f1_score: 0.7296
Epoch 256/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5552 - f1_score:
0.8354 - val_loss: 0.9708 - val_f1_score: 0.7255
Epoch 257/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5400 - f1_score:
0.8318 - val_loss: 0.9891 - val_f1_score: 0.7432
Epoch 258/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5454 - f1_score:
0.8336 - val_loss: 0.9599 - val_f1_score: 0.7550
Epoch 259/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5481 - f1_score:
0.8234 - val_loss: 1.2727 - val_f1_score: 0.6876
Epoch 260/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5541 - f1_score:
0.8392 - val_loss: 0.9787 - val_f1_score: 0.7324
Epoch 261/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5128 - f1_score:
0.8438 - val_loss: 0.9242 - val_f1_score: 0.7491
Epoch 262/500
28/28 [==============================] - 2s 61ms/step - loss: 0.5393 - f1_score:
0.8292 - val_loss: 1.1690 - val_f1_score: 0.7265
Epoch 263/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5144 - f1_score:
0.8399 - val_loss: 1.0351 - val_f1_score: 0.7251
Epoch 264/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5389 - f1_score:
0.8434 - val_loss: 1.1401 - val_f1_score: 0.6833
```

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Epoch 265/500
28/28 [==============================] - 2s 61ms/step - loss: 0.5492 - f1_score:
0.8292 - val_loss: 1.2017 - val_f1_score: 0.6707
Epoch 266/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5077 - f1_score:
0.8449 - val_loss: 0.9589 - val_f1_score: 0.7304
Epoch 267/500
27/28 [===========================>..] - ETA: 0s - loss: 0.5098 - f1_score:
0.8454

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 357ms/step - loss: 0.5149 -
f1_score: 0.8439 - val_loss: 0.9032 - val_f1_score: 0.7692
Epoch 268/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5236 - f1_score:
0.8434 - val_loss: 1.0006 - val_f1_score: 0.7432
Epoch 269/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5015 - f1_score:
0.8427 - val_loss: 1.2044 - val_f1_score: 0.7105
Epoch 270/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5449 - f1_score:
0.8285 - val_loss: 1.0183 - val_f1_score: 0.7144
Epoch 271/500
28/28 [==============================] - 2s 57ms/step - loss: 0.5046 - f1_score:
0.8437 - val_loss: 1.1208 - val_f1_score: 0.6668
Epoch 272/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5088 - f1_score:
0.8462 - val_loss: 1.0967 - val_f1_score: 0.7003
Epoch 273/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5010 - f1_score:
0.8434 - val_loss: 1.0204 - val_f1_score: 0.7256
Epoch 274/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5070 - f1_score:
0.8476 - val_loss: 0.9586 - val_f1_score: 0.7383
Epoch 275/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4882 - f1_score:
0.8576 - val_loss: 0.9891 - val_f1_score: 0.7474
Epoch 276/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4933 - f1_score:
0.8413 - val_loss: 1.1458 - val_f1_score: 0.7164
Epoch 277/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4936 - f1_score:
```

```
0.8460 - val_loss: 0.9536 - val_f1_score: 0.7542
Epoch 278/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4864 - f1_score:
0.8492 - val_loss: 1.0149 - val_f1_score: 0.7347
Epoch 279/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4768 - f1_score:
0.8604 - val_loss: 0.9225 - val_f1_score: 0.7377
Epoch 280/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5436 - f1_score:
0.8298 - val_loss: 0.9668 - val_f1_score: 0.7497
Epoch 281/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4938 - f1_score:
0.8463 - val_loss: 0.9105 - val_f1_score: 0.7391
Epoch 282/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5027 - f1_score:
0.8440 - val_loss: 0.9681 - val_f1_score: 0.7347
Epoch 283/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5132 - f1_score:
0.8434 - val_loss: 0.9189 - val_f1_score: 0.7419
Epoch 284/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4809 - f1_score:
0.8578

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 12s 448ms/step - loss: 0.4785 -
f1_score: 0.8589 - val_loss: 0.8823 - val_f1_score: 0.7752
Epoch 285/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4522 - f1_score:
0.8654 - val_loss: 0.8880 - val_f1_score: 0.7664
Epoch 286/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4863 - f1_score:
0.8468 - val_loss: 0.9567 - val_f1_score: 0.7383
Epoch 287/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4874 - f1_score:
0.8508 - val_loss: 0.9853 - val_f1_score: 0.7659
Epoch 288/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4634 - f1_score:
0.8663 - val_loss: 0.9692 - val_f1_score: 0.7250
Epoch 289/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4745 - f1_score:
0.8539 - val_loss: 1.0540 - val_f1_score: 0.7242
Epoch 290/500
```

```
28/28 [==============================] - 2s 57ms/step - loss: 0.4967 - f1_score:
0.8532 - val_loss: 0.9076 - val_f1_score: 0.7630
Epoch 291/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4650 - f1_score:
0.8646 - val_loss: 1.0731 - val_f1_score: 0.7299
Epoch 292/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5085 - f1_score:
0.8423 - val_loss: 0.9295 - val_f1_score: 0.7298
Epoch 293/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4710 - f1_score:
0.8604 - val_loss: 1.2080 - val_f1_score: 0.6950
Epoch 294/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4937 - f1_score:
0.8460 - val_loss: 1.2057 - val_f1_score: 0.6932
Epoch 295/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4557 - f1_score:
0.8631 - val_loss: 0.9660 - val_f1_score: 0.7460
Epoch 296/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4662 - f1_score:
0.8660 - val_loss: 0.9123 - val_f1_score: 0.7481
Epoch 297/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4319 - f1_score:
0.8739 - val_loss: 0.9228 - val_f1_score: 0.7587
Epoch 298/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4848 - f1_score:
0.8437

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 353ms/step - loss: 0.4773 -
f1_score: 0.8469 - val_loss: 0.8736 - val_f1_score: 0.7819
Epoch 299/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4594 - f1_score:
0.8576 - val_loss: 0.9534 - val_f1_score: 0.7486
Epoch 300/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4899 - f1_score:
0.8538 - val_loss: 0.9095 - val_f1_score: 0.7621
Epoch 301/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4406 - f1_score:
0.8673 - val_loss: 0.9696 - val_f1_score: 0.7815
Epoch 302/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4648 - f1_score:
0.8606 - val_loss: 1.0056 - val_f1_score: 0.7575
```

```
Epoch 303/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4396 - f1_score:
0.8625 - val_loss: 0.9681 - val_f1_score: 0.7546
Epoch 304/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4662 - f1_score:
0.8574 - val_loss: 1.0586 - val_f1_score: 0.7241
Epoch 305/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4640 - f1_score:
0.8555 - val_loss: 0.9884 - val_f1_score: 0.7513
Epoch 306/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4617 - f1_score:
0.8624 - val_loss: 0.9099 - val_f1_score: 0.7557
Epoch 307/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4447 - f1_score:
0.8685 - val_loss: 0.9953 - val_f1_score: 0.7483
Epoch 308/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4719 - f1_score:
0.8575 - val_loss: 1.1137 - val_f1_score: 0.7284
Epoch 309/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4494 - f1_score:
0.8574 - val_loss: 0.9681 - val_f1_score: 0.7389
Epoch 310/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4462 - f1_score:
0.8677 - val_loss: 1.0259 - val_f1_score: 0.7286
Epoch 311/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4496 - f1_score:
0.8659 - val_loss: 1.1509 - val_f1_score: 0.7155
Epoch 312/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4293 - f1_score:
0.8724 - val_loss: 0.9903 - val_f1_score: 0.7450
Epoch 313/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4370 - f1_score:
0.8726 - val_loss: 0.8886 - val_f1_score: 0.7691
Epoch 314/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4358 - f1_score:
0.8766 - val_loss: 0.9758 - val_f1_score: 0.7531
Epoch 315/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4414 - f1_score:
0.8643 - val_loss: 0.9993 - val_f1_score: 0.7662
Epoch 316/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4236 - f1_score:
0.8796 - val_loss: 0.9364 - val_f1_score: 0.7679
Epoch 317/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4473 - f1_score:
0.8725 - val_loss: 0.9798 - val_f1_score: 0.7593
Epoch 318/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4632 - f1_score:
0.8662 - val_loss: 0.9963 - val_f1_score: 0.7559
```

```
Epoch 319/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4014 - f1_score:
0.8840 - val_loss: 1.0377 - val_f1_score: 0.7302
Epoch 320/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4794 - f1_score:
0.8484 - val_loss: 1.0718 - val_f1_score: 0.7150
Epoch 321/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4642 - f1_score:
0.8621 - val_loss: 1.0540 - val_f1_score: 0.7281
Epoch 322/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4204 - f1_score:
0.8707 - val_loss: 0.9653 - val_f1_score: 0.7521
Epoch 323/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4228 - f1_score:
0.8740 - val_loss: 0.9862 - val_f1_score: 0.7673
Epoch 324/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4249 - f1_score:
0.8704 - val_loss: 0.9036 - val_f1_score: 0.7709
Epoch 325/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4015 - f1_score:
0.8745 - val_loss: 0.9957 - val_f1_score: 0.7140
Epoch 326/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4247 - f1_score:
0.8741 - val_loss: 0.9121 - val_f1_score: 0.7597
Epoch 327/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4672 - f1_score:
0.8582 - val_loss: 1.2590 - val_f1_score: 0.7069
Epoch 328/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4257 - f1_score:
0.8689 - val_loss: 1.0860 - val_f1_score: 0.7553
Epoch 329/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4063 - f1_score:
0.8818 - val_loss: 1.0487 - val_f1_score: 0.7552
Epoch 330/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3921 - f1_score:
0.8868 - val_loss: 0.9697 - val_f1_score: 0.7432
Epoch 331/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4014 - f1_score:
0.8777 - val_loss: 1.0421 - val_f1_score: 0.7233
Epoch 332/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3885 - f1_score:
0.8833 - val_loss: 0.9762 - val_f1_score: 0.7522
Epoch 333/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4142 - f1_score:
0.8790 - val_loss: 1.1042 - val_f1_score: 0.7125
Epoch 334/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4083 - f1_score:
0.8769 - val_loss: 1.0662 - val_f1_score: 0.7306
```

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Epoch 335/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4222 - f1_score:
0.8680 - val_loss: 1.0776 - val_f1_score: 0.7282
Epoch 336/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4001 - f1_score:
0.8839 - val_loss: 0.9666 - val_f1_score: 0.7632
Epoch 337/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4134 - f1_score:
0.8731 - val_loss: 0.9137 - val_f1_score: 0.7487
Epoch 338/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3881 - f1_score:
0.8865 - val_loss: 0.9336 - val_f1_score: 0.7597
Epoch 339/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4208 - f1_score:
0.8743 - val_loss: 1.0220 - val_f1_score: 0.7283
Epoch 340/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4077 - f1_score:
0.8782 - val_loss: 1.2632 - val_f1_score: 0.7076
Epoch 341/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4037 - f1_score:
0.8826 - val_loss: 1.0138 - val_f1_score: 0.7211
Epoch 342/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3985 - f1_score:
0.8793 - val_loss: 0.9487 - val_f1_score: 0.7486
Epoch 343/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4009 - f1_score:
0.8780 - val_loss: 0.8961 - val_f1_score: 0.7764
Epoch 344/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3930 - f1_score:
0.8774 - val_loss: 0.9720 - val_f1_score: 0.7676
Epoch 345/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3927 - f1_score:
0.8840 - val_loss: 0.9895 - val_f1_score: 0.7397
Epoch 346/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4252 - f1_score:
0.8722 - val_loss: 1.0340 - val_f1_score: 0.7437
Epoch 347/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3902 - f1_score:
0.8837 - val_loss: 1.0503 - val_f1_score: 0.7288
Epoch 348/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3956 - f1_score:
0.8792 - val_loss: 0.9773 - val_f1_score: 0.7335
Epoch 349/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4093 - f1_score:
0.8755 - val_loss: 1.0484 - val_f1_score: 0.7408
Epoch 350/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3977 - f1_score:
0.8826 - val_loss: 1.1373 - val_f1_score: 0.7417
```

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Epoch 351/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4148 - f1_score:
0.8746 - val_loss: 1.0159 - val_f1_score: 0.7188
Epoch 352/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3918 - f1_score:
0.8865 - val_loss: 1.0003 - val_f1_score: 0.7441
Epoch 353/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4020 - f1_score:
0.8825 - val_loss: 1.0331 - val_f1_score: 0.7382
Epoch 354/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3770 - f1_score:
0.8872 - val_loss: 0.9953 - val_f1_score: 0.7455
Epoch 355/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3978 - f1_score:
0.8868 - val_loss: 1.0063 - val_f1_score: 0.7438
Epoch 356/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3827 - f1_score:
0.8834 - val_loss: 0.9988 - val_f1_score: 0.7342
Epoch 357/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3612 - f1_score:
0.8911 - val_loss: 0.9439 - val_f1_score: 0.7729
Epoch 358/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3888 - f1_score:
0.8808 - val_loss: 1.1009 - val_f1_score: 0.7337
Epoch 359/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3810 - f1_score:
0.8947 - val_loss: 0.9624 - val_f1_score: 0.7488
Epoch 360/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3700 - f1_score:
0.8893 - val_loss: 1.0991 - val_f1_score: 0.7310
Epoch 361/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3752 - f1_score:
0.8883 - val_loss: 1.0257 - val_f1_score: 0.7377
Epoch 362/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3730 - f1_score:
0.8895 - val_loss: 0.9809 - val_f1_score: 0.7502
Epoch 363/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3986 - f1_score:
0.8795 - val_loss: 0.9778 - val_f1_score: 0.7759
Epoch 364/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4019 - f1_score:
0.8832 - val_loss: 1.1860 - val_f1_score: 0.7126
Epoch 365/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3717 - f1_score:
0.8891 - val_loss: 0.9989 - val_f1_score: 0.7505
Epoch 366/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3939 - f1_score:
0.8883 - val_loss: 0.9596 - val_f1_score: 0.7655
```

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Epoch 367/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3942 - f1_score:
0.8836 - val_loss: 1.0319 - val_f1_score: 0.7500
Epoch 368/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3481 - f1_score:
0.8950 - val_loss: 1.0584 - val_f1_score: 0.7223
Epoch 369/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3908 - f1_score:
0.8837 - val_loss: 1.0776 - val_f1_score: 0.7164
Epoch 370/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3915 - f1_score:
0.8830 - val_loss: 1.0677 - val_f1_score: 0.7529
Epoch 371/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3679 - f1_score:
0.8923 - val_loss: 1.0029 - val_f1_score: 0.7539
Epoch 372/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3666 - f1_score:
0.8920 - val_loss: 0.9313 - val_f1_score: 0.7813
Epoch 373/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3699 - f1_score:
0.8944 - val_loss: 0.8885 - val_f1_score: 0.7663
Epoch 374/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3618 - f1_score:
0.8934 - val_loss: 1.0298 - val_f1_score: 0.7549
Epoch 375/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3890 - f1_score:
0.8756 - val_loss: 1.1062 - val_f1_score: 0.7336
Epoch 376/500
27/28 [============================>..] - ETA: 0s - loss: 0.3893 - f1_score:
0.8802

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU/assets

28/28 [==============================] - 10s 371ms/step - loss: 0.3876 -
f1_score: 0.8822 - val_loss: 0.9192 - val_f1_score: 0.7912
Epoch 377/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3767 - f1_score:
0.8859 - val_loss: 1.0871 - val_f1_score: 0.7445
Epoch 378/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4174 - f1_score:
0.8766 - val_loss: 1.0157 - val_f1_score: 0.7435
Epoch 379/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3657 - f1_score:
```

```
0.8957 - val_loss: 0.9571 - val_f1_score: 0.7639
Epoch 380/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3566 - f1_score:
0.8934 - val_loss: 0.9155 - val_f1_score: 0.7498
Epoch 381/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3361 - f1_score:
0.9008 - val_loss: 0.9999 - val_f1_score: 0.7561
Epoch 382/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3684 - f1_score:
0.8896 - val_loss: 0.9010 - val_f1_score: 0.7473
Epoch 383/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3270 - f1_score:
0.9065 - val_loss: 0.9676 - val_f1_score: 0.7646
Epoch 384/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3431 - f1_score:
0.9027 - val_loss: 0.9900 - val_f1_score: 0.7401
Epoch 385/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3407 - f1_score:
0.9027 - val_loss: 1.0090 - val_f1_score: 0.7466
Epoch 386/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3377 - f1_score:
0.9030 - val_loss: 1.1117 - val_f1_score: 0.7273
Epoch 387/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3750 - f1_score:
0.8924 - val_loss: 0.9822 - val_f1_score: 0.7527
Epoch 388/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3340 - f1_score:
0.8973 - val_loss: 0.9828 - val_f1_score: 0.7333
Epoch 389/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3484 - f1_score:
0.8968 - val_loss: 1.0647 - val_f1_score: 0.7282
Epoch 390/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3692 - f1_score:
0.8892 - val_loss: 1.0670 - val_f1_score: 0.7136
Epoch 391/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3240 - f1_score:
0.9027 - val_loss: 1.1056 - val_f1_score: 0.7111
Epoch 392/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3355 - f1_score:
0.9018 - val_loss: 0.9874 - val_f1_score: 0.7560
Epoch 393/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3732 - f1_score:
0.8905 - val_loss: 1.2398 - val_f1_score: 0.7226
Epoch 394/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3754 - f1_score:
0.8871 - val_loss: 0.9813 - val_f1_score: 0.7565
Epoch 395/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3554 - f1_score:
```

```
0.8922 - val_loss: 1.0984 - val_f1_score: 0.7413
Epoch 396/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3360 - f1_score:
0.8985 - val_loss: 1.0599 - val_f1_score: 0.7599
Epoch 397/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3334 - f1_score:
0.9072 - val_loss: 0.9781 - val_f1_score: 0.7699
Epoch 398/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3306 - f1_score:
0.9037 - val_loss: 1.1550 - val_f1_score: 0.7202
Epoch 399/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3557 - f1_score:
0.8925 - val_loss: 1.0066 - val_f1_score: 0.7688
Epoch 400/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3291 - f1_score:
0.9038 - val_loss: 1.0034 - val_f1_score: 0.7701
Epoch 401/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3641 - f1_score:
0.8980 - val_loss: 0.9493 - val_f1_score: 0.7581
Epoch 402/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3400 - f1_score:
0.9025 - val_loss: 1.0589 - val_f1_score: 0.7380
Epoch 403/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3348 - f1_score:
0.8976 - val_loss: 1.0197 - val_f1_score: 0.7466
Epoch 404/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3416 - f1_score:
0.9005 - val_loss: 1.0627 - val_f1_score: 0.7546
Epoch 405/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3013 - f1_score:
0.9081 - val_loss: 0.9538 - val_f1_score: 0.7519
Epoch 406/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3401 - f1_score:
0.8965 - val_loss: 1.1146 - val_f1_score: 0.7366
Epoch 407/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3302 - f1_score:
0.9060 - val_loss: 1.0361 - val_f1_score: 0.7516
Epoch 408/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3216 - f1_score:
0.9025 - val_loss: 1.0328 - val_f1_score: 0.7621
Epoch 409/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3520 - f1_score:
0.8955 - val_loss: 1.0288 - val_f1_score: 0.7490
Epoch 410/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3489 - f1_score:
0.8956 - val_loss: 1.0390 - val_f1_score: 0.7415
Epoch 411/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3172 - f1_score:
```

```
0.9018 - val_loss: 1.0915 - val_f1_score: 0.7583
Epoch 412/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3245 - f1_score:
0.9070 - val_loss: 0.9167 - val_f1_score: 0.7478
Epoch 413/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3189 - f1_score:
0.9107 - val_loss: 1.0713 - val_f1_score: 0.7306
Epoch 414/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3196 - f1_score:
0.9039 - val_loss: 0.9963 - val_f1_score: 0.7712
Epoch 415/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3112 - f1_score:
0.9133 - val_loss: 0.9870 - val_f1_score: 0.7694
Epoch 416/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3290 - f1_score:
0.8978 - val_loss: 1.1000 - val_f1_score: 0.7382
Epoch 417/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3142 - f1_score:
0.9031 - val_loss: 1.2781 - val_f1_score: 0.7128
Epoch 418/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3037 - f1_score:
0.9131 - val_loss: 1.0578 - val_f1_score: 0.7425
Epoch 419/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3172 - f1_score:
0.9089 - val_loss: 1.0306 - val_f1_score: 0.7579
Epoch 420/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3379 - f1_score:
0.9032 - val_loss: 0.9957 - val_f1_score: 0.7594
Epoch 421/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3552 - f1_score:
0.8955 - val_loss: 1.0754 - val_f1_score: 0.7416
Epoch 422/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3183 - f1_score:
0.9067 - val_loss: 0.9961 - val_f1_score: 0.7569
Epoch 423/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3254 - f1_score:
0.8999 - val_loss: 0.9322 - val_f1_score: 0.7423
Epoch 424/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3437 - f1_score:
0.8996 - val_loss: 0.9937 - val_f1_score: 0.7476
Epoch 425/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2945 - f1_score:
0.9106 - val_loss: 0.8784 - val_f1_score: 0.7589
Epoch 426/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3126 - f1_score:
0.9083 - val_loss: 1.0030 - val_f1_score: 0.7474
Epoch 427/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3129 - f1_score:
```

```
0.9060 - val_loss: 1.0263 - val_f1_score: 0.7683
Epoch 428/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3048 - f1_score:
0.9109 - val_loss: 1.0568 - val_f1_score: 0.7418
Epoch 429/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3388 - f1_score:
0.8974 - val_loss: 1.1581 - val_f1_score: 0.7276
Epoch 430/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2913 - f1_score:
0.9164 - val_loss: 0.9655 - val_f1_score: 0.7741
Epoch 431/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3690 - f1_score:
0.8910 - val_loss: 0.9778 - val_f1_score: 0.7671
Epoch 432/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2941 - f1_score:
0.9124 - val_loss: 1.0707 - val_f1_score: 0.7421
Epoch 433/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3105 - f1_score:
0.9135 - val_loss: 1.0092 - val_f1_score: 0.7641
Epoch 434/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3067 - f1_score:
0.9116 - val_loss: 1.5759 - val_f1_score: 0.6756
Epoch 435/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3949 - f1_score:
0.8834 - val_loss: 1.0595 - val_f1_score: 0.7279
Epoch 436/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3033 - f1_score:
0.9138 - val_loss: 1.0322 - val_f1_score: 0.7334
Epoch 437/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2877 - f1_score:
0.9115 - val_loss: 0.9459 - val_f1_score: 0.7491
Epoch 438/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2775 - f1_score:
0.9183 - val_loss: 0.9768 - val_f1_score: 0.7532
Epoch 439/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3019 - f1_score:
0.9099 - val_loss: 1.2006 - val_f1_score: 0.6939
Epoch 440/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2878 - f1_score:
0.9171 - val_loss: 0.9997 - val_f1_score: 0.7421
Epoch 441/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3002 - f1_score:
0.9117 - val_loss: 1.1250 - val_f1_score: 0.7477
Epoch 442/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3024 - f1_score:
0.9108 - val_loss: 1.0134 - val_f1_score: 0.7625
Epoch 443/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2721 - f1_score:
```

```
0.9137 - val_loss: 1.1915 - val_f1_score: 0.7246
Epoch 444/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3260 - f1_score:
0.9058 - val_loss: 0.9779 - val_f1_score: 0.7638
Epoch 445/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3145 - f1_score:
0.9116 - val_loss: 0.9228 - val_f1_score: 0.7723
Epoch 446/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3396 - f1_score:
0.9014 - val_loss: 0.9339 - val_f1_score: 0.7659
Epoch 447/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2996 - f1_score:
0.9202 - val_loss: 1.1771 - val_f1_score: 0.7476
Epoch 448/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3177 - f1_score:
0.9055 - val_loss: 1.1186 - val_f1_score: 0.7549
Epoch 449/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3196 - f1_score:
0.9102 - val_loss: 1.0200 - val_f1_score: 0.7491
Epoch 450/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3050 - f1_score:
0.9128 - val_loss: 1.0913 - val_f1_score: 0.7126
Epoch 451/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3187 - f1_score:
0.9082 - val_loss: 1.1918 - val_f1_score: 0.7271
Epoch 452/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3185 - f1_score:
0.9115 - val_loss: 1.0446 - val_f1_score: 0.7354
Epoch 453/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2860 - f1_score:
0.9183 - val_loss: 0.9702 - val_f1_score: 0.7768
Epoch 454/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2858 - f1_score:
0.9203 - val_loss: 1.1040 - val_f1_score: 0.7619
Epoch 455/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3296 - f1_score:
0.9068 - val_loss: 1.0176 - val_f1_score: 0.7223
Epoch 456/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2884 - f1_score:
0.9245 - val_loss: 1.1202 - val_f1_score: 0.7463
Epoch 457/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2679 - f1_score:
0.9253 - val_loss: 1.0934 - val_f1_score: 0.7263
Epoch 458/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3036 - f1_score:
0.9083 - val_loss: 1.0698 - val_f1_score: 0.7501
Epoch 459/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2802 - f1_score:
```

```
0.9149 - val_loss: 1.0449 - val_f1_score: 0.7528
Epoch 460/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2814 - f1_score:
0.9196 - val_loss: 1.0910 - val_f1_score: 0.7245
Epoch 461/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3008 - f1_score:
0.9099 - val_loss: 1.0526 - val_f1_score: 0.7480
Epoch 462/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3014 - f1_score:
0.9123 - val_loss: 1.0368 - val_f1_score: 0.7663
Epoch 463/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2911 - f1_score:
0.9179 - val_loss: 0.9894 - val_f1_score: 0.7727
Epoch 464/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2866 - f1_score:
0.9200 - val_loss: 1.1926 - val_f1_score: 0.7311
Epoch 465/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2844 - f1_score:
0.9192 - val_loss: 1.0199 - val_f1_score: 0.7367
Epoch 466/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2879 - f1_score:
0.9169 - val_loss: 0.9674 - val_f1_score: 0.7648
Epoch 467/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2930 - f1_score:
0.9159 - val_loss: 1.0240 - val_f1_score: 0.7685
Epoch 468/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2926 - f1_score:
0.9162 - val_loss: 1.1315 - val_f1_score: 0.7407
Epoch 469/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2858 - f1_score:
0.9232 - val_loss: 1.0324 - val_f1_score: 0.7602
Epoch 470/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2564 - f1_score:
0.9255 - val_loss: 1.0245 - val_f1_score: 0.7533
Epoch 471/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2797 - f1_score:
0.9200 - val_loss: 1.0774 - val_f1_score: 0.7404
Epoch 472/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2986 - f1_score:
0.9163 - val_loss: 0.9703 - val_f1_score: 0.7742
Epoch 473/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3056 - f1_score:
0.9092 - val_loss: 1.1232 - val_f1_score: 0.7333
Epoch 474/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3203 - f1_score:
0.9073 - val_loss: 1.2596 - val_f1_score: 0.6906
Epoch 475/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3091 - f1_score:
```

```
0.9060 - val_loss: 1.0348 - val_f1_score: 0.7210
Epoch 476/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2812 - f1_score:
0.9239 - val_loss: 1.0120 - val_f1_score: 0.7587
Epoch 477/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3065 - f1_score:
0.9164 - val_loss: 1.0247 - val_f1_score: 0.7496
Epoch 478/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2886 - f1_score:
0.9156 - val_loss: 1.2401 - val_f1_score: 0.6880
Epoch 479/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2952 - f1_score:
0.9147 - val_loss: 1.0332 - val_f1_score: 0.7524
Epoch 480/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2768 - f1_score:
0.9215 - val_loss: 1.0393 - val_f1_score: 0.7437
Epoch 481/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2846 - f1_score:
0.9184 - val_loss: 1.1663 - val_f1_score: 0.7167
Epoch 482/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2588 - f1_score:
0.9318 - val_loss: 1.1465 - val_f1_score: 0.7441
Epoch 483/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2911 - f1_score:
0.9201 - val_loss: 1.0621 - val_f1_score: 0.7634
Epoch 484/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3091 - f1_score:
0.9105 - val_loss: 0.9447 - val_f1_score: 0.7708
Epoch 485/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2598 - f1_score:
0.9251 - val_loss: 1.0974 - val_f1_score: 0.7450
Epoch 486/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2729 - f1_score:
0.9206 - val_loss: 1.1161 - val_f1_score: 0.7415
Epoch 487/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2546 - f1_score:
0.9298 - val_loss: 1.2033 - val_f1_score: 0.7237
Epoch 488/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2920 - f1_score:
0.9183 - val_loss: 1.0233 - val_f1_score: 0.7638
Epoch 489/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2614 - f1_score:
0.9250 - val_loss: 1.1166 - val_f1_score: 0.7451
Epoch 490/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2485 - f1_score:
0.9290 - val_loss: 1.0773 - val_f1_score: 0.7592
Epoch 491/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2774 - f1_score:
```

```
0.9228 - val_loss: 1.0394 - val_f1_score: 0.7617
Epoch 492/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2585 - f1_score:
0.9260 - val_loss: 1.2959 - val_f1_score: 0.7352
Epoch 493/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2872 - f1_score:
0.9166 - val_loss: 1.2374 - val_f1_score: 0.7324
Epoch 494/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2679 - f1_score:
0.9237 - val_loss: 1.1201 - val_f1_score: 0.7309
Epoch 495/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2865 - f1_score:
0.9144 - val_loss: 1.0130 - val_f1_score: 0.7674
Epoch 496/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2687 - f1_score:
0.9221 - val_loss: 1.0365 - val_f1_score: 0.7532
Epoch 497/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2578 - f1_score:
0.9263 - val_loss: 1.0457 - val_f1_score: 0.7599
Epoch 498/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2597 - f1_score:
0.9259 - val_loss: 1.1679 - val_f1_score: 0.7449
Epoch 499/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2709 - f1_score:
0.9252 - val_loss: 1.0475 - val_f1_score: 0.7415
Epoch 500/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3050 - f1_score:
0.9060 - val_loss: 1.3055 - val_f1_score: 0.7193
```

[137]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 9ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.571     0.400     0.471        10
        BELT      0.667     1.000     0.800         4
        BITE      0.875     0.875     0.875         8
   BREAKFAST      0.400     0.667     0.500         6
      CANCER      1.000     1.000     1.000         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      1.000     0.833     0.909         6
```

```
        DARK      0.800     1.000     0.889         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      1.000     0.833     0.909         6
      DEMAND      1.000     0.625     0.769         8
     DEVELOP      0.400     1.000     0.571         6
      DINNER      0.889     1.000     0.941         8
         DOG      0.556     0.833     0.667         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.667     0.500     0.571         4
         EAT      0.857     1.000     0.923         6
        EDIT      1.000     0.833     0.909         6
    ELEVATOR      0.667     0.500     0.571         8
        FINE      1.000     0.500     0.667         4
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      0.800     1.000     0.889         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.800     0.667     0.727         6
 HURDLE/TRIP      0.667     0.500     0.571         4
     JEWELRY      1.000     0.750     0.857         4
      KNIGHT      0.667     0.500     0.571         4
        LOCK      0.500     0.250     0.333         8
       LUNCH      1.000     0.500     0.667         8
       MAPLE      0.500     0.750     0.600         4
        MEAT      0.143     0.167     0.154         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.421     1.000     0.593         8
        NOON      0.800     1.000     0.889         8
       PARTY      0.857     0.750     0.800         8
     PATIENT      0.667     0.667     0.667         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      0.667     0.667     0.667         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.667     0.800     0.727        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      1.000     0.750     0.857         4
       TWINS      0.700     0.875     0.778         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.741       324
   macro avg      0.759     0.727     0.719       324
weighted avg      0.776     0.741     0.734       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
```

```
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[138]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '2 1DCNN + 1 GRU/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[60]:
```
hist_df = pd.read_csv('2 1DCNN + 1 GRU/history.csv', index_col=0)
hist_df.tail()
```

[60]:

	loss	f1_score	val_loss	val_f1_score
495	0.268732	0.922070	1.036492	0.753181
496	0.257815	0.926315	1.045713	0.759923
497	0.259685	0.925887	1.167926	0.744852
498	0.270945	0.925242	1.047520	0.741497
499	0.305009	0.905961	1.305487	0.719328

[61]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
```

```
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[62]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
```

```
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')

plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[119]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU")
```

```
2023-09-08 01:20:37.407224: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-08 01:20:37.483234: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1739 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

[120]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_2 (Conv1D)           (None, 122, 100)          359200

 max_pooling1d_2 (MaxPooling  (None, 13, 100)          0
 1D)

 conv1d_3 (Conv1D)           (None, 13, 125)           12625

 max_pooling1d_3 (MaxPooling  (None, 13, 125)          0
 1D)

 dropout_2 (Dropout)         (None, 13, 125)           0

 gru_1 (GRU)                 (None, 75)                45450

 dropout_3 (Dropout)         (None, 75)                0

 dense_2 (Dense)             (None, 100)               7600

 dense_3 (Dense)             (None, 50)                5050

=================================================================
Total params: 429,925
Trainable params: 429,925
Non-trainable params: 0
_________________________________________________________________
```

[121]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[121]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 122, 100)
MaxPooling1D
input: (None, 122, 100)
output: (None, 13, 100)
Conv1D
input: (None, 13, 100)
output: (None, 13, 125)
MaxPooling1D
input: (None, 13, 125)
output: (None, 13, 125)
Dropout
input: (None, 13, 125)
output: (None, 13, 125)
GRU
input: (None, 13, 125)
output: (None, 75)
Dropout
input: (None, 75)
output: (None, 75)
Dense
input: (None, 75)
output: (None, 100)
Dense
input: (None, 100)
output: (None, 50)

[122]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
2023-09-08 01:20:47.578885: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 67223520
exceeds 10% of free system memory.
2023-09-08 01:20:47.642676: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 67223520
exceeds 10% of free system memory.
2023-09-08 01:20:48.615446: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [==============================] - 2s 19ms/step - loss: 0.9192 - f1_score:
0.7912
```

[122]:
```
[0.9192284345626831, 0.7912141680717468]
```

[123]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-08 01:21:06.069351: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
2023-09-08 01:21:06.651930: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.

84/84 [==============================] - 1s 16ms/step - loss: 0.0864 - f1_score:
0.9901
```

[123]:
```
[0.08639702200889587, 0.9900971055030823]
```

[145]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 8ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.667     1.000     0.800         6
  BASKETBALL      0.900     0.900     0.900        10
         BEE      0.692     0.900     0.783        10
        BELT      0.800     1.000     0.889         4
        BITE      1.000     1.000     1.000         8
   BREAKFAST      0.667     0.667     0.667         6
      CANCER      0.889     1.000     0.941         8
```

CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	1.000	1.000	1.000	6
DARK	1.000	1.000	1.000	4
DEAF	0.400	0.333	0.364	6
DECIDE	1.000	0.667	0.800	6
DEMAND	1.000	0.750	0.857	8
DEVELOP	0.750	0.500	0.600	6
DINNER	0.889	1.000	0.941	8
DOG	1.000	0.667	0.800	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	0.667	0.500	0.571	4
EAT	1.000	1.000	1.000	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.800	1.000	0.889	8
FINE	1.000	0.750	0.857	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	0.750	1.000	0.857	6
GUESS	0.800	1.000	0.889	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	1.000	0.667	0.800	6
HURDLE/TRIP	0.333	0.250	0.286	4
JEWELRY	0.750	0.750	0.750	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.583	0.875	0.700	8
LUNCH	1.000	0.500	0.667	8
MAPLE	1.000	1.000	1.000	4
MEAT	0.500	0.500	0.500	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.636	0.875	0.737	8
NOON	0.800	1.000	0.889	8
PARTY	0.857	0.750	0.800	8
PATIENT	0.400	0.667	0.500	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.667	0.667	0.667	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.833	1.000	0.909	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.667	0.500	0.571	4
THEY	1.000	0.750	0.857	4
TWINS	0.778	0.875	0.824	8
WHATFOR	0.889	0.800	0.842	10
accuracy			0.812	324
macro avg	0.827	0.788	0.791	324
weighted avg	0.832	0.812	0.806	324

[119]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 GRU Mish/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[121]:
```
act_function = mish
model = Sequential()
model.add(
    Conv1D(filters=100,
           kernel_size=9,
           activation=act_function,
           input_shape=(130, 399)))
model.add(MaxPooling1D(pool_size=9))
model.add(Conv1D(filters=125, kernel_size=1, activation=act_function))
model.add(MaxPooling1D(pool_size=1))
model.add(Dropout(.7))
model.add(
    GRU(units=75,
        return_sequences=False,
        kernel_regularizer=regularizers.l2(.0023285010665210285)))
model.add(Dropout(.5))
model.add(Dense(units=100, activation=act_function))
model.add(Dense(50, activation='softmax'))

model.compile(tf.optimizers.experimental.Nadam(.0003730278430367326),
              loss='categorical_crossentropy',
              metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
model.summary()
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_2 (Conv1D)           (None, 122, 100)          359200

 max_pooling1d_2 (MaxPooling  (None, 13, 100)          0
 1D)

 conv1d_3 (Conv1D)           (None, 13, 125)           12625
```

```
 max_pooling1d_3 (MaxPooling  (None, 13, 125)          0
 1D)

 dropout_2 (Dropout)         (None, 13, 125)           0

 gru_1 (GRU)                 (None, 75)                45450

 dropout_3 (Dropout)         (None, 75)                0

 dense_2 (Dense)             (None, 100)               7600

 dense_3 (Dense)             (None, 50)                5050

=================================================================
Total params: 429,925
Trainable params: 429,925
Non-trainable params: 0
_________________________________________________________________
Epoch 1/500

2023-09-12 00:22:17.151974: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
2023-09-12 00:22:18.578629: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x7f65048d1a00 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
2023-09-12 00:22:18.578659: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-12 00:22:18.588256: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-12 00:22:18.754804: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.

28/28 [==============================] - ETA: 0s - loss: 4.3027 - f1_score:
0.0201

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 29s 837ms/step - loss: 4.3027 -
f1_score: 0.0201 - val_loss: 4.2574 - val_f1_score: 0.0015
Epoch 2/500
28/28 [==============================] - ETA: 0s - loss: 4.2411 - f1_score:
0.0178
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 320ms/step - loss: 4.2411 -
f1_score: 0.0178 - val_loss: 4.2047 - val_f1_score: 0.0065
Epoch 3/500
28/28 [==============================] - 2s 58ms/step - loss: 4.1911 - f1_score:
0.0213 - val_loss: 4.1721 - val_f1_score: 6.2745e-04
Epoch 4/500
28/28 [==============================] - 2s 62ms/step - loss: 4.1556 - f1_score:
0.0217 - val_loss: 4.1377 - val_f1_score: 7.4303e-04
Epoch 5/500
28/28 [==============================] - 2s 58ms/step - loss: 4.1203 - f1_score:
0.0148 - val_loss: 4.1084 - val_f1_score: 0.0016
Epoch 6/500
28/28 [==============================] - 2s 59ms/step - loss: 4.0878 - f1_score:
0.0162 - val_loss: 4.0747 - val_f1_score: 0.0059
Epoch 7/500
28/28 [==============================] - 2s 58ms/step - loss: 4.0526 - f1_score:
0.0188 - val_loss: 4.0211 - val_f1_score: 0.0049
Epoch 8/500
28/28 [==============================] - 2s 59ms/step - loss: 3.9782 - f1_score:
0.0173 - val_loss: 3.8930 - val_f1_score: 0.0035
Epoch 9/500
27/28 [===========================>..] - ETA: 0s - loss: 3.8486 - f1_score:
0.0198

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 326ms/step - loss: 3.8442 -
f1_score: 0.0196 - val_loss: 3.7564 - val_f1_score: 0.0082
Epoch 10/500
27/28 [===========================>..] - ETA: 0s - loss: 3.7347 - f1_score:
0.0248

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 337ms/step - loss: 3.7329 -
f1_score: 0.0253 - val_loss: 3.6327 - val_f1_score: 0.0152
Epoch 11/500
28/28 [==============================] - 2s 59ms/step - loss: 3.6550 - f1_score:
0.0293 - val_loss: 3.5489 - val_f1_score: 0.0118
Epoch 12/500
28/28 [==============================] - 2s 58ms/step - loss: 3.6124 - f1_score:
0.0343 - val_loss: 3.4770 - val_f1_score: 0.0138
Epoch 13/500
27/28 [===========================>..] - ETA: 0s - loss: 3.5274 - f1_score:
0.0427

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 347ms/step - loss: 3.5255 -
f1_score: 0.0427 - val_loss: 3.3585 - val_f1_score: 0.0425
Epoch 14/500
27/28 [===========================>..] - ETA: 0s - loss: 3.4411 - f1_score:
0.0508

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 11s 395ms/step - loss: 3.4383 -
f1_score: 0.0506 - val_loss: 3.3080 - val_f1_score: 0.0615
Epoch 15/500
28/28 [==============================] - 2s 59ms/step - loss: 3.3494 - f1_score:
0.0559 - val_loss: 3.1773 - val_f1_score: 0.0491
Epoch 16/500
28/28 [==============================] - 2s 59ms/step - loss: 3.3007 - f1_score:
0.0557 - val_loss: 3.1175 - val_f1_score: 0.0485
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 3.2470 - f1_score:
0.0688
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 8s 312ms/step - loss: 3.2470 -
f1_score: 0.0688 - val_loss: 3.0806 - val_f1_score: 0.0829
Epoch 18/500
28/28 [==============================] - 2s 59ms/step - loss: 3.2111 - f1_score:
0.0643 - val_loss: 3.0653 - val_f1_score: 0.0681
Epoch 19/500
28/28 [==============================] - 2s 59ms/step - loss: 3.1740 - f1_score:
0.0692 - val_loss: 3.0190 - val_f1_score: 0.0761
Epoch 20/500
28/28 [==============================] - 2s 59ms/step - loss: 3.1394 - f1_score:
0.0844 - val_loss: 3.0338 - val_f1_score: 0.0790
Epoch 21/500
28/28 [==============================] - ETA: 0s - loss: 3.1148 - f1_score:
0.0848

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 323ms/step - loss: 3.1148 -
f1_score: 0.0848 - val_loss: 2.9879 - val_f1_score: 0.0886
Epoch 22/500
27/28 [===========================>..] - ETA: 0s - loss: 3.0582 - f1_score:
0.0921

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 344ms/step - loss: 3.0582 -
f1_score: 0.0913 - val_loss: 2.9512 - val_f1_score: 0.1026
Epoch 23/500
28/28 [==============================] - 2s 59ms/step - loss: 3.0324 - f1_score:
0.0922 - val_loss: 2.9147 - val_f1_score: 0.0862
```

```
Epoch 24/500
28/28 [==============================] - 2s 59ms/step - loss: 2.9987 - f1_score:
0.1075 - val_loss: 2.9183 - val_f1_score: 0.0977
Epoch 25/500
27/28 [===========================>..] - ETA: 0s - loss: 2.9963 - f1_score:
0.0972

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 26s 946ms/step - loss: 2.9955 -
f1_score: 0.0979 - val_loss: 2.8144 - val_f1_score: 0.1300
Epoch 26/500
28/28 [==============================] - ETA: 0s - loss: 2.9236 - f1_score:
0.1212

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 332ms/step - loss: 2.9236 -
f1_score: 0.1212 - val_loss: 2.8197 - val_f1_score: 0.1377
Epoch 27/500
28/28 [==============================] - 2s 58ms/step - loss: 2.8913 - f1_score:
0.1188 - val_loss: 2.7914 - val_f1_score: 0.1243
Epoch 28/500
28/28 [==============================] - 2s 59ms/step - loss: 2.8789 - f1_score:
0.1226 - val_loss: 2.7757 - val_f1_score: 0.1326
Epoch 29/500
28/28 [==============================] - 2s 59ms/step - loss: 2.8303 - f1_score:
0.1320 - val_loss: 2.7004 - val_f1_score: 0.1164
Epoch 30/500
27/28 [===========================>..] - ETA: 0s - loss: 2.7924 - f1_score:
0.1446

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 340ms/step - loss: 2.7871 -
f1_score: 0.1453 - val_loss: 2.6479 - val_f1_score: 0.1588
Epoch 31/500
28/28 [==============================] - 2s 59ms/step - loss: 2.7706 - f1_score:
0.1502 - val_loss: 2.7344 - val_f1_score: 0.1384
Epoch 32/500
27/28 [===========================>..] - ETA: 0s - loss: 2.7740 - f1_score:
0.1561

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 359ms/step - loss: 2.7706 -
f1_score: 0.1565 - val_loss: 2.6524 - val_f1_score: 0.1880
Epoch 33/500
28/28 [==============================] - 2s 59ms/step - loss: 2.7060 - f1_score:
0.1620 - val_loss: 2.6942 - val_f1_score: 0.1516
Epoch 34/500
28/28 [==============================] - 2s 59ms/step - loss: 2.6889 - f1_score:
0.1657 - val_loss: 2.6459 - val_f1_score: 0.1663
Epoch 35/500
28/28 [==============================] - ETA: 0s - loss: 2.6703 - f1_score:
0.1709

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 13s 468ms/step - loss: 2.6703 -
f1_score: 0.1709 - val_loss: 2.5912 - val_f1_score: 0.1882
Epoch 36/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6568 - f1_score:
0.1722

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 357ms/step - loss: 2.6587 -
f1_score: 0.1710 - val_loss: 2.5127 - val_f1_score: 0.1929
Epoch 37/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6108 - f1_score:
0.1839

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 330ms/step - loss: 2.6074 -
f1_score: 0.1865 - val_loss: 2.5057 - val_f1_score: 0.2090
Epoch 38/500
28/28 [==============================] - 2s 58ms/step - loss: 2.6051 - f1_score:
0.1874 - val_loss: 2.5444 - val_f1_score: 0.1972
Epoch 39/500
28/28 [==============================] - 2s 59ms/step - loss: 2.5669 - f1_score:
0.1982 - val_loss: 2.5369 - val_f1_score: 0.1867
Epoch 40/500
28/28 [==============================] - 2s 59ms/step - loss: 2.5665 - f1_score:
0.1996 - val_loss: 2.4628 - val_f1_score: 0.1948
Epoch 41/500
28/28 [==============================] - ETA: 0s - loss: 2.5345 - f1_score:
0.1956

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 337ms/step - loss: 2.5345 -
f1_score: 0.1956 - val_loss: 2.4315 - val_f1_score: 0.2278
Epoch 42/500
27/28 [===========================>..] - ETA: 0s - loss: 2.5095 - f1_score:
0.2192

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 339ms/step - loss: 2.5070 -
f1_score: 0.2202 - val_loss: 2.3912 - val_f1_score: 0.2607
Epoch 43/500
28/28 [==============================] - 2s 59ms/step - loss: 2.4975 - f1_score:
0.2341 - val_loss: 2.3607 - val_f1_score: 0.2357
Epoch 44/500
28/28 [==============================] - 2s 59ms/step - loss: 2.4562 - f1_score:
0.2320 - val_loss: 2.8342 - val_f1_score: 0.1843
Epoch 45/500
28/28 [==============================] - 2s 59ms/step - loss: 2.4797 - f1_score:
0.2334 - val_loss: 2.3635 - val_f1_score: 0.2297
Epoch 46/500
28/28 [==============================] - 2s 60ms/step - loss: 2.4268 - f1_score:
0.2573 - val_loss: 2.3028 - val_f1_score: 0.2490
Epoch 47/500
28/28 [==============================] - 2s 60ms/step - loss: 2.4353 - f1_score:
0.2398 - val_loss: 2.3413 - val_f1_score: 0.2465
Epoch 48/500
28/28 [==============================] - 2s 59ms/step - loss: 2.3764 - f1_score:
0.2593 - val_loss: 2.2939 - val_f1_score: 0.2500
Epoch 49/500
28/28 [==============================] - 2s 60ms/step - loss: 2.3515 - f1_score:
0.2568 - val_loss: 2.2569 - val_f1_score: 0.2540
Epoch 50/500
28/28 [==============================] - ETA: 0s - loss: 2.3626 - f1_score:
0.2637

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 376ms/step - loss: 2.3626 -
f1_score: 0.2637 - val_loss: 2.2674 - val_f1_score: 0.2636
Epoch 51/500
28/28 [==============================] - 2s 60ms/step - loss: 2.3207 - f1_score:
0.2711 - val_loss: 2.2360 - val_f1_score: 0.2623
Epoch 52/500
28/28 [==============================] - ETA: 0s - loss: 2.3162 - f1_score:
0.2739

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 361ms/step - loss: 2.3162 -
f1_score: 0.2739 - val_loss: 2.1957 - val_f1_score: 0.2978
Epoch 53/500
28/28 [==============================] - 2s 59ms/step - loss: 2.2982 - f1_score:
0.2753 - val_loss: 2.2152 - val_f1_score: 0.2759
Epoch 54/500
28/28 [==============================] - 2s 60ms/step - loss: 2.2987 - f1_score:
0.2912 - val_loss: 2.2819 - val_f1_score: 0.2789
Epoch 55/500
28/28 [==============================] - 2s 59ms/step - loss: 2.2578 - f1_score:
0.2911 - val_loss: 2.2649 - val_f1_score: 0.2904
Epoch 56/500
28/28 [==============================] - 2s 59ms/step - loss: 2.2744 - f1_score:
0.2804 - val_loss: 2.1923 - val_f1_score: 0.2932
Epoch 57/500
28/28 [==============================] - 2s 59ms/step - loss: 2.2308 - f1_score:
0.2957 - val_loss: 2.2186 - val_f1_score: 0.2957
Epoch 58/500
28/28 [==============================] - ETA: 0s - loss: 2.2407 - f1_score:
0.2932

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 354ms/step - loss: 2.2407 -
f1_score: 0.2932 - val_loss: 2.1638 - val_f1_score: 0.3225
Epoch 59/500
28/28 [==============================] - 2s 59ms/step - loss: 2.2014 - f1_score:
0.3129 - val_loss: 2.1733 - val_f1_score: 0.3128
Epoch 60/500
28/28 [==============================] - 2s 60ms/step - loss: 2.1742 - f1_score:
0.3133 - val_loss: 2.1570 - val_f1_score: 0.3207
Epoch 61/500
28/28 [==============================] - 2s 60ms/step - loss: 2.1723 - f1_score:
0.3114 - val_loss: 2.1106 - val_f1_score: 0.3214
Epoch 62/500
27/28 [============================>..] - ETA: 0s - loss: 2.1992 - f1_score:
0.3067

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
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gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 367ms/step - loss: 2.1962 -
f1_score: 0.3069 - val_loss: 2.1253 - val_f1_score: 0.3434
Epoch 63/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1656 - f1_score:
0.3165 - val_loss: 2.1289 - val_f1_score: 0.3426
Epoch 64/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1478 - f1_score:
0.3135 - val_loss: 2.1263 - val_f1_score: 0.3399
Epoch 65/500
28/28 [==============================] - 2s 61ms/step - loss: 2.1197 - f1_score:
0.3312 - val_loss: 2.1462 - val_f1_score: 0.3185
Epoch 66/500
28/28 [==============================] - ETA: 0s - loss: 2.1438 - f1_score:
0.3330

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 11s 395ms/step - loss: 2.1438 -
f1_score: 0.3330 - val_loss: 2.1128 - val_f1_score: 0.3620
Epoch 67/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1224 - f1_score:
0.3335 - val_loss: 2.0557 - val_f1_score: 0.3576
Epoch 68/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1231 - f1_score:
0.3340 - val_loss: 2.1346 - val_f1_score: 0.3210
Epoch 69/500
28/28 [==============================] - 2s 59ms/step - loss: 2.1131 - f1_score:
0.3461 - val_loss: 2.1003 - val_f1_score: 0.3254
Epoch 70/500
27/28 [============================>..] - ETA: 0s - loss: 2.0852 - f1_score:
0.3321

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 370ms/step - loss: 2.0867 -
f1_score: 0.3322 - val_loss: 2.0482 - val_f1_score: 0.3836
Epoch 71/500
28/28 [==============================] - 2s 59ms/step - loss: 2.0721 - f1_score:
0.3403 - val_loss: 2.1105 - val_f1_score: 0.3437
Epoch 72/500
28/28 [==============================] - 2s 59ms/step - loss: 2.0798 - f1_score:
0.3517 - val_loss: 2.1249 - val_f1_score: 0.3717
Epoch 73/500
28/28 [==============================] - 2s 60ms/step - loss: 2.0642 - f1_score:
0.3550 - val_loss: 2.0518 - val_f1_score: 0.3750
Epoch 74/500
28/28 [==============================] - 2s 60ms/step - loss: 2.0610 - f1_score:
0.3430 - val_loss: 2.0798 - val_f1_score: 0.3386
Epoch 75/500
28/28 [==============================] - 2s 59ms/step - loss: 2.0260 - f1_score:
0.3523 - val_loss: 2.0409 - val_f1_score: 0.3511
Epoch 76/500
28/28 [==============================] - 2s 59ms/step - loss: 2.0184 - f1_score:
0.3594 - val_loss: 2.0466 - val_f1_score: 0.3768
Epoch 77/500
28/28 [==============================] - 2s 60ms/step - loss: 2.0105 - f1_score:
0.3529 - val_loss: 2.0774 - val_f1_score: 0.3742
Epoch 78/500
28/28 [==============================] - 2s 60ms/step - loss: 1.9866 - f1_score:
0.3671 - val_loss: 1.9939 - val_f1_score: 0.3812
Epoch 79/500
28/28 [==============================] - ETA: 0s - loss: 1.9967 - f1_score:
0.3690

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 9s 333ms/step - loss: 1.9967 -
f1_score: 0.3690 - val_loss: 2.0417 - val_f1_score: 0.3937
Epoch 80/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9828 - f1_score:
0.3637 - val_loss: 2.1297 - val_f1_score: 0.3553
Epoch 81/500
28/28 [==============================] - ETA: 0s - loss: 1.9678 - f1_score:
0.3651

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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```
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 351ms/step - loss: 1.9678 -
f1_score: 0.3651 - val_loss: 2.0445 - val_f1_score: 0.4046
Epoch 82/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9616 - f1_score:
0.3738 - val_loss: 2.0941 - val_f1_score: 0.3407
Epoch 83/500
28/28 [==============================] - ETA: 0s - loss: 1.9533 - f1_score:
0.3793

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 370ms/step - loss: 1.9533 -
f1_score: 0.3793 - val_loss: 1.9908 - val_f1_score: 0.4108
Epoch 84/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9651 - f1_score:
0.3735 - val_loss: 2.0316 - val_f1_score: 0.3835
Epoch 85/500
28/28 [==============================] - 2s 61ms/step - loss: 1.9204 - f1_score:
0.3920 - val_loss: 2.0484 - val_f1_score: 0.3962
Epoch 86/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9525 - f1_score:
0.3818 - val_loss: 2.0734 - val_f1_score: 0.3691
Epoch 87/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9401 - f1_score:
0.3757

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 363ms/step - loss: 1.9406 -
f1_score: 0.3777 - val_loss: 1.9939 - val_f1_score: 0.4130
Epoch 88/500
```

```
28/28 [==============================] - 2s 59ms/step - loss: 1.9297 - f1_score:
0.3861 - val_loss: 2.0123 - val_f1_score: 0.3821
Epoch 89/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9184 - f1_score:
0.3882 - val_loss: 1.9419 - val_f1_score: 0.4090
Epoch 90/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9173 - f1_score:
0.3983 - val_loss: 1.9778 - val_f1_score: 0.3850
Epoch 91/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8956 - f1_score:
0.3977 - val_loss: 2.0434 - val_f1_score: 0.3792
Epoch 92/500
28/28 [==============================] - 2s 59ms/step - loss: 1.9006 - f1_score:
0.3962 - val_loss: 1.9468 - val_f1_score: 0.4030
Epoch 93/500
28/28 [==============================] - 2s 59ms/step - loss: 1.8774 - f1_score:
0.4025 - val_loss: 2.0568 - val_f1_score: 0.3636
Epoch 94/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8993 - f1_score:
0.4048 - val_loss: 1.9424 - val_f1_score: 0.4049
Epoch 95/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8761 - f1_score:
0.4022 - val_loss: 1.9399 - val_f1_score: 0.3921
Epoch 96/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8782 - f1_score:
0.4060 - val_loss: 2.0109 - val_f1_score: 0.3844
Epoch 97/500
27/28 [===========================>..] - ETA: 0s - loss: 1.8559 - f1_score:
0.4102

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 354ms/step - loss: 1.8546 -
f1_score: 0.4124 - val_loss: 1.9251 - val_f1_score: 0.4538
Epoch 98/500
28/28 [==============================] - 2s 59ms/step - loss: 1.8336 - f1_score:
0.4197 - val_loss: 2.1702 - val_f1_score: 0.3556
Epoch 99/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8743 - f1_score:
0.4033 - val_loss: 1.9263 - val_f1_score: 0.4085
Epoch 100/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8133 - f1_score:
0.4298 - val_loss: 1.9302 - val_f1_score: 0.4062
```

```
Epoch 101/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8381 - f1_score:
0.4191 - val_loss: 1.9037 - val_f1_score: 0.4398
Epoch 102/500
28/28 [==============================] - 2s 60ms/step - loss: 1.8172 - f1_score:
0.4128 - val_loss: 2.0624 - val_f1_score: 0.3744
Epoch 103/500
28/28 [==============================] - 2s 63ms/step - loss: 1.8135 - f1_score:
0.4297 - val_loss: 1.9042 - val_f1_score: 0.4533
Epoch 104/500
28/28 [==============================] - 2s 61ms/step - loss: 1.8146 - f1_score:
0.4149 - val_loss: 2.0321 - val_f1_score: 0.3864
Epoch 105/500
28/28 [==============================] - 2s 62ms/step - loss: 1.8218 - f1_score:
0.4154 - val_loss: 1.9303 - val_f1_score: 0.4097
Epoch 106/500
28/28 [==============================] - 2s 61ms/step - loss: 1.8072 - f1_score:
0.4251 - val_loss: 1.9140 - val_f1_score: 0.4295
Epoch 107/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7862 - f1_score:
0.4325 - val_loss: 1.9030 - val_f1_score: 0.4459
Epoch 108/500
28/28 [==============================] - 2s 62ms/step - loss: 1.7500 - f1_score:
0.4388 - val_loss: 1.9695 - val_f1_score: 0.4026
Epoch 109/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7845 - f1_score:
0.4285 - val_loss: 1.9199 - val_f1_score: 0.3900
Epoch 110/500
28/28 [==============================] - 2s 63ms/step - loss: 1.7548 - f1_score:
0.4381 - val_loss: 1.8744 - val_f1_score: 0.4331
Epoch 111/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7308 - f1_score:
0.4388 - val_loss: 1.9851 - val_f1_score: 0.4163
Epoch 112/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7532 - f1_score:
0.4492 - val_loss: 1.9004 - val_f1_score: 0.4219
Epoch 113/500
28/28 [==============================] - 2s 65ms/step - loss: 1.7353 - f1_score:
0.4417 - val_loss: 1.9250 - val_f1_score: 0.4029
Epoch 114/500
28/28 [==============================] - 2s 62ms/step - loss: 1.7670 - f1_score:
0.4404 - val_loss: 1.8872 - val_f1_score: 0.4446
Epoch 115/500
28/28 [==============================] - 2s 60ms/step - loss: 1.7216 - f1_score:
0.4402 - val_loss: 2.0020 - val_f1_score: 0.3954
Epoch 116/500
28/28 [==============================] - 2s 60ms/step - loss: 1.7253 - f1_score:
0.4429 - val_loss: 1.9390 - val_f1_score: 0.4398
```

```
Epoch 117/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7201 - f1_score:
0.4479 - val_loss: 1.9615 - val_f1_score: 0.4284
Epoch 118/500
28/28 [==============================] - 2s 60ms/step - loss: 1.7088 - f1_score:
0.4520 - val_loss: 1.9584 - val_f1_score: 0.4044
Epoch 119/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7379 - f1_score:
0.4437 - val_loss: 1.8770 - val_f1_score: 0.4319
Epoch 120/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7129 - f1_score:
0.4306 - val_loss: 2.0636 - val_f1_score: 0.4102
Epoch 121/500
28/28 [==============================] - 2s 60ms/step - loss: 1.6928 - f1_score:
0.4517 - val_loss: 1.9141 - val_f1_score: 0.4451
Epoch 122/500
28/28 [==============================] - 2s 61ms/step - loss: 1.7076 - f1_score:
0.4410 - val_loss: 1.8148 - val_f1_score: 0.4275
Epoch 123/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6769 - f1_score:
0.4644 - val_loss: 1.9070 - val_f1_score: 0.4097
Epoch 124/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6793 - f1_score:
0.4527 - val_loss: 1.9565 - val_f1_score: 0.4471
Epoch 125/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6694 - f1_score:
0.4693 - val_loss: 1.8544 - val_f1_score: 0.4096
Epoch 126/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6624 - f1_score:
0.4692 - val_loss: 1.9096 - val_f1_score: 0.4140
Epoch 127/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6759 - f1_score:
0.4637 - val_loss: 1.8379 - val_f1_score: 0.4244
Epoch 128/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6618 - f1_score:
0.4696 - val_loss: 2.0377 - val_f1_score: 0.4045
Epoch 129/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6704 - f1_score:
0.4638 - val_loss: 1.9149 - val_f1_score: 0.4425
Epoch 130/500
28/28 [==============================] - 2s 64ms/step - loss: 1.6639 - f1_score:
0.4719 - val_loss: 1.9131 - val_f1_score: 0.4159
Epoch 131/500
28/28 [==============================] - 2s 67ms/step - loss: 1.6539 - f1_score:
0.4610 - val_loss: 1.9540 - val_f1_score: 0.4075
Epoch 132/500
28/28 [==============================] - 2s 68ms/step - loss: 1.6354 - f1_score:
0.4846 - val_loss: 1.9144 - val_f1_score: 0.4480
```

```
Epoch 133/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6499 - f1_score:
0.4710 - val_loss: 1.9677 - val_f1_score: 0.4378
Epoch 134/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6272 - f1_score:
0.4746 - val_loss: 1.8594 - val_f1_score: 0.4142
Epoch 135/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6282 - f1_score:
0.4811 - val_loss: 1.9022 - val_f1_score: 0.4483
Epoch 136/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6512 - f1_score:
0.4708 - val_loss: 1.8372 - val_f1_score: 0.4434
Epoch 137/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6005 - f1_score:
0.4895 - val_loss: 1.8717 - val_f1_score: 0.4489
Epoch 138/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6154 - f1_score:
0.4788 - val_loss: 1.8787 - val_f1_score: 0.4276
Epoch 139/500
28/28 [==============================] - 2s 62ms/step - loss: 1.5924 - f1_score:
0.4976 - val_loss: 2.0132 - val_f1_score: 0.4096
Epoch 140/500
28/28 [==============================] - 2s 62ms/step - loss: 1.5902 - f1_score:
0.4808 - val_loss: 1.8261 - val_f1_score: 0.4304
Epoch 141/500
28/28 [==============================] - 2s 62ms/step - loss: 1.6245 - f1_score:
0.4775 - val_loss: 1.9475 - val_f1_score: 0.4422
Epoch 142/500
28/28 [==============================] - ETA: 0s - loss: 1.5744 - f1_score:
0.5013

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 12s 437ms/step - loss: 1.5744 -
f1_score: 0.5013 - val_loss: 1.8913 - val_f1_score: 0.4757
Epoch 143/500
28/28 [==============================] - 2s 61ms/step - loss: 1.6056 - f1_score:
0.4947 - val_loss: 1.8862 - val_f1_score: 0.4272
Epoch 144/500
28/28 [==============================] - 2s 60ms/step - loss: 1.5891 - f1_score:
0.4895 - val_loss: 1.9521 - val_f1_score: 0.4205
Epoch 145/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5538 - f1_score:
```

```
0.4899 - val_loss: 1.9380 - val_f1_score: 0.4526
Epoch 146/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5754 - f1_score:
0.4903 - val_loss: 1.8340 - val_f1_score: 0.4535
Epoch 147/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5597 - f1_score:
0.5058 - val_loss: 1.9575 - val_f1_score: 0.4314
Epoch 148/500
28/28 [==============================] - 2s 60ms/step - loss: 1.5790 - f1_score:
0.4793 - val_loss: 1.9267 - val_f1_score: 0.4255
Epoch 149/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5650 - f1_score:
0.5023 - val_loss: 1.9750 - val_f1_score: 0.4273
Epoch 150/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5287 - f1_score:
0.5101 - val_loss: 1.8714 - val_f1_score: 0.4529
Epoch 151/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5582 - f1_score:
0.4947 - val_loss: 1.9201 - val_f1_score: 0.4336
Epoch 152/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5474 - f1_score:
0.5010 - val_loss: 1.9810 - val_f1_score: 0.4451
Epoch 153/500
28/28 [==============================] - 2s 62ms/step - loss: 1.5396 - f1_score:
0.5192 - val_loss: 1.9008 - val_f1_score: 0.4433
Epoch 154/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5407 - f1_score:
0.4990 - val_loss: 1.9150 - val_f1_score: 0.4619
Epoch 155/500
28/28 [==============================] - 2s 64ms/step - loss: 1.5130 - f1_score:
0.5085 - val_loss: 2.0132 - val_f1_score: 0.4109
Epoch 156/500
28/28 [==============================] - 2s 61ms/step - loss: 1.5174 - f1_score:
0.5066 - val_loss: 1.8667 - val_f1_score: 0.4548
Epoch 157/500
28/28 [==============================] - 2s 62ms/step - loss: 1.5139 - f1_score:
0.5185 - val_loss: 1.9529 - val_f1_score: 0.4327
Epoch 158/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4766 - f1_score:
0.5216 - val_loss: 1.8748 - val_f1_score: 0.4492
Epoch 159/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4845 - f1_score:
0.5272 - val_loss: 1.9161 - val_f1_score: 0.4369
Epoch 160/500
28/28 [==============================] - 2s 65ms/step - loss: 1.5364 - f1_score:
0.5212 - val_loss: 1.8660 - val_f1_score: 0.4551
Epoch 161/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4776 - f1_score:
```

```
0.5258 - val_loss: 1.8483 - val_f1_score: 0.4608
Epoch 162/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4956 - f1_score:
0.5181 - val_loss: 1.8198 - val_f1_score: 0.4423
Epoch 163/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4758 - f1_score:
0.5251 - val_loss: 1.9352 - val_f1_score: 0.4499
Epoch 164/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4634 - f1_score:
0.5291 - val_loss: 1.8613 - val_f1_score: 0.4475
Epoch 165/500
28/28 [==============================] - ETA: 0s - loss: 1.4731 - f1_score:
0.5257

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 11s 422ms/step - loss: 1.4731 -
f1_score: 0.5257 - val_loss: 1.8201 - val_f1_score: 0.4823
Epoch 166/500
28/28 [==============================] - 2s 60ms/step - loss: 1.4672 - f1_score:
0.5154 - val_loss: 1.8655 - val_f1_score: 0.4467
Epoch 167/500
28/28 [==============================] - 2s 60ms/step - loss: 1.4522 - f1_score:
0.5369 - val_loss: 1.8356 - val_f1_score: 0.4588
Epoch 168/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4764 - f1_score:
0.5215 - val_loss: 1.8497 - val_f1_score: 0.4605
Epoch 169/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4771 - f1_score:
0.5233 - val_loss: 1.8535 - val_f1_score: 0.4593
Epoch 170/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4557 - f1_score:
0.5319 - val_loss: 1.8256 - val_f1_score: 0.4804
Epoch 171/500
28/28 [==============================] - 2s 62ms/step - loss: 1.4335 - f1_score:
0.5342 - val_loss: 1.8527 - val_f1_score: 0.4644
Epoch 172/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4325 - f1_score:
0.5408 - val_loss: 1.8640 - val_f1_score: 0.4599
Epoch 173/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4314 - f1_score:
0.5433 - val_loss: 1.8786 - val_f1_score: 0.4599
Epoch 174/500
```

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28/28 [==============================] - 2s 61ms/step - loss: 1.4432 - f1_score:
0.5318 - val_loss: 1.8661 - val_f1_score: 0.4634
Epoch 175/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4269 - f1_score:
0.5372 - val_loss: 1.9355 - val_f1_score: 0.4581
Epoch 176/500
28/28 [==============================] - 2s 69ms/step - loss: 1.4028 - f1_score:
0.5495 - val_loss: 2.0055 - val_f1_score: 0.4307
Epoch 177/500
28/28 [==============================] - 2s 61ms/step - loss: 1.4118 - f1_score:
0.5444 - val_loss: 1.8838 - val_f1_score: 0.4479
Epoch 178/500
28/28 [==============================] - ETA: 0s - loss: 1.4306 - f1_score:
0.5354

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 11s 407ms/step - loss: 1.4306 -
f1_score: 0.5354 - val_loss: 1.7662 - val_f1_score: 0.4903
Epoch 179/500
28/28 [==============================] - 2s 60ms/step - loss: 1.4143 - f1_score:
0.5379 - val_loss: 1.9490 - val_f1_score: 0.4618
Epoch 180/500
28/28 [==============================] - 2s 60ms/step - loss: 1.4280 - f1_score:
0.5436 - val_loss: 1.9155 - val_f1_score: 0.4591
Epoch 181/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3921 - f1_score:
0.5508 - val_loss: 1.8366 - val_f1_score: 0.4826
Epoch 182/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3861 - f1_score:
0.5644 - val_loss: 1.9048 - val_f1_score: 0.4688
Epoch 183/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3665 - f1_score:
0.5578 - val_loss: 1.9010 - val_f1_score: 0.4434
Epoch 184/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3962 - f1_score:
0.5452 - val_loss: 1.8336 - val_f1_score: 0.4803
Epoch 185/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3959 - f1_score:
0.5454 - val_loss: 1.9845 - val_f1_score: 0.4683
Epoch 186/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3712 - f1_score:
0.5592 - val_loss: 1.8367 - val_f1_score: 0.4705
```

```
Epoch 187/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3732 - f1_score:
0.5638 - val_loss: 1.9435 - val_f1_score: 0.4526
Epoch 188/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3773 - f1_score:
0.5567 - val_loss: 1.9749 - val_f1_score: 0.4630
Epoch 189/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3921 - f1_score:
0.5261 - val_loss: 1.8836 - val_f1_score: 0.4884
Epoch 190/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3550 - f1_score:
0.5704 - val_loss: 1.8649 - val_f1_score: 0.4739
Epoch 191/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3835 - f1_score:
0.5448 - val_loss: 1.8293 - val_f1_score: 0.4881
Epoch 192/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3784 - f1_score:
0.5507 - val_loss: 1.8253 - val_f1_score: 0.4767
Epoch 193/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3562 - f1_score:
0.5508 - val_loss: 1.8863 - val_f1_score: 0.4877
Epoch 194/500
28/28 [==============================] - 2s 61ms/step - loss: 1.3523 - f1_score:
0.5617 - val_loss: 1.8856 - val_f1_score: 0.4725
Epoch 195/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3658 - f1_score:
0.5465 - val_loss: 1.9202 - val_f1_score: 0.4664
Epoch 196/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3405 - f1_score:
0.5756 - val_loss: 1.8937 - val_f1_score: 0.4596
Epoch 197/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3457 - f1_score:
0.5648 - val_loss: 1.8718 - val_f1_score: 0.4848
Epoch 198/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3399 - f1_score:
0.5725 - val_loss: 1.8504 - val_f1_score: 0.4707
Epoch 199/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3396 - f1_score:
0.5622 - val_loss: 1.8705 - val_f1_score: 0.4782
Epoch 200/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3278 - f1_score:
0.5640 - val_loss: 1.8339 - val_f1_score: 0.4855
Epoch 201/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3263 - f1_score:
0.5687 - val_loss: 1.9838 - val_f1_score: 0.4706
Epoch 202/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2896 - f1_score:
0.5928 - val_loss: 1.8644 - val_f1_score: 0.4853
```

```
Epoch 203/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3316 - f1_score:
0.5673 - val_loss: 1.8393 - val_f1_score: 0.4739
Epoch 204/500
28/28 [==============================] - 2s 65ms/step - loss: 1.3363 - f1_score:
0.5657 - val_loss: 1.8762 - val_f1_score: 0.4850
Epoch 205/500
28/28 [==============================] - 2s 66ms/step - loss: 1.3059 - f1_score:
0.5770 - val_loss: 1.9087 - val_f1_score: 0.4608
Epoch 206/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2972 - f1_score:
0.5780 - val_loss: 1.9502 - val_f1_score: 0.4487
Epoch 207/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3223 - f1_score:
0.5735 - val_loss: 1.9073 - val_f1_score: 0.4661
Epoch 208/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3101 - f1_score:
0.5840 - val_loss: 2.0441 - val_f1_score: 0.4585
Epoch 209/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3019 - f1_score:
0.5770 - val_loss: 2.2616 - val_f1_score: 0.4293
Epoch 210/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3266 - f1_score:
0.5731 - val_loss: 1.8209 - val_f1_score: 0.4822
Epoch 211/500
28/28 [==============================] - 2s 63ms/step - loss: 1.3242 - f1_score:
0.5827 - val_loss: 1.9405 - val_f1_score: 0.4692
Epoch 212/500
28/28 [==============================] - ETA: 0s - loss: 1.2772 - f1_score:
0.5859

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 11s 422ms/step - loss: 1.2772 -
f1_score: 0.5859 - val_loss: 1.8312 - val_f1_score: 0.4983
Epoch 213/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2853 - f1_score:
0.5849 - val_loss: 1.8040 - val_f1_score: 0.4811
Epoch 214/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2772 - f1_score:
0.5846 - val_loss: 1.9339 - val_f1_score: 0.4771
Epoch 215/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2467 - f1_score:
```

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0.5982 - val_loss: 1.9632 - val_f1_score: 0.4641
Epoch 216/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2581 - f1_score:
0.5881 - val_loss: 1.8310 - val_f1_score: 0.4794
Epoch 217/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2888 - f1_score:
0.5766 - val_loss: 1.8410 - val_f1_score: 0.4933
Epoch 218/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2688 - f1_score:
0.5970 - val_loss: 1.8961 - val_f1_score: 0.4538
Epoch 219/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2801 - f1_score:
0.5868 - val_loss: 1.9300 - val_f1_score: 0.4677
Epoch 220/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2865 - f1_score:
0.5863 - val_loss: 2.0725 - val_f1_score: 0.4391
Epoch 221/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2514 - f1_score:
0.5960 - val_loss: 1.7901 - val_f1_score: 0.4892
Epoch 222/500
28/28 [==============================] - 2s 61ms/step - loss: 1.2614 - f1_score:
0.5842 - val_loss: 1.8056 - val_f1_score: 0.4948
Epoch 223/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2493 - f1_score:
0.5760 - val_loss: 1.8097 - val_f1_score: 0.4913
Epoch 224/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2296 - f1_score:
0.6053 - val_loss: 1.9692 - val_f1_score: 0.4621
Epoch 225/500
28/28 [==============================] - 2s 62ms/step - loss: 1.3319 - f1_score:
0.5712 - val_loss: 1.8884 - val_f1_score: 0.4710
Epoch 226/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2393 - f1_score:
0.5845 - val_loss: 1.8265 - val_f1_score: 0.4868
Epoch 227/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2131 - f1_score:
0.6117 - val_loss: 1.8348 - val_f1_score: 0.4950
Epoch 228/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2341 - f1_score:
0.5949 - val_loss: 1.9683 - val_f1_score: 0.4845
Epoch 229/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2041 - f1_score:
0.6113 - val_loss: 1.9835 - val_f1_score: 0.4887
Epoch 230/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2106 - f1_score:
0.6048 - val_loss: 1.9151 - val_f1_score: 0.4775
Epoch 231/500
28/28 [==============================] - 2s 65ms/step - loss: 1.2383 - f1_score:
```

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0.6067 - val_loss: 1.8826 - val_f1_score: 0.4848
Epoch 232/500
28/28 [==============================] - 2s 65ms/step - loss: 1.2154 - f1_score:
0.6059 - val_loss: 1.9461 - val_f1_score: 0.4621
Epoch 233/500
28/28 [==============================] - 2s 64ms/step - loss: 1.2296 - f1_score:
0.5940 - val_loss: 1.7981 - val_f1_score: 0.4913
Epoch 234/500
28/28 [==============================] - 2s 62ms/step - loss: 1.2258 - f1_score:
0.6099 - val_loss: 1.8069 - val_f1_score: 0.4788
Epoch 235/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1955 - f1_score:
0.6108 - val_loss: 1.8577 - val_f1_score: 0.4807
Epoch 236/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2085 - f1_score:
0.6008 - val_loss: 1.8825 - val_f1_score: 0.4900
Epoch 237/500
28/28 [==============================] - ETA: 0s - loss: 1.2115 - f1_score:
0.6064

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 12s 441ms/step - loss: 1.2115 -
f1_score: 0.6064 - val_loss: 1.8556 - val_f1_score: 0.4997
Epoch 238/500
28/28 [==============================] - 2s 60ms/step - loss: 1.2129 - f1_score:
0.6005 - val_loss: 2.0666 - val_f1_score: 0.4475
Epoch 239/500
28/28 [==============================] - ETA: 0s - loss: 1.2108 - f1_score:
0.6040

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 10s 360ms/step - loss: 1.2108 -
f1_score: 0.6040 - val_loss: 1.9284 - val_f1_score: 0.5017
Epoch 240/500
28/28 [==============================] - 2s 60ms/step - loss: 1.1889 - f1_score:
0.6054 - val_loss: 1.9243 - val_f1_score: 0.4878
```

```
Epoch 241/500
28/28 [==============================] - 2s 60ms/step - loss: 1.1943 - f1_score:
0.6051 - val_loss: 1.9236 - val_f1_score: 0.4587
Epoch 242/500
28/28 [==============================] - 2s 60ms/step - loss: 1.1869 - f1_score:
0.6203 - val_loss: 1.8476 - val_f1_score: 0.4824
Epoch 243/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1974 - f1_score:
0.6112 - val_loss: 1.9604 - val_f1_score: 0.4812
Epoch 244/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1703 - f1_score:
0.6259 - val_loss: 1.8736 - val_f1_score: 0.4667
Epoch 245/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1985 - f1_score:
0.6037 - val_loss: 1.9045 - val_f1_score: 0.4827
Epoch 246/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1886 - f1_score:
0.6135 - val_loss: 1.9741 - val_f1_score: 0.4708
Epoch 247/500
28/28 [==============================] - 2s 60ms/step - loss: 1.1656 - f1_score:
0.6309 - val_loss: 2.0029 - val_f1_score: 0.4550
Epoch 248/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1254 - f1_score:
0.6232 - val_loss: 1.8290 - val_f1_score: 0.4970
Epoch 249/500
28/28 [==============================] - 2s 60ms/step - loss: 1.1377 - f1_score:
0.6235 - val_loss: 1.9183 - val_f1_score: 0.4874
Epoch 250/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1699 - f1_score:
0.6252 - val_loss: 1.9131 - val_f1_score: 0.4797
Epoch 251/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1775 - f1_score:
0.6321 - val_loss: 1.8305 - val_f1_score: 0.4994
Epoch 252/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1439 - f1_score:
0.6304 - val_loss: 1.9690 - val_f1_score: 0.4847
Epoch 253/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1657 - f1_score:
0.6302 - val_loss: 1.9107 - val_f1_score: 0.4714
Epoch 254/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1289 - f1_score:
0.6336 - val_loss: 1.9881 - val_f1_score: 0.4812
Epoch 255/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1921 - f1_score:
0.6139 - val_loss: 1.8900 - val_f1_score: 0.4753
Epoch 256/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1395 - f1_score:
0.6269 - val_loss: 1.9366 - val_f1_score: 0.4931
```

```
Epoch 257/500
28/28 [==============================] - 2s 64ms/step - loss: 1.1724 - f1_score:
0.6175 - val_loss: 1.9058 - val_f1_score: 0.4704
Epoch 258/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1602 - f1_score:
0.6213 - val_loss: 2.0836 - val_f1_score: 0.4658
Epoch 259/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0989 - f1_score:
0.6383 - val_loss: 1.9435 - val_f1_score: 0.4694
Epoch 260/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1362 - f1_score:
0.6195 - val_loss: 1.8889 - val_f1_score: 0.4811
Epoch 261/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1389 - f1_score:
0.6224 - val_loss: 2.0770 - val_f1_score: 0.4342
Epoch 262/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1264 - f1_score:
0.6309 - val_loss: 1.9438 - val_f1_score: 0.4756
Epoch 263/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1100 - f1_score:
0.6407 - val_loss: 1.9724 - val_f1_score: 0.4618
Epoch 264/500
28/28 [==============================] - 2s 64ms/step - loss: 1.1300 - f1_score:
0.6314 - val_loss: 1.8382 - val_f1_score: 0.4989
Epoch 265/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1172 - f1_score:
0.6226 - val_loss: 1.8927 - val_f1_score: 0.4704
Epoch 266/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1338 - f1_score:
0.6343 - val_loss: 1.8462 - val_f1_score: 0.4778
Epoch 267/500
28/28 [==============================] - ETA: 0s - loss: 1.1143 - f1_score:
0.6313

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 12s 426ms/step - loss: 1.1143 -
f1_score: 0.6313 - val_loss: 1.8340 - val_f1_score: 0.5070
Epoch 268/500
28/28 [==============================] - 2s 60ms/step - loss: 1.0885 - f1_score:
0.6393 - val_loss: 1.9789 - val_f1_score: 0.4755
Epoch 269/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1143 - f1_score:
```

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0.6487 - val_loss: 1.8180 - val_f1_score: 0.5023
Epoch 270/500
28/28 [==============================] - 2s 61ms/step - loss: 1.1128 - f1_score:
0.6268 - val_loss: 2.0550 - val_f1_score: 0.4644
Epoch 271/500
28/28 [==============================] - 2s 60ms/step - loss: 1.0536 - f1_score:
0.6662 - val_loss: 1.9375 - val_f1_score: 0.4883
Epoch 272/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1083 - f1_score:
0.6354 - val_loss: 2.1269 - val_f1_score: 0.4546
Epoch 273/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1579 - f1_score:
0.6235 - val_loss: 1.9991 - val_f1_score: 0.4786
Epoch 274/500
28/28 [==============================] - 2s 66ms/step - loss: 1.0860 - f1_score:
0.6480 - val_loss: 1.8662 - val_f1_score: 0.4834
Epoch 275/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0883 - f1_score:
0.6426 - val_loss: 1.9631 - val_f1_score: 0.4919
Epoch 276/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0900 - f1_score:
0.6372 - val_loss: 1.9787 - val_f1_score: 0.4681
Epoch 277/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0882 - f1_score:
0.6487 - val_loss: 1.8992 - val_f1_score: 0.4690
Epoch 278/500
28/28 [==============================] - 2s 61ms/step - loss: 1.0890 - f1_score:
0.6498 - val_loss: 1.8512 - val_f1_score: 0.4921
Epoch 279/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0917 - f1_score:
0.6393 - val_loss: 1.8992 - val_f1_score: 0.4724
Epoch 280/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0608 - f1_score:
0.6601 - val_loss: 2.0025 - val_f1_score: 0.4661
Epoch 281/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0934 - f1_score:
0.6436 - val_loss: 2.0503 - val_f1_score: 0.4680
Epoch 282/500
28/28 [==============================] - 2s 62ms/step - loss: 1.1084 - f1_score:
0.6392 - val_loss: 1.8932 - val_f1_score: 0.4772
Epoch 283/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0824 - f1_score:
0.6468 - val_loss: 1.9953 - val_f1_score: 0.4611
Epoch 284/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0852 - f1_score:
0.6411 - val_loss: 1.9421 - val_f1_score: 0.4774
Epoch 285/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0935 - f1_score:
```

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0.6491 - val_loss: 1.9847 - val_f1_score: 0.4803
Epoch 286/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0423 - f1_score:
0.6629 - val_loss: 1.9773 - val_f1_score: 0.4753
Epoch 287/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0482 - f1_score:
0.6598 - val_loss: 1.9975 - val_f1_score: 0.4738
Epoch 288/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0552 - f1_score:
0.6593 - val_loss: 2.0840 - val_f1_score: 0.4801
Epoch 289/500
28/28 [==============================] - 2s 65ms/step - loss: 1.0655 - f1_score:
0.6482 - val_loss: 1.9803 - val_f1_score: 0.4729
Epoch 290/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0588 - f1_score:
0.6556 - val_loss: 1.9868 - val_f1_score: 0.4806
Epoch 291/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0586 - f1_score:
0.6521 - val_loss: 1.8813 - val_f1_score: 0.4957
Epoch 292/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0686 - f1_score:
0.6430 - val_loss: 1.9768 - val_f1_score: 0.4710
Epoch 293/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0483 - f1_score:
0.6590 - val_loss: 1.8877 - val_f1_score: 0.4859
Epoch 294/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0151 - f1_score:
0.6705 - val_loss: 1.8542 - val_f1_score: 0.4912
Epoch 295/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0197 - f1_score:
0.6637 - val_loss: 2.0385 - val_f1_score: 0.4862
Epoch 296/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0314 - f1_score:
0.6507 - val_loss: 1.9341 - val_f1_score: 0.4777
Epoch 297/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0318 - f1_score:
0.6511 - val_loss: 1.8601 - val_f1_score: 0.4849
Epoch 298/500
28/28 [==============================] - 2s 66ms/step - loss: 1.0499 - f1_score:
0.6558 - val_loss: 1.9772 - val_f1_score: 0.4963
Epoch 299/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0171 - f1_score:
0.6742 - val_loss: 2.0797 - val_f1_score: 0.4478
Epoch 300/500
28/28 [==============================] - 2s 76ms/step - loss: 1.0487 - f1_score:
0.6689 - val_loss: 1.9242 - val_f1_score: 0.4914
Epoch 301/500
28/28 [==============================] - 2s 65ms/step - loss: 1.0365 - f1_score:
```

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0.6490 - val_loss: 1.9359 - val_f1_score: 0.4982
Epoch 302/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0267 - f1_score:
0.6712 - val_loss: 1.9456 - val_f1_score: 0.4786
Epoch 303/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0438 - f1_score:
0.6489 - val_loss: 1.9161 - val_f1_score: 0.4906
Epoch 304/500
28/28 [==============================] - 2s 64ms/step - loss: 1.0425 - f1_score:
0.6589 - val_loss: 1.9332 - val_f1_score: 0.4850
Epoch 305/500
28/28 [==============================] - 2s 65ms/step - loss: 1.0001 - f1_score:
0.6740 - val_loss: 1.9417 - val_f1_score: 0.4902
Epoch 306/500
28/28 [==============================] - 2s 65ms/step - loss: 1.0141 - f1_score:
0.6683 - val_loss: 2.0561 - val_f1_score: 0.4963
Epoch 307/500
28/28 [==============================] - 2s 66ms/step - loss: 0.9910 - f1_score:
0.6754 - val_loss: 2.0007 - val_f1_score: 0.4765
Epoch 308/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0335 - f1_score:
0.6538 - val_loss: 2.0141 - val_f1_score: 0.4717
Epoch 309/500
28/28 [==============================] - 2s 63ms/step - loss: 1.0224 - f1_score:
0.6607 - val_loss: 2.0141 - val_f1_score: 0.4779
Epoch 310/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0038 - f1_score:
0.6779 - val_loss: 1.8768 - val_f1_score: 0.4742
Epoch 311/500
28/28 [==============================] - ETA: 0s - loss: 1.0080 - f1_score:
0.6601

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

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28/28 [==============================] - 13s 473ms/step - loss: 1.0080 -
f1_score: 0.6601 - val_loss: 1.9540 - val_f1_score: 0.5137
Epoch 312/500
28/28 [==============================] - 2s 62ms/step - loss: 1.0261 - f1_score:
0.6557 - val_loss: 1.9356 - val_f1_score: 0.4956
Epoch 313/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9988 - f1_score:
0.6761 - val_loss: 1.9707 - val_f1_score: 0.4939
Epoch 314/500
```

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28/28 [==============================] - 2s 60ms/step - loss: 1.0075 - f1_score:
0.6711 - val_loss: 2.0371 - val_f1_score: 0.4775
Epoch 315/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9919 - f1_score:
0.6726 - val_loss: 1.9736 - val_f1_score: 0.4943
Epoch 316/500
28/28 [==============================] - 2s 59ms/step - loss: 0.9851 - f1_score:
0.6734 - val_loss: 2.0604 - val_f1_score: 0.4758
Epoch 317/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9802 - f1_score:
0.6731 - val_loss: 2.1442 - val_f1_score: 0.4636
Epoch 318/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9811 - f1_score:
0.6773 - val_loss: 2.0410 - val_f1_score: 0.4726
Epoch 319/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9725 - f1_score:
0.6716 - val_loss: 2.0172 - val_f1_score: 0.4829
Epoch 320/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9830 - f1_score:
0.6645 - val_loss: 2.0213 - val_f1_score: 0.4587
Epoch 321/500
28/28 [==============================] - 2s 61ms/step - loss: 1.0178 - f1_score:
0.6530 - val_loss: 1.8949 - val_f1_score: 0.4865
Epoch 322/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9723 - f1_score:
0.6878 - val_loss: 1.9409 - val_f1_score: 0.4752
Epoch 323/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9767 - f1_score:
0.6771 - val_loss: 1.9824 - val_f1_score: 0.4886
Epoch 324/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9573 - f1_score:
0.7006 - val_loss: 2.0325 - val_f1_score: 0.4871
Epoch 325/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9613 - f1_score:
0.6719 - val_loss: 1.9944 - val_f1_score: 0.4783
Epoch 326/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9989 - f1_score:
0.6772 - val_loss: 2.1122 - val_f1_score: 0.4661
Epoch 327/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9904 - f1_score:
0.6691 - val_loss: 1.9892 - val_f1_score: 0.4925
Epoch 328/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9842 - f1_score:
0.6709 - val_loss: 2.3454 - val_f1_score: 0.4310
Epoch 329/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9659 - f1_score:
0.6854 - val_loss: 2.1119 - val_f1_score: 0.4754
Epoch 330/500
```

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28/28 [==============================] - 2s 62ms/step - loss: 0.9466 - f1_score:
0.6857 - val_loss: 2.0289 - val_f1_score: 0.4797
Epoch 331/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9213 - f1_score:
0.6986 - val_loss: 2.0208 - val_f1_score: 0.5012
Epoch 332/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9486 - f1_score:
0.6883 - val_loss: 1.9760 - val_f1_score: 0.4740
Epoch 333/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9791 - f1_score:
0.6802 - val_loss: 2.1001 - val_f1_score: 0.4587
Epoch 334/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9248 - f1_score:
0.6983 - val_loss: 2.0162 - val_f1_score: 0.4957
Epoch 335/500
28/28 [==============================] - ETA: 0s - loss: 0.9234 - f1_score:
0.6902

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

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28/28 [==============================] - 12s 433ms/step - loss: 0.9234 -
f1_score: 0.6902 - val_loss: 1.9987 - val_f1_score: 0.5171
Epoch 336/500
28/28 [==============================] - 2s 60ms/step - loss: 0.9743 - f1_score:
0.6726 - val_loss: 1.9783 - val_f1_score: 0.4954
Epoch 337/500
28/28 [==============================] - 2s 61ms/step - loss: 0.9614 - f1_score:
0.6894 - val_loss: 1.9711 - val_f1_score: 0.5099
Epoch 338/500
28/28 [==============================] - 2s 68ms/step - loss: 0.9408 - f1_score:
0.6930 - val_loss: 1.9374 - val_f1_score: 0.5120
Epoch 339/500
28/28 [==============================] - 2s 65ms/step - loss: 0.9480 - f1_score:
0.6897 - val_loss: 1.9800 - val_f1_score: 0.5039
Epoch 340/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9395 - f1_score:
0.6993 - val_loss: 1.9677 - val_f1_score: 0.5041
Epoch 341/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9541 - f1_score:
0.6854 - val_loss: 2.1657 - val_f1_score: 0.4458
Epoch 342/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9625 - f1_score:
0.6863 - val_loss: 1.9505 - val_f1_score: 0.5143
```

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Epoch 343/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9540 - f1_score:
0.6852 - val_loss: 2.0326 - val_f1_score: 0.4897
Epoch 344/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9340 - f1_score:
0.6842 - val_loss: 2.0890 - val_f1_score: 0.4572
Epoch 345/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9452 - f1_score:
0.6912 - val_loss: 1.9573 - val_f1_score: 0.5141
Epoch 346/500
28/28 [==============================] - 2s 62ms/step - loss: 0.9007 - f1_score:
0.7029 - val_loss: 2.1376 - val_f1_score: 0.4788
Epoch 347/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9229 - f1_score:
0.7010 - val_loss: 2.0846 - val_f1_score: 0.4824
Epoch 348/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9436 - f1_score:
0.6878 - val_loss: 2.0506 - val_f1_score: 0.4722
Epoch 349/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9064 - f1_score:
0.7015 - val_loss: 2.0248 - val_f1_score: 0.4943
Epoch 350/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9065 - f1_score:
0.7083 - val_loss: 2.1211 - val_f1_score: 0.4652
Epoch 351/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9060 - f1_score:
0.7039 - val_loss: 2.0170 - val_f1_score: 0.5073
Epoch 352/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9225 - f1_score:
0.6964 - val_loss: 2.0715 - val_f1_score: 0.4861
Epoch 353/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8855 - f1_score:
0.7063 - val_loss: 2.1538 - val_f1_score: 0.4711
Epoch 354/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9343 - f1_score:
0.6983 - val_loss: 2.0872 - val_f1_score: 0.4646
Epoch 355/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8940 - f1_score:
0.7146 - val_loss: 2.0382 - val_f1_score: 0.4825
Epoch 356/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8953 - f1_score:
0.7045 - val_loss: 1.9662 - val_f1_score: 0.5057
Epoch 357/500
28/28 [==============================] - 2s 67ms/step - loss: 0.9419 - f1_score:
0.6891 - val_loss: 2.0437 - val_f1_score: 0.4802
Epoch 358/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8868 - f1_score:
0.7113 - val_loss: 2.1218 - val_f1_score: 0.4807
```

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Epoch 359/500
28/28 [==============================] - 2s 63ms/step - loss: 0.9025 - f1_score:
0.7051 - val_loss: 2.0175 - val_f1_score: 0.4800
Epoch 360/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8899 - f1_score:
0.7053 - val_loss: 2.0460 - val_f1_score: 0.4903
Epoch 361/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8903 - f1_score:
0.7114 - val_loss: 2.1689 - val_f1_score: 0.4644
Epoch 362/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8835 - f1_score:
0.7116 - val_loss: 2.0958 - val_f1_score: 0.4961
Epoch 363/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8999 - f1_score:
0.6931 - val_loss: 2.2076 - val_f1_score: 0.4925
Epoch 364/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8700 - f1_score:
0.7168 - val_loss: 2.0273 - val_f1_score: 0.4977
Epoch 365/500
28/28 [==============================] - 2s 62ms/step - loss: 0.8696 - f1_score:
0.7050 - val_loss: 2.2521 - val_f1_score: 0.4415
Epoch 366/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8702 - f1_score:
0.7105 - val_loss: 2.0051 - val_f1_score: 0.5161
Epoch 367/500
28/28 [==============================] - 2s 62ms/step - loss: 0.8797 - f1_score:
0.7209 - val_loss: 2.2362 - val_f1_score: 0.4838
Epoch 368/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8966 - f1_score:
0.7075 - val_loss: 2.0590 - val_f1_score: 0.4771
Epoch 369/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8831 - f1_score:
0.7022 - val_loss: 2.1136 - val_f1_score: 0.4688
Epoch 370/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8949 - f1_score:
0.7030 - val_loss: 1.9580 - val_f1_score: 0.5132
Epoch 371/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8969 - f1_score:
0.7090 - val_loss: 2.0590 - val_f1_score: 0.4629
Epoch 372/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8833 - f1_score:
0.7106 - val_loss: 2.1350 - val_f1_score: 0.4515
Epoch 373/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8529 - f1_score:
0.7255 - val_loss: 2.1113 - val_f1_score: 0.4818
Epoch 374/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8822 - f1_score:
0.7057 - val_loss: 2.1692 - val_f1_score: 0.4901
```

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Epoch 375/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8513 - f1_score:
0.7183 - val_loss: 2.1051 - val_f1_score: 0.4761
Epoch 376/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8491 - f1_score:
0.7208 - val_loss: 2.1672 - val_f1_score: 0.4669
Epoch 377/500
28/28 [==============================] - 2s 63ms/step - loss: 0.8671 - f1_score:
0.7109 - val_loss: 2.0556 - val_f1_score: 0.4914
Epoch 378/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8518 - f1_score:
0.7213 - val_loss: 2.1175 - val_f1_score: 0.4780
Epoch 379/500
28/28 [==============================] - 2s 67ms/step - loss: 0.8536 - f1_score:
0.7116 - val_loss: 2.0853 - val_f1_score: 0.4884
Epoch 380/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8793 - f1_score:
0.7169 - val_loss: 2.0551 - val_f1_score: 0.4869
Epoch 381/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8999 - f1_score:
0.7090 - val_loss: 2.2751 - val_f1_score: 0.4702
Epoch 382/500
28/28 [==============================] - 2s 70ms/step - loss: 0.8605 - f1_score:
0.7186 - val_loss: 2.1020 - val_f1_score: 0.4882
Epoch 383/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8536 - f1_score:
0.7101 - val_loss: 2.0681 - val_f1_score: 0.4602
Epoch 384/500
28/28 [==============================] - 2s 68ms/step - loss: 0.8697 - f1_score:
0.7140 - val_loss: 2.2575 - val_f1_score: 0.4816
Epoch 385/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8571 - f1_score:
0.7169 - val_loss: 2.1077 - val_f1_score: 0.4929
Epoch 386/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8229 - f1_score:
0.7286 - val_loss: 2.2445 - val_f1_score: 0.4415
Epoch 387/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8512 - f1_score:
0.7307 - val_loss: 2.0893 - val_f1_score: 0.4782
Epoch 388/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8677 - f1_score:
0.7110 - val_loss: 2.0852 - val_f1_score: 0.4908
Epoch 389/500
28/28 [==============================] - 2s 67ms/step - loss: 0.8526 - f1_score:
0.7164 - val_loss: 2.0877 - val_f1_score: 0.4973
Epoch 390/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8264 - f1_score:
0.7289 - val_loss: 2.1259 - val_f1_score: 0.4747
```

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Epoch 391/500
28/28 [==============================] - 2s 69ms/step - loss: 0.8272 - f1_score:
0.7297 - val_loss: 2.0941 - val_f1_score: 0.4823
Epoch 392/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8717 - f1_score:
0.7168 - val_loss: 2.2064 - val_f1_score: 0.4775
Epoch 393/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8728 - f1_score:
0.7120 - val_loss: 2.0526 - val_f1_score: 0.4822
Epoch 394/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8183 - f1_score:
0.7292 - val_loss: 2.2450 - val_f1_score: 0.4417
Epoch 395/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8079 - f1_score:
0.7343 - val_loss: 2.1366 - val_f1_score: 0.4988
Epoch 396/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8524 - f1_score:
0.7189 - val_loss: 2.0156 - val_f1_score: 0.5111
Epoch 397/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8043 - f1_score:
0.7338 - val_loss: 2.0936 - val_f1_score: 0.4830
Epoch 398/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8196 - f1_score:
0.7277 - val_loss: 2.2602 - val_f1_score: 0.4634
Epoch 399/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8546 - f1_score:
0.7126 - val_loss: 2.0425 - val_f1_score: 0.5155
Epoch 400/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8118 - f1_score:
0.7411 - val_loss: 2.0862 - val_f1_score: 0.5113
Epoch 401/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8137 - f1_score:
0.7330 - val_loss: 2.1217 - val_f1_score: 0.4606
Epoch 402/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8248 - f1_score:
0.7223 - val_loss: 2.0831 - val_f1_score: 0.5160
Epoch 403/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7865 - f1_score:
0.7455 - val_loss: 2.0680 - val_f1_score: 0.4746
Epoch 404/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8312 - f1_score:
0.7200 - val_loss: 2.1921 - val_f1_score: 0.4526
Epoch 405/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8126 - f1_score:
0.7239 - val_loss: 2.2221 - val_f1_score: 0.4507
Epoch 406/500
28/28 [==============================] - 2s 64ms/step - loss: 0.8177 - f1_score:
0.7273 - val_loss: 2.0984 - val_f1_score: 0.4846
```

```
Epoch 407/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7991 - f1_score:
0.7287 - val_loss: 2.1410 - val_f1_score: 0.4867
Epoch 408/500
28/28 [==============================] - 2s 65ms/step - loss: 0.8247 - f1_score:
0.7315 - val_loss: 2.2570 - val_f1_score: 0.4729
Epoch 409/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7839 - f1_score:
0.7485 - val_loss: 2.0755 - val_f1_score: 0.5012
Epoch 410/500
28/28 [==============================] - 2s 66ms/step - loss: 0.8326 - f1_score:
0.7291 - val_loss: 2.1230 - val_f1_score: 0.4695
Epoch 411/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7841 - f1_score:
0.7441 - val_loss: 2.1358 - val_f1_score: 0.5074
Epoch 412/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7920 - f1_score:
0.7307 - val_loss: 1.9707 - val_f1_score: 0.5033
Epoch 413/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7811 - f1_score:
0.7483 - val_loss: 2.1330 - val_f1_score: 0.5028
Epoch 414/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7921 - f1_score:
0.7462 - val_loss: 2.1666 - val_f1_score: 0.5046
Epoch 415/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7986 - f1_score:
0.7318 - val_loss: 2.1794 - val_f1_score: 0.4968
Epoch 416/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7917 - f1_score:
0.7468 - val_loss: 2.1738 - val_f1_score: 0.4960
Epoch 417/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7891 - f1_score:
0.7471 - val_loss: 2.2154 - val_f1_score: 0.4887
Epoch 418/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7988 - f1_score:
0.7309 - val_loss: 2.1787 - val_f1_score: 0.4893
Epoch 419/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7870 - f1_score:
0.7376 - val_loss: 2.1459 - val_f1_score: 0.4633
Epoch 420/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7507 - f1_score:
0.7452 - val_loss: 2.3041 - val_f1_score: 0.4642
Epoch 421/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7836 - f1_score:
0.7427 - val_loss: 2.2858 - val_f1_score: 0.4816
Epoch 422/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7498 - f1_score:
0.7533 - val_loss: 2.0886 - val_f1_score: 0.4941
```

```
Epoch 423/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7856 - f1_score:
0.7359 - val_loss: 2.1177 - val_f1_score: 0.4881
Epoch 424/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7738 - f1_score:
0.7543 - val_loss: 2.2812 - val_f1_score: 0.4952
Epoch 425/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7945 - f1_score:
0.7389 - val_loss: 2.2089 - val_f1_score: 0.5020
Epoch 426/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7731 - f1_score:
0.7433 - val_loss: 2.2141 - val_f1_score: 0.4609
Epoch 427/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7736 - f1_score:
0.7477 - val_loss: 2.2250 - val_f1_score: 0.4630
Epoch 428/500
28/28 [==============================] - ETA: 0s - loss: 0.7737 - f1_score:
0.7430

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_1_layer_call_fn,
gru_cell_1_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [==============================] - 18s 674ms/step - loss: 0.7737 -
f1_score: 0.7430 - val_loss: 2.1017 - val_f1_score: 0.5181
Epoch 429/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7548 - f1_score:
0.7405 - val_loss: 2.1481 - val_f1_score: 0.5057
Epoch 430/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7579 - f1_score:
0.7571 - val_loss: 2.1506 - val_f1_score: 0.4975
Epoch 431/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7725 - f1_score:
0.7375 - val_loss: 2.1398 - val_f1_score: 0.5000
Epoch 432/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7563 - f1_score:
0.7531 - val_loss: 2.1816 - val_f1_score: 0.4933
Epoch 433/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7919 - f1_score:
0.7427 - val_loss: 2.1610 - val_f1_score: 0.4695
Epoch 434/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7758 - f1_score:
0.7414 - val_loss: 2.2386 - val_f1_score: 0.4667
Epoch 435/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7629 - f1_score:
```

```
0.7568 - val_loss: 2.1759 - val_f1_score: 0.4814
Epoch 436/500
28/28 [==============================] - 2s 61ms/step - loss: 0.7564 - f1_score:
0.7599 - val_loss: 2.0901 - val_f1_score: 0.5051
Epoch 437/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7809 - f1_score:
0.7471 - val_loss: 2.2664 - val_f1_score: 0.4841
Epoch 438/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7471 - f1_score:
0.7576 - val_loss: 2.1090 - val_f1_score: 0.4906
Epoch 439/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7858 - f1_score:
0.7399 - val_loss: 2.4625 - val_f1_score: 0.4812
Epoch 440/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7417 - f1_score:
0.7582 - val_loss: 2.0083 - val_f1_score: 0.5138
Epoch 441/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7619 - f1_score:
0.7519 - val_loss: 2.0876 - val_f1_score: 0.5005
Epoch 442/500
28/28 [==============================] - 2s 62ms/step - loss: 0.7709 - f1_score:
0.7497 - val_loss: 2.1253 - val_f1_score: 0.4688
Epoch 443/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7178 - f1_score:
0.7658 - val_loss: 2.0753 - val_f1_score: 0.4785
Epoch 444/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7160 - f1_score:
0.7678 - val_loss: 2.1484 - val_f1_score: 0.4975
Epoch 445/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7311 - f1_score:
0.7599 - val_loss: 2.2000 - val_f1_score: 0.4776
Epoch 446/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7133 - f1_score:
0.7725 - val_loss: 2.2192 - val_f1_score: 0.4761
Epoch 447/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7550 - f1_score:
0.7520 - val_loss: 2.1111 - val_f1_score: 0.4886
Epoch 448/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7793 - f1_score:
0.7500 - val_loss: 2.1678 - val_f1_score: 0.4806
Epoch 449/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7622 - f1_score:
0.7537 - val_loss: 2.0963 - val_f1_score: 0.4856
Epoch 450/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7022 - f1_score:
0.7625 - val_loss: 2.1352 - val_f1_score: 0.4896
Epoch 451/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6979 - f1_score:
```

```
0.7696 - val_loss: 2.1016 - val_f1_score: 0.4944
Epoch 452/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7153 - f1_score:
0.7595 - val_loss: 2.1731 - val_f1_score: 0.4879
Epoch 453/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7152 - f1_score:
0.7713 - val_loss: 2.1600 - val_f1_score: 0.4958
Epoch 454/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7111 - f1_score:
0.7669 - val_loss: 2.1527 - val_f1_score: 0.4976
Epoch 455/500
28/28 [==============================] - 2s 63ms/step - loss: 0.7615 - f1_score:
0.7501 - val_loss: 2.3176 - val_f1_score: 0.4728
Epoch 456/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7233 - f1_score:
0.7678 - val_loss: 2.1767 - val_f1_score: 0.4941
Epoch 457/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6964 - f1_score:
0.7763 - val_loss: 2.5180 - val_f1_score: 0.4713
Epoch 458/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7497 - f1_score:
0.7519 - val_loss: 2.2037 - val_f1_score: 0.4918
Epoch 459/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7408 - f1_score:
0.7592 - val_loss: 2.1881 - val_f1_score: 0.4629
Epoch 460/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7233 - f1_score:
0.7560 - val_loss: 2.2300 - val_f1_score: 0.4869
Epoch 461/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7560 - f1_score:
0.7511 - val_loss: 2.1120 - val_f1_score: 0.5008
Epoch 462/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7227 - f1_score:
0.7622 - val_loss: 2.0900 - val_f1_score: 0.4919
Epoch 463/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7132 - f1_score:
0.7741 - val_loss: 2.2397 - val_f1_score: 0.4876
Epoch 464/500
28/28 [==============================] - 2s 66ms/step - loss: 0.7031 - f1_score:
0.7713 - val_loss: 2.1497 - val_f1_score: 0.4637
Epoch 465/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7028 - f1_score:
0.7785 - val_loss: 2.2195 - val_f1_score: 0.4841
Epoch 466/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7048 - f1_score:
0.7690 - val_loss: 2.2661 - val_f1_score: 0.4774
Epoch 467/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7193 - f1_score:
```

```
0.7691 - val_loss: 2.2657 - val_f1_score: 0.4757
Epoch 468/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7180 - f1_score:
0.7656 - val_loss: 2.1540 - val_f1_score: 0.4977
Epoch 469/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6991 - f1_score:
0.7713 - val_loss: 2.1871 - val_f1_score: 0.4732
Epoch 470/500
28/28 [==============================] - 2s 67ms/step - loss: 0.6927 - f1_score:
0.7741 - val_loss: 2.2458 - val_f1_score: 0.4812
Epoch 471/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6902 - f1_score:
0.7701 - val_loss: 2.2632 - val_f1_score: 0.4875
Epoch 472/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6972 - f1_score:
0.7712 - val_loss: 2.2865 - val_f1_score: 0.4763
Epoch 473/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7043 - f1_score:
0.7591 - val_loss: 2.1984 - val_f1_score: 0.4917
Epoch 474/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7028 - f1_score:
0.7751 - val_loss: 2.3219 - val_f1_score: 0.5012
Epoch 475/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6856 - f1_score:
0.7701 - val_loss: 2.0978 - val_f1_score: 0.5098
Epoch 476/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7214 - f1_score:
0.7576 - val_loss: 2.1660 - val_f1_score: 0.4882
Epoch 477/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6670 - f1_score:
0.7801 - val_loss: 2.1491 - val_f1_score: 0.4788
Epoch 478/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7102 - f1_score:
0.7723 - val_loss: 2.1417 - val_f1_score: 0.4858
Epoch 479/500
28/28 [==============================] - 2s 64ms/step - loss: 0.7245 - f1_score:
0.7616 - val_loss: 2.2244 - val_f1_score: 0.4765
Epoch 480/500
28/28 [==============================] - 2s 68ms/step - loss: 0.7006 - f1_score:
0.7630 - val_loss: 2.3573 - val_f1_score: 0.4809
Epoch 481/500
28/28 [==============================] - 2s 67ms/step - loss: 0.7118 - f1_score:
0.7582 - val_loss: 2.4362 - val_f1_score: 0.4635
Epoch 482/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6952 - f1_score:
0.7824 - val_loss: 2.3009 - val_f1_score: 0.4669
Epoch 483/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6819 - f1_score:
```

```
0.7781 - val_loss: 2.1996 - val_f1_score: 0.4870
Epoch 484/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6786 - f1_score:
0.7747 - val_loss: 2.3295 - val_f1_score: 0.4790
Epoch 485/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6971 - f1_score:
0.7617 - val_loss: 2.3395 - val_f1_score: 0.4778
Epoch 486/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6944 - f1_score:
0.7758 - val_loss: 2.2149 - val_f1_score: 0.4871
Epoch 487/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6661 - f1_score:
0.7826 - val_loss: 2.2974 - val_f1_score: 0.5095
Epoch 488/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6748 - f1_score:
0.7840 - val_loss: 2.2122 - val_f1_score: 0.4823
Epoch 489/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6831 - f1_score:
0.7734 - val_loss: 2.2991 - val_f1_score: 0.4776
Epoch 490/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6993 - f1_score:
0.7632 - val_loss: 2.2002 - val_f1_score: 0.4935
Epoch 491/500
28/28 [==============================] - 2s 65ms/step - loss: 0.7108 - f1_score:
0.7680 - val_loss: 2.1574 - val_f1_score: 0.4684
Epoch 492/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6916 - f1_score:
0.7745 - val_loss: 2.1603 - val_f1_score: 0.5113
Epoch 493/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6849 - f1_score:
0.7707 - val_loss: 2.4932 - val_f1_score: 0.4740
Epoch 494/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6679 - f1_score:
0.7839 - val_loss: 2.0972 - val_f1_score: 0.5045
Epoch 495/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6713 - f1_score:
0.7817 - val_loss: 2.1005 - val_f1_score: 0.5103
Epoch 496/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6773 - f1_score:
0.7742 - val_loss: 2.1473 - val_f1_score: 0.4839
Epoch 497/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6639 - f1_score:
0.7824 - val_loss: 2.2804 - val_f1_score: 0.4907
Epoch 498/500
28/28 [==============================] - 2s 65ms/step - loss: 0.6624 - f1_score:
0.7827 - val_loss: 2.1574 - val_f1_score: 0.4817
Epoch 499/500
28/28 [==============================] - 2s 66ms/step - loss: 0.6869 - f1_score:
```

```
0.7697 - val_loss: 2.2868 - val_f1_score: 0.5044
Epoch 500/500
28/28 [==============================] - 2s 64ms/step - loss: 0.6887 - f1_score:
0.7751 - val_loss: 2.4691 - val_f1_score: 0.4677
```

[122]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 13ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.750     0.857         8
    BACKPACK      0.667     0.667     0.667         6
  BASKETBALL      0.667     0.800     0.727        10
         BEE      0.000     0.000     0.000        10
        BELT      1.000     0.500     0.667         4
        BITE      1.000     0.250     0.400         8
   BREAKFAST      0.000     0.000     0.000         6
      CANCER      0.625     0.625     0.625         8
   CHRISTMAS      0.286     0.667     0.400         6
    CONFUSED      0.500     0.500     0.500         6
        DARK      0.667     1.000     0.800         4
        DEAF      0.333     0.333     0.333         6
      DECIDE      1.000     0.500     0.667         6
      DEMAND      1.000     0.375     0.545         8
     DEVELOP      0.308     0.667     0.421         6
      DINNER      0.250     0.125     0.167         8
         DOG      1.000     0.833     0.909         6
    DOWNSIZE      0.800     1.000     0.889         8
        DRAG      0.000     0.000     0.000         4
         EAT      0.222     0.333     0.267         6
        EDIT      0.714     0.833     0.769         6
    ELEVATOR      0.200     0.250     0.222         8
        FINE      0.222     0.500     0.308         4
       FLOAT      0.500     0.500     0.500         4
   FOREIGNER      0.750     1.000     0.857         6
       GUESS      0.714     0.625     0.667         8
   HALLOWEEN      0.667     1.000     0.800         8
    HOSPITAL      0.429     0.500     0.462         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      0.750     0.375     0.500         8
       LUNCH      0.100     0.125     0.111         8
       MAPLE      0.200     0.250     0.222         4
```

```
        MEAT      0.167     0.333     0.222         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.267     0.500     0.348         8
        NOON      0.600     0.750     0.667         8
       PARTY      1.000     0.250     0.400         8
     PATIENT      0.000     0.000     0.000         6
       RAZOR      0.000     0.000     0.000         4
       RIVER      1.000     0.667     0.800         6
ROCKINGCHAIR      0.667     1.000     0.800         8
       SHAVE      0.333     0.400     0.364        10
        SINK      0.400     0.333     0.364         6
     SQUEEZE      0.333     0.250     0.286         4
        THEY      0.400     0.500     0.444         4
       TWINS      0.167     0.125     0.143         8
     WHATFOR      0.833     0.500     0.625        10

    accuracy                          0.485       324
   macro avg      0.515     0.480     0.468       324
weighted avg      0.533     0.485     0.476       324


/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[123]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '2 1DCNN + 1 GRU Mish/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[126]:
```
hist_df = pd.read_csv('2 1DCNN + 1 GRU Mish/history.csv', index_col=0)
hist_df.tail()
```

[126]:

	loss	f1_score	val_loss	val_f1_score
495	0.677261	0.774161	2.147294	0.483863
496	0.663863	0.782352	2.280390	0.490715
497	0.662396	0.782707	2.157412	0.481689
498	0.686876	0.769690	2.286758	0.504359
499	0.688723	0.775062	2.469056	0.467741

[127]:

```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[128]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[138]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU Mish")
```

[130]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_2 (Conv1D)           (None, 122, 100)          359200

 max_pooling1d_2 (MaxPooling  (None, 13, 100)          0
 1D)

 conv1d_3 (Conv1D)           (None, 13, 125)           12625

 max_pooling1d_3 (MaxPooling  (None, 13, 125)          0
 1D)
```

```
 dropout_2 (Dropout)         (None, 13, 125)           0

 gru_1 (GRU)                 (None, 75)                45450

 dropout_3 (Dropout)         (None, 75)                0

 dense_2 (Dense)             (None, 100)               7600

 dense_3 (Dense)             (None, 50)                5050

=================================================================
Total params: 429,925
Trainable params: 429,925
Non-trainable params: 0
_________________________________________________________________
```

[131]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[131]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 122, 100)
MaxPooling1D
input: (None, 122, 100)
output: (None, 13, 100)
Conv1D
input: (None, 13, 100)
output: (None, 13, 125)
MaxPooling1D
input: (None, 13, 125)
output: (None, 13, 125)
Dropout
input: (None, 13, 125)
output: (None, 13, 125)
GRU
input: (None, 13, 125)
output: (None, 75)
Dropout
input: (None, 75)
output: (None, 75)
Dense
input: (None, 75)
output: (None, 100)
Dense
input: (None, 100)
output: (None, 50)

[132]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 9ms/step - loss: 2.1017 - f1_score:
0.5181
```

[132]:
```
[2.1016790866851807, 0.5180920958518982]
```

[133]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 12ms/step - loss: 0.4131 - f1_score:
0.8835
```

[133]:
```
[0.41311243176460266, 0.8834774494171143]
```

[134]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 8ms/step
              precision    recall  f1-score   support

         AXE      0.857     0.750     0.800         8
    BACKPACK      0.667     0.667     0.667         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.000     0.000     0.000        10
        BELT      1.000     0.500     0.667         4
        BITE      0.667     0.250     0.364         8
   BREAKFAST      0.000     0.000     0.000         6
      CANCER      0.667     0.750     0.706         8
   CHRISTMAS      0.333     0.500     0.400         6
    CONFUSED      0.429     0.500     0.462         6
        DARK      0.667     1.000     0.800         4
        DEAF      0.250     0.333     0.286         6
      DECIDE      1.000     0.500     0.667         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.444     0.667     0.533         6
      DINNER      0.400     0.250     0.308         8
         DOG      1.000     0.833     0.909         6
    DOWNSIZE      0.727     1.000     0.842         8
        DRAG      0.000     0.000     0.000         4
         EAT      0.333     0.333     0.333         6
        EDIT      0.556     0.833     0.667         6
    ELEVATOR      0.400     0.500     0.444         8
        FINE      0.250     0.500     0.333         4
```

```
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.714     0.625     0.667         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      0.333     0.500     0.400         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.500     0.500     0.500         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      0.833     0.625     0.714         8
       LUNCH      0.222     0.250     0.235         8
       MAPLE      0.400     0.500     0.444         4
        MEAT      0.417     0.833     0.556         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.231     0.375     0.286         8
        NOON      0.625     0.625     0.625         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.333     0.167     0.222         6
       RAZOR      0.500     0.250     0.333         4
       RIVER      0.800     0.667     0.727         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.400     0.400     0.400        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.250     0.250     0.250         4
        THEY      0.333     0.500     0.400         4
       TWINS      0.375     0.375     0.375         8
     WHATFOR      0.714     0.500     0.588        10

    accuracy                          0.543       324
   macro avg      0.537     0.531     0.518       324
weighted avg      0.554     0.543     0.533       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

3.9 Hyperparameter Tuning 1 1D CNN Layer + 1 LSTM

[119]:
```
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_2453193/1222377179.py:2: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, SpatialDropout1D, GRU
import keras_tuner
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='relu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[5, 10, 15, 20],
                       default=20,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
```

```
                values=[5, 10, 15, 20],
                default=20,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(
            LSTM(units=hp.Int('units_1',
                               min_value=50,
                               max_value=200,
                               step=25,
                               default=100),
                 return_sequences=False,
                 kernel_regularizer=regularizers.l2(
                     hp.Float('regularizer',
                               min_value=1e-4,
                               max_value=1e-2,
                               sampling='LOG',
                               default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))
        model.add(
            Dense(units=hp.Int('units_2',
                                min_value=70,
                                max_value=120,
                                step=10,
                                default=80),
                   activation=act_function))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
```

```
                            default=.00062198175395800846)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

[121]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='1_1D_CNN+1_LSTM',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN+1_LSTM/tuner0.json
```

[122]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 10
dense_activation (Choice)
{'default': 'gelu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 20, 'conditions': [], 'values': [5, 10, 15, 20], 'ordered': True}
pool_1 (Choice)
{'default': 20, 'conditions': [], 'values': [5, 10, 15, 20], 'ordered': True}
dropout_1 (Float)
{'default': 0.8, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_2 (Float)
```

```
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0006219817539580085, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[123]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[125]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 18m 16s]
val_f1_score: 0.48599615693092346

Best val_f1_score So Far: 0.6922096014022827
Total elapsed time: 13h 33m 12s
INFO:tensorflow:Oracle triggered exit
```

[122]:
```
best_model = tuner.get_best_models(num_models=10)[0]
```

```
2023-09-10 12:10:16.313283: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-10 12:10:16.402915: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1561 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1

WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
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object: (root).optimizer._variables.9
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object: (root).optimizer._variables.12
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```

```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

[127]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 121, 200)          798200

 max_pooling1d (MaxPooling1D  (None, 24, 200)          0
 )

 dropout (Dropout)           (None, 24, 200)           0

 lstm (LSTM)                 (None, 125)               163000

 dropout_1 (Dropout)         (None, 125)               0

 dense (Dense)               (None, 110)               13860

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 980,610
Trainable params: 980,610
```

```
Non-trainable params: 0
_________________________________________________________________
```

[128]:
```python
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[128]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 121, 200)
MaxPooling1D
input:
(None, 121, 200)
output:
(None, 24, 200)
Dropout
input:
(None, 24, 200)
output:
(None, 24, 200)
LSTM
input:
(None, 24, 200)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[124]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(best_model, legend=True, font=font)
```

[124]:

Conv1D
MaxPooling1D
Dropout
LSTM
Dense

[129]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/1_1D_CNN+1_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0714 summary
Hyperparameters:
dense_activation: elu
filters_1: 200
kernel_1: 10
pool_1: 5
dropout_1: 0.65
units_1: 125
regularizer: 0.0034365682734906543
dropout_2: 0.1
units_2: 110
learning_rate: 0.00015386971155916857
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0711
Score: 0.6922096014022827

Trial 0426 summary
Hyperparameters:
dense_activation: selu
filters_1: 125
kernel_1: 5
pool_1: 15
dropout_1: 0.05
units_1: 50
regularizer: 0.00022773443777239995
dropout_2: 0.2
units_2: 110
learning_rate: 0.0003243806953412315
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0425
Score: 0.6846268773078918
```

```
Trial 0670 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 5
pool_1: 15
dropout_1: 0.4
units_1: 200
regularizer: 0.005387318024861541
dropout_2: 0.30000000000000004
units_2: 70
learning_rate: 0.0004933580644287955
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.6654454171657562

Trial 0717 summary
Hyperparameters:
dense_activation: selu
filters_1: 100
kernel_1: 20
pool_1: 15
dropout_1: 0.55
units_1: 150
regularizer: 0.0024305409582891496
dropout_2: 0.5
units_2: 100
learning_rate: 0.00010335966296352788
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0705
Score: 0.6501639783382416

Trial 0664 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 5
pool_1: 15
dropout_1: 0.4
units_1: 200
regularizer: 0.005387318024861541
dropout_2: 0.30000000000000004
```

```
units_2: 70
learning_rate: 0.0004933580644287955
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0648
Score: 0.646025687456131

Trial 0427 summary
Hyperparameters:
dense_activation: selu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.0
units_1: 125
regularizer: 0.00012376448929669534
dropout_2: 0.2
units_2: 70
learning_rate: 0.0004747431780433045
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0422
Score: 0.6381381154060364

Trial 0425 summary
Hyperparameters:
dense_activation: selu
filters_1: 125
kernel_1: 5
pool_1: 15
dropout_1: 0.05
units_1: 50
regularizer: 0.00022773443777239995
dropout_2: 0.2
units_2: 110
learning_rate: 0.0003243806953412315
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0414
Score: 0.6299729347229004

Trial 0700 summary
```

```
Hyperparameters:
dense_activation: mish
filters_1: 150
kernel_1: 15
pool_1: 10
dropout_1: 0.15000000000000002
units_1: 100
regularizer: 0.006504293881116204
dropout_2: 0.25
units_2: 120
learning_rate: 0.00035152323387747806
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.6299708485603333

Trial 0422 summary
Hyperparameters:
dense_activation: selu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.0
units_1: 125
regularizer: 0.00012376448929669534
dropout_2: 0.2
units_2: 70
learning_rate: 0.0004747431780433045
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0411
Score: 0.6290981769561768

Trial 0711 summary
Hyperparameters:
dense_activation: elu
filters_1: 200
kernel_1: 10
pool_1: 5
dropout_1: 0.65
units_1: 125
regularizer: 0.0034365682734906543
dropout_2: 0.1
units_2: 110
```

```
learning_rate: 0.00015386971155916857
tuner/epochs: 100
tuner/initial_epoch: 0
tuner/bracket: 1
tuner/round: 0
Score: 0.6273985207080841
```

[130]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 3s 60ms/step - loss: 1.2940 - f1_score:
0.6936
```

[142]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 2s 18ms/step - loss: 0.3471 - f1_score:
0.9563
```

[131]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 15ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.462     0.600     0.522        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.250     0.400         8
   BREAKFAST      0.625     0.833     0.714         6
      CANCER      0.800     1.000     0.889         8
   CHRISTMAS      0.667     1.000     0.800         6
    CONFUSED      1.000     1.000     1.000         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.333     0.333     0.333         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.857     0.750     0.800         8
     DEVELOP      1.000     0.333     0.500         6
      DINNER      0.750     0.750     0.750         8
         DOG      0.500     0.333     0.400         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.500     0.500     0.500         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.600     1.000     0.750         6
    ELEVATOR      0.444     0.500     0.471         8
        FINE      1.000     0.250     0.400         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.571     0.500     0.533         8
   HALLOWEEN      0.889     1.000     0.941         8
    HOSPITAL      1.000     0.333     0.500         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      0.667     0.500     0.571         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.545     0.750     0.632         8
       LUNCH      0.571     0.500     0.533         8
       MAPLE      1.000     0.500     0.667         4
        MEAT      0.600     1.000     0.750         6
    MECHANIC      0.667     1.000     0.800         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.583     0.875     0.700         8
        NOON      0.889     1.000     0.941         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.400     0.667     0.500         6
       RAZOR      1.000     0.750     0.857         4
       RIVER      0.455     0.833     0.588         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      1.000     0.800     0.889        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.571     1.000     0.727         4
       TWINS      0.615     1.000     0.762         8
     WHATFOR      1.000     0.400     0.571        10

    accuracy                          0.722       324
   macro avg      0.761     0.710     0.694       324
weighted avg      0.767     0.722     0.704       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[132]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[133]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1DCNN + 1 LSTM/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[134]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - ETA: 0s - loss: 4.9186 - f1_score:
0.0117

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 21s 584ms/step - loss: 4.9186 -
f1_score: 0.0117 - val_loss: 4.8784 - val_f1_score: 7.3404e-04
Epoch 2/500
28/28 [==============================] - 3s 91ms/step - loss: 4.8604 - f1_score:
0.0159 - val_loss: 4.8159 - val_f1_score: 7.2727e-04
Epoch 3/500
28/28 [==============================] - 3s 90ms/step - loss: 4.8141 - f1_score:
0.0162 - val_loss: 4.7778 - val_f1_score: 7.3394e-04
Epoch 4/500
28/28 [==============================] - 3s 91ms/step - loss: 4.7750 - f1_score:
0.0136 - val_loss: 4.7394 - val_f1_score: 7.2727e-04
Epoch 5/500
28/28 [==============================] - 3s 90ms/step - loss: 4.7328 - f1_score:
0.0134 - val_loss: 4.7000 - val_f1_score: 7.2727e-04
Epoch 6/500
28/28 [==============================] - ETA: 0s - loss: 4.6963 - f1_score:
0.0137
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 413ms/step - loss: 4.6963 -
f1_score: 0.0137 - val_loss: 4.6644 - val_f1_score: 0.0012
Epoch 7/500
28/28 [==============================] - 3s 90ms/step - loss: 4.6618 - f1_score:
0.0128 - val_loss: 4.6322 - val_f1_score: 5.0473e-04
Epoch 8/500
28/28 [==============================] - ETA: 0s - loss: 4.6298 - f1_score:
0.0127

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 371ms/step - loss: 4.6298 -
f1_score: 0.0127 - val_loss: 4.6037 - val_f1_score: 0.0012
Epoch 9/500
28/28 [==============================] - ETA: 0s - loss: 4.5921 - f1_score:
0.0116

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 392ms/step - loss: 4.5921 -
f1_score: 0.0116 - val_loss: 4.5712 - val_f1_score: 0.0018
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 4.5678 - f1_score:
0.0158

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 423ms/step - loss: 4.5678 -
f1_score: 0.0158 - val_loss: 4.5355 - val_f1_score: 0.0032
Epoch 11/500
28/28 [==============================] - 3s 90ms/step - loss: 4.5371 - f1_score:
0.0176 - val_loss: 4.5027 - val_f1_score: 0.0012
Epoch 12/500
28/28 [==============================] - 3s 92ms/step - loss: 4.5081 - f1_score:
0.0193 - val_loss: 4.4711 - val_f1_score: 0.0026
Epoch 13/500
28/28 [==============================] - 3s 92ms/step - loss: 4.4721 - f1_score:
0.0184 - val_loss: 4.4628 - val_f1_score: 7.2727e-04
Epoch 14/500
28/28 [==============================] - 3s 93ms/step - loss: 4.4508 - f1_score:
0.0170 - val_loss: 4.4228 - val_f1_score: 0.0012
Epoch 15/500
28/28 [==============================] - ETA: 0s - loss: 4.4173 - f1_score:
0.0186

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 397ms/step - loss: 4.4173 -
f1_score: 0.0186 - val_loss: 4.3913 - val_f1_score: 0.0055
Epoch 16/500
28/28 [==============================] - ETA: 0s - loss: 4.3877 - f1_score:
0.0225

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 421ms/step - loss: 4.3877 -
f1_score: 0.0225 - val_loss: 4.3476 - val_f1_score: 0.0065
Epoch 17/500
28/28 [==============================] - ETA: 0s - loss: 4.3444 - f1_score:
0.0235

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
```

```
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 372ms/step - loss: 4.3444 -
f1_score: 0.0235 - val_loss: 4.2816 - val_f1_score: 0.0203
Epoch 18/500
28/28 [==============================] - 3s 90ms/step - loss: 4.2738 - f1_score:
0.0297 - val_loss: 4.2007 - val_f1_score: 0.0155
Epoch 19/500
28/28 [==============================] - 3s 91ms/step - loss: 4.1782 - f1_score:
0.0303 - val_loss: 4.0966 - val_f1_score: 0.0177
Epoch 20/500
28/28 [==============================] - 3s 92ms/step - loss: 4.1090 - f1_score:
0.0307 - val_loss: 4.0482 - val_f1_score: 0.0015
Epoch 21/500
28/28 [==============================] - 3s 92ms/step - loss: 4.0188 - f1_score:
0.0267 - val_loss: 3.9240 - val_f1_score: 0.0087
Epoch 22/500
28/28 [==============================] - ETA: 0s - loss: 3.9471 - f1_score:
0.0267

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 377ms/step - loss: 3.9471 -
f1_score: 0.0267 - val_loss: 3.8654 - val_f1_score: 0.0275
Epoch 23/500
28/28 [==============================] - ETA: 0s - loss: 3.8857 - f1_score:
0.0339

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 443ms/step - loss: 3.8857 -
f1_score: 0.0339 - val_loss: 3.7526 - val_f1_score: 0.0372
Epoch 24/500
28/28 [==============================] - 3s 91ms/step - loss: 3.7998 - f1_score:
```

```
0.0468 - val_loss: 3.6479 - val_f1_score: 0.0325
Epoch 25/500
28/28 [==============================] - ETA: 0s - loss: 3.7123 - f1_score:
0.0539

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 388ms/step - loss: 3.7123 -
f1_score: 0.0539 - val_loss: 3.5974 - val_f1_score: 0.0397
Epoch 26/500
28/28 [==============================] - ETA: 0s - loss: 3.6145 - f1_score:
0.0699

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 388ms/step - loss: 3.6145 -
f1_score: 0.0699 - val_loss: 3.4944 - val_f1_score: 0.0694
Epoch 27/500
28/28 [==============================] - ETA: 0s - loss: 3.5421 - f1_score:
0.0749

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 388ms/step - loss: 3.5421 -
f1_score: 0.0749 - val_loss: 3.4018 - val_f1_score: 0.0981
Epoch 28/500
28/28 [==============================] - 3s 91ms/step - loss: 3.4578 - f1_score:
0.0854 - val_loss: 3.3306 - val_f1_score: 0.0835
Epoch 29/500
28/28 [==============================] - 3s 91ms/step - loss: 3.3715 - f1_score:
0.0975 - val_loss: 3.2575 - val_f1_score: 0.0912
Epoch 30/500
28/28 [==============================] - 3s 92ms/step - loss: 3.2959 - f1_score:
```

```
0.1200 - val_loss: 3.1341 - val_f1_score: 0.0964
Epoch 31/500
28/28 [==============================] - ETA: 0s - loss: 3.1937 - f1_score:
0.1472

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 426ms/step - loss: 3.1937 -
f1_score: 0.1472 - val_loss: 3.1597 - val_f1_score: 0.1249
Epoch 32/500
28/28 [==============================] - ETA: 0s - loss: 3.1141 - f1_score:
0.1644

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 364ms/step - loss: 3.1141 -
f1_score: 0.1644 - val_loss: 2.9959 - val_f1_score: 0.1294
Epoch 33/500
28/28 [==============================] - ETA: 0s - loss: 3.0187 - f1_score:
0.1801

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 421ms/step - loss: 3.0187 -
f1_score: 0.1801 - val_loss: 3.0235 - val_f1_score: 0.1380
Epoch 34/500
28/28 [==============================] - ETA: 0s - loss: 2.9483 - f1_score:
0.1979

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 373ms/step - loss: 2.9483 -
f1_score: 0.1979 - val_loss: 2.9151 - val_f1_score: 0.1475
Epoch 35/500
28/28 [==============================] - ETA: 0s - loss: 2.9000 - f1_score:
0.1977

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 365ms/step - loss: 2.9000 -
f1_score: 0.1977 - val_loss: 2.8686 - val_f1_score: 0.1805
Epoch 36/500
28/28 [==============================] - ETA: 0s - loss: 2.8038 - f1_score:
0.2256

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 390ms/step - loss: 2.8038 -
f1_score: 0.2256 - val_loss: 2.7776 - val_f1_score: 0.2151
Epoch 37/500
28/28 [==============================] - 3s 90ms/step - loss: 2.7552 - f1_score:
0.2396 - val_loss: 2.8336 - val_f1_score: 0.1994
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 2.6976 - f1_score:
0.2408

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 394ms/step - loss: 2.6976 -
f1_score: 0.2408 - val_loss: 2.7603 - val_f1_score: 0.2160
Epoch 39/500
```

```
28/28 [==============================] - ETA: 0s - loss: 2.6420 - f1_score:
0.2705

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 377ms/step - loss: 2.6420 -
f1_score: 0.2705 - val_loss: 2.6784 - val_f1_score: 0.2535
Epoch 40/500
28/28 [==============================] - ETA: 0s - loss: 2.5720 - f1_score:
0.2779

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 382ms/step - loss: 2.5720 -
f1_score: 0.2779 - val_loss: 2.6147 - val_f1_score: 0.2600
Epoch 41/500
28/28 [==============================] - ETA: 0s - loss: 2.5544 - f1_score:
0.2824

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 370ms/step - loss: 2.5544 -
f1_score: 0.2824 - val_loss: 2.5591 - val_f1_score: 0.2658
Epoch 42/500
28/28 [==============================] - ETA: 0s - loss: 2.4871 - f1_score:
0.3033

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
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INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 383ms/step - loss: 2.4871 -
f1_score: 0.3033 - val_loss: 2.5220 - val_f1_score: 0.3196
Epoch 43/500
28/28 [==============================] - 3s 90ms/step - loss: 2.4579 - f1_score:
0.3151 - val_loss: 2.5531 - val_f1_score: 0.2833
Epoch 44/500
28/28 [==============================] - 3s 92ms/step - loss: 2.4168 - f1_score:
0.3074 - val_loss: 2.4947 - val_f1_score: 0.2923
Epoch 45/500
28/28 [==============================] - 3s 91ms/step - loss: 2.3673 - f1_score:
0.3298 - val_loss: 2.4384 - val_f1_score: 0.3127
Epoch 46/500
28/28 [==============================] - ETA: 0s - loss: 2.3422 - f1_score:
0.3373

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 384ms/step - loss: 2.3422 -
f1_score: 0.3373 - val_loss: 2.3986 - val_f1_score: 0.3377
Epoch 47/500
28/28 [==============================] - 3s 92ms/step - loss: 2.2979 - f1_score:
0.3364 - val_loss: 2.4062 - val_f1_score: 0.3012
Epoch 48/500
28/28 [==============================] - 3s 91ms/step - loss: 2.2461 - f1_score:
0.3670 - val_loss: 2.4009 - val_f1_score: 0.3223
Epoch 49/500
28/28 [==============================] - ETA: 0s - loss: 2.2101 - f1_score:
0.3719

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 365ms/step - loss: 2.2101 -
f1_score: 0.3719 - val_loss: 2.3387 - val_f1_score: 0.3387
Epoch 50/500
28/28 [==============================] - ETA: 0s - loss: 2.1948 - f1_score:
0.3782
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 403ms/step - loss: 2.1948 -
f1_score: 0.3782 - val_loss: 2.3175 - val_f1_score: 0.3499
Epoch 51/500
28/28 [==============================] - 3s 90ms/step - loss: 2.1496 - f1_score:
0.3831 - val_loss: 2.3253 - val_f1_score: 0.3407
Epoch 52/500
28/28 [==============================] - 3s 91ms/step - loss: 2.0961 - f1_score:
0.4186 - val_loss: 2.3213 - val_f1_score: 0.3298
Epoch 53/500
28/28 [==============================] - 3s 93ms/step - loss: 2.0831 - f1_score:
0.4115 - val_loss: 2.3049 - val_f1_score: 0.3215
Epoch 54/500
28/28 [==============================] - 3s 92ms/step - loss: 2.0282 - f1_score:
0.4322 - val_loss: 2.2283 - val_f1_score: 0.3396
Epoch 55/500
28/28 [==============================] - ETA: 0s - loss: 2.0045 - f1_score:
0.4404

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 397ms/step - loss: 2.0045 -
f1_score: 0.4404 - val_loss: 2.1948 - val_f1_score: 0.3557
Epoch 56/500
28/28 [==============================] - 3s 90ms/step - loss: 1.9750 - f1_score:
0.4366 - val_loss: 2.1666 - val_f1_score: 0.3530
Epoch 57/500
28/28 [==============================] - ETA: 0s - loss: 1.9555 - f1_score:
0.4474

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
```

```
28/28 [==============================] - 11s 402ms/step - loss: 1.9555 -
f1_score: 0.4474 - val_loss: 2.1802 - val_f1_score: 0.3701
Epoch 58/500
28/28 [==============================] - ETA: 0s - loss: 1.9216 - f1_score:
0.4538

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 415ms/step - loss: 1.9216 -
f1_score: 0.4538 - val_loss: 2.1159 - val_f1_score: 0.4052
Epoch 59/500
28/28 [==============================] - 3s 90ms/step - loss: 1.8962 - f1_score:
0.4680 - val_loss: 2.1496 - val_f1_score: 0.3804
Epoch 60/500
28/28 [==============================] - 3s 92ms/step - loss: 1.8699 - f1_score:
0.4815 - val_loss: 2.1220 - val_f1_score: 0.3793
Epoch 61/500
28/28 [==============================] - ETA: 0s - loss: 1.8260 - f1_score:
0.4853

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 368ms/step - loss: 1.8260 -
f1_score: 0.4853 - val_loss: 2.0717 - val_f1_score: 0.4151
Epoch 62/500
28/28 [==============================] - 3s 90ms/step - loss: 1.7886 - f1_score:
0.5091 - val_loss: 2.0359 - val_f1_score: 0.3765
Epoch 63/500
28/28 [==============================] - 3s 92ms/step - loss: 1.7692 - f1_score:
0.5071 - val_loss: 2.0803 - val_f1_score: 0.4071
Epoch 64/500
28/28 [==============================] - ETA: 0s - loss: 1.7501 - f1_score:
0.5221

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 446ms/step - loss: 1.7501 -
f1_score: 0.5221 - val_loss: 2.0704 - val_f1_score: 0.4296
Epoch 65/500
28/28 [==============================] - ETA: 0s - loss: 1.7286 - f1_score:
0.5219

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 440ms/step - loss: 1.7286 -
f1_score: 0.5219 - val_loss: 2.0124 - val_f1_score: 0.4389
Epoch 66/500
28/28 [==============================] - ETA: 0s - loss: 1.6844 - f1_score:
0.5243

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 356ms/step - loss: 1.6844 -
f1_score: 0.5243 - val_loss: 2.0116 - val_f1_score: 0.4392
Epoch 67/500
28/28 [==============================] - ETA: 0s - loss: 1.6541 - f1_score:
0.5503

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 404ms/step - loss: 1.6541 -
f1_score: 0.5503 - val_loss: 1.9994 - val_f1_score: 0.4512
Epoch 68/500
28/28 [==============================] - 3s 90ms/step - loss: 1.6243 - f1_score:
0.5506 - val_loss: 1.9779 - val_f1_score: 0.4506
Epoch 69/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.6254 - f1_score:
0.5374

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 372ms/step - loss: 1.6254 -
f1_score: 0.5374 - val_loss: 1.8899 - val_f1_score: 0.4579
Epoch 70/500
28/28 [==============================] - ETA: 0s - loss: 1.5808 - f1_score:
0.5662

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 374ms/step - loss: 1.5808 -
f1_score: 0.5662 - val_loss: 1.9108 - val_f1_score: 0.4754
Epoch 71/500
28/28 [==============================] - 3s 91ms/step - loss: 1.5655 - f1_score:
0.5654 - val_loss: 1.9593 - val_f1_score: 0.4278
Epoch 72/500
28/28 [==============================] - 3s 90ms/step - loss: 1.5652 - f1_score:
0.5528 - val_loss: 1.9353 - val_f1_score: 0.4738
Epoch 73/500
28/28 [==============================] - ETA: 0s - loss: 1.5279 - f1_score:
0.5734

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 443ms/step - loss: 1.5279 -
f1_score: 0.5734 - val_loss: 1.8265 - val_f1_score: 0.4808
Epoch 74/500
28/28 [==============================] - ETA: 0s - loss: 1.4904 - f1_score:
0.5955
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 372ms/step - loss: 1.4904 -
f1_score: 0.5955 - val_loss: 1.8169 - val_f1_score: 0.5082
Epoch 75/500
28/28 [==============================] - 3s 90ms/step - loss: 1.4668 - f1_score:
0.6027 - val_loss: 1.7930 - val_f1_score: 0.4977
Epoch 76/500
28/28 [==============================] - ETA: 0s - loss: 1.4292 - f1_score:
0.6150

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 386ms/step - loss: 1.4292 -
f1_score: 0.6150 - val_loss: 1.8133 - val_f1_score: 0.5454
Epoch 77/500
28/28 [==============================] - 3s 91ms/step - loss: 1.4233 - f1_score:
0.6099 - val_loss: 1.8113 - val_f1_score: 0.5072
Epoch 78/500
28/28 [==============================] - 3s 90ms/step - loss: 1.4163 - f1_score:
0.6091 - val_loss: 1.7714 - val_f1_score: 0.5349
Epoch 79/500
28/28 [==============================] - 3s 93ms/step - loss: 1.4083 - f1_score:
0.6046 - val_loss: 1.7835 - val_f1_score: 0.5281
Epoch 80/500
28/28 [==============================] - 3s 92ms/step - loss: 1.3763 - f1_score:
0.6275 - val_loss: 1.8205 - val_f1_score: 0.5266
Epoch 81/500
28/28 [==============================] - ETA: 0s - loss: 1.3577 - f1_score:
0.6301

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
```

```
28/28 [==============================] - 11s 414ms/step - loss: 1.3577 -
f1_score: 0.6301 - val_loss: 1.7926 - val_f1_score: 0.5540
Epoch 82/500
28/28 [==============================] - ETA: 0s - loss: 1.3202 - f1_score:
0.6375

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 372ms/step - loss: 1.3202 -
f1_score: 0.6375 - val_loss: 1.7429 - val_f1_score: 0.5541
Epoch 83/500
28/28 [==============================] - 3s 90ms/step - loss: 1.3045 - f1_score:
0.6543 - val_loss: 1.6877 - val_f1_score: 0.5494
Epoch 84/500
28/28 [==============================] - 3s 93ms/step - loss: 1.2878 - f1_score:
0.6539 - val_loss: 1.6935 - val_f1_score: 0.5424
Epoch 85/500
28/28 [==============================] - ETA: 0s - loss: 1.2683 - f1_score:
0.6609

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 393ms/step - loss: 1.2683 -
f1_score: 0.6609 - val_loss: 1.7140 - val_f1_score: 0.5621
Epoch 86/500
28/28 [==============================] - 3s 90ms/step - loss: 1.2281 - f1_score:
0.6722 - val_loss: 1.7085 - val_f1_score: 0.5599
Epoch 87/500
28/28 [==============================] - ETA: 0s - loss: 1.2564 - f1_score:
0.6615

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
```

```
28/28 [==============================] - 11s 387ms/step - loss: 1.2564 -
f1_score: 0.6615 - val_loss: 1.6827 - val_f1_score: 0.5641
Epoch 88/500
28/28 [==============================] - ETA: 0s - loss: 1.2353 - f1_score:
0.6595

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 356ms/step - loss: 1.2353 -
f1_score: 0.6595 - val_loss: 1.6850 - val_f1_score: 0.5670
Epoch 89/500
28/28 [==============================] - ETA: 0s - loss: 1.2065 - f1_score:
0.6684

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 378ms/step - loss: 1.2065 -
f1_score: 0.6684 - val_loss: 1.6145 - val_f1_score: 0.5761
Epoch 90/500
28/28 [==============================] - ETA: 0s - loss: 1.1965 - f1_score:
0.6736

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 381ms/step - loss: 1.1965 -
f1_score: 0.6736 - val_loss: 1.6662 - val_f1_score: 0.5823
Epoch 91/500
28/28 [==============================] - 3s 93ms/step - loss: 1.2095 - f1_score:
0.6695 - val_loss: 1.6231 - val_f1_score: 0.5814
Epoch 92/500
28/28 [==============================] - 3s 90ms/step - loss: 1.1517 - f1_score:
0.6971 - val_loss: 1.7137 - val_f1_score: 0.5562
Epoch 93/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.1604 - f1_score:
0.6793

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 10s 370ms/step - loss: 1.1604 -
f1_score: 0.6793 - val_loss: 1.6147 - val_f1_score: 0.6000
Epoch 94/500
28/28 [==============================] - 3s 91ms/step - loss: 1.1598 - f1_score:
0.6859 - val_loss: 1.6395 - val_f1_score: 0.5986
Epoch 95/500
28/28 [==============================] - 3s 91ms/step - loss: 1.1142 - f1_score:
0.6928 - val_loss: 1.6295 - val_f1_score: 0.5839
Epoch 96/500
28/28 [==============================] - ETA: 0s - loss: 1.1020 - f1_score:
0.6987

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 413ms/step - loss: 1.1020 -
f1_score: 0.6987 - val_loss: 1.6141 - val_f1_score: 0.6024
Epoch 97/500
28/28 [==============================] - 3s 90ms/step - loss: 1.1133 - f1_score:
0.7053 - val_loss: 1.6064 - val_f1_score: 0.5935
Epoch 98/500
28/28 [==============================] - 3s 92ms/step - loss: 1.0651 - f1_score:
0.7195 - val_loss: 1.5993 - val_f1_score: 0.5902
Epoch 99/500
28/28 [==============================] - ETA: 0s - loss: 1.0660 - f1_score:
0.7150

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets
```

```
28/28 [==============================] - 10s 372ms/step - loss: 1.0660 -
f1_score: 0.7150 - val_loss: 1.5675 - val_f1_score: 0.6266
Epoch 100/500
28/28 [==============================] - 3s 90ms/step - loss: 1.0552 - f1_score:
0.7247 - val_loss: 1.5641 - val_f1_score: 0.5865
Epoch 101/500
28/28 [==============================] - 3s 92ms/step - loss: 1.0602 - f1_score:
0.7066 - val_loss: 1.5378 - val_f1_score: 0.6098
Epoch 102/500
28/28 [==============================] - 3s 92ms/step - loss: 1.0499 - f1_score:
0.7202 - val_loss: 1.6212 - val_f1_score: 0.5931
Epoch 103/500
28/28 [==============================] - 3s 93ms/step - loss: 1.0258 - f1_score:
0.7268 - val_loss: 1.5532 - val_f1_score: 0.5979
Epoch 104/500
28/28 [==============================] - 3s 95ms/step - loss: 1.0107 - f1_score:
0.7356 - val_loss: 1.5694 - val_f1_score: 0.6004
Epoch 105/500
28/28 [==============================] - 3s 95ms/step - loss: 0.9979 - f1_score:
0.7270 - val_loss: 1.6685 - val_f1_score: 0.5733
Epoch 106/500
28/28 [==============================] - 3s 94ms/step - loss: 0.9837 - f1_score:
0.7463 - val_loss: 1.5923 - val_f1_score: 0.6055
Epoch 107/500
28/28 [==============================] - ETA: 0s - loss: 0.9834 - f1_score:
0.7338

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 399ms/step - loss: 0.9834 -
f1_score: 0.7338 - val_loss: 1.5167 - val_f1_score: 0.6340
Epoch 108/500
28/28 [==============================] - 3s 91ms/step - loss: 0.9537 - f1_score:
0.7522 - val_loss: 1.5862 - val_f1_score: 0.5827
Epoch 109/500
28/28 [==============================] - 3s 94ms/step - loss: 0.9215 - f1_score:
0.7565 - val_loss: 1.5150 - val_f1_score: 0.6299
Epoch 110/500
28/28 [==============================] - 3s 93ms/step - loss: 0.9237 - f1_score:
0.7600 - val_loss: 1.5701 - val_f1_score: 0.6126
Epoch 111/500
28/28 [==============================] - 3s 94ms/step - loss: 0.9131 - f1_score:
0.7630 - val_loss: 1.5221 - val_f1_score: 0.6270
```

```
Epoch 112/500
28/28 [==============================] - ETA: 0s - loss: 0.9309 - f1_score:
0.7590

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 442ms/step - loss: 0.9309 -
f1_score: 0.7590 - val_loss: 1.5057 - val_f1_score: 0.6434
Epoch 113/500
28/28 [==============================] - 3s 93ms/step - loss: 0.8972 - f1_score:
0.7522 - val_loss: 1.5119 - val_f1_score: 0.6230
Epoch 114/500
28/28 [==============================] - 3s 92ms/step - loss: 0.8889 - f1_score:
0.7680 - val_loss: 1.5209 - val_f1_score: 0.6098
Epoch 115/500
28/28 [==============================] - 3s 94ms/step - loss: 0.8706 - f1_score:
0.7734 - val_loss: 1.4631 - val_f1_score: 0.6309
Epoch 116/500
28/28 [==============================] - 3s 94ms/step - loss: 0.8518 - f1_score:
0.7749 - val_loss: 1.4865 - val_f1_score: 0.6202
Epoch 117/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8488 - f1_score:
0.7810 - val_loss: 1.4843 - val_f1_score: 0.6132
Epoch 118/500
28/28 [==============================] - ETA: 0s - loss: 0.8439 - f1_score:
0.7823

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 431ms/step - loss: 0.8439 -
f1_score: 0.7823 - val_loss: 1.4858 - val_f1_score: 0.6470
Epoch 119/500
28/28 [==============================] - 3s 93ms/step - loss: 0.8127 - f1_score:
0.7893 - val_loss: 1.5220 - val_f1_score: 0.6155
Epoch 120/500
28/28 [==============================] - 3s 92ms/step - loss: 0.8356 - f1_score:
0.7740 - val_loss: 1.4602 - val_f1_score: 0.6426
Epoch 121/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 0.8514 - f1_score:
0.7687 - val_loss: 1.4860 - val_f1_score: 0.6345
Epoch 122/500
28/28 [==============================] - ETA: 0s - loss: 0.8146 - f1_score:
0.7903

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 401ms/step - loss: 0.8146 -
f1_score: 0.7903 - val_loss: 1.4479 - val_f1_score: 0.6539
Epoch 123/500
28/28 [==============================] - 3s 90ms/step - loss: 0.7946 - f1_score:
0.7937 - val_loss: 1.4963 - val_f1_score: 0.6395
Epoch 124/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7860 - f1_score:
0.7864 - val_loss: 1.4879 - val_f1_score: 0.6369
Epoch 125/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7854 - f1_score:
0.7930 - val_loss: 1.4724 - val_f1_score: 0.6175
Epoch 126/500
28/28 [==============================] - 3s 95ms/step - loss: 0.7913 - f1_score:
0.7885 - val_loss: 1.4616 - val_f1_score: 0.6446
Epoch 127/500
28/28 [==============================] - 3s 94ms/step - loss: 0.7669 - f1_score:
0.8015 - val_loss: 1.4579 - val_f1_score: 0.6476
Epoch 128/500
28/28 [==============================] - ETA: 0s - loss: 0.7754 - f1_score:
0.7934

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 418ms/step - loss: 0.7754 -
f1_score: 0.7934 - val_loss: 1.4538 - val_f1_score: 0.6569
Epoch 129/500
28/28 [==============================] - 3s 91ms/step - loss: 0.7448 - f1_score:
0.8118 - val_loss: 1.4602 - val_f1_score: 0.6178
Epoch 130/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7405 - f1_score:
```

```
0.8065 - val_loss: 1.5013 - val_f1_score: 0.6208
Epoch 131/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7260 - f1_score:
0.8169 - val_loss: 1.4608 - val_f1_score: 0.6475
Epoch 132/500
28/28 [==============================] - 3s 94ms/step - loss: 0.7259 - f1_score:
0.8090 - val_loss: 1.5261 - val_f1_score: 0.5970
Epoch 133/500
28/28 [==============================] - ETA: 0s - loss: 0.7312 - f1_score:
0.8121

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 417ms/step - loss: 0.7312 -
f1_score: 0.8121 - val_loss: 1.4811 - val_f1_score: 0.6632
Epoch 134/500
28/28 [==============================] - 3s 90ms/step - loss: 0.7426 - f1_score:
0.7962 - val_loss: 1.4688 - val_f1_score: 0.6315
Epoch 135/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7025 - f1_score:
0.8192 - val_loss: 1.5173 - val_f1_score: 0.6377
Epoch 136/500
28/28 [==============================] - 3s 99ms/step - loss: 0.6917 - f1_score:
0.8201 - val_loss: 1.5060 - val_f1_score: 0.6184
Epoch 137/500
28/28 [==============================] - 3s 93ms/step - loss: 0.6850 - f1_score:
0.8228 - val_loss: 1.4202 - val_f1_score: 0.6381
Epoch 138/500
28/28 [==============================] - 3s 100ms/step - loss: 0.6657 -
f1_score: 0.8296 - val_loss: 1.4522 - val_f1_score: 0.6372
Epoch 139/500
28/28 [==============================] - 3s 94ms/step - loss: 0.6560 - f1_score:
0.8361 - val_loss: 1.5058 - val_f1_score: 0.6358
Epoch 140/500
28/28 [==============================] - 3s 97ms/step - loss: 0.6765 - f1_score:
0.8226 - val_loss: 1.4012 - val_f1_score: 0.6565
Epoch 141/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6572 - f1_score:
0.8296 - val_loss: 1.4303 - val_f1_score: 0.6613
Epoch 142/500
28/28 [==============================] - 3s 97ms/step - loss: 0.6709 - f1_score:
0.8224 - val_loss: 1.4359 - val_f1_score: 0.6547
Epoch 143/500
```

```
28/28 [==============================] - 3s 95ms/step - loss: 0.6341 - f1_score:
0.8451 - val_loss: 1.4787 - val_f1_score: 0.6330
Epoch 144/500
28/28 [==============================] - ETA: 0s - loss: 0.6275 - f1_score:
0.8472

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 419ms/step - loss: 0.6275 -
f1_score: 0.8472 - val_loss: 1.4164 - val_f1_score: 0.6773
Epoch 145/500
28/28 [==============================] - 3s 91ms/step - loss: 0.6195 - f1_score:
0.8552 - val_loss: 1.4294 - val_f1_score: 0.6531
Epoch 146/500
28/28 [==============================] - 3s 95ms/step - loss: 0.6122 - f1_score:
0.8448 - val_loss: 1.4669 - val_f1_score: 0.6368
Epoch 147/500
28/28 [==============================] - 3s 94ms/step - loss: 0.6254 - f1_score:
0.8446 - val_loss: 1.5052 - val_f1_score: 0.6263
Epoch 148/500
28/28 [==============================] - 3s 96ms/step - loss: 0.6211 - f1_score:
0.8446 - val_loss: 1.4191 - val_f1_score: 0.6380
Epoch 149/500
28/28 [==============================] - 3s 94ms/step - loss: 0.6110 - f1_score:
0.8359 - val_loss: 1.4915 - val_f1_score: 0.6310
Epoch 150/500
28/28 [==============================] - 3s 96ms/step - loss: 0.6031 - f1_score:
0.8433 - val_loss: 1.4452 - val_f1_score: 0.6294
Epoch 151/500
28/28 [==============================] - 3s 94ms/step - loss: 0.5950 - f1_score:
0.8517 - val_loss: 1.4094 - val_f1_score: 0.6340
Epoch 152/500
28/28 [==============================] - 3s 96ms/step - loss: 0.5759 - f1_score:
0.8625 - val_loss: 1.5001 - val_f1_score: 0.6342
Epoch 153/500
28/28 [==============================] - 3s 95ms/step - loss: 0.5708 - f1_score:
0.8559 - val_loss: 1.3862 - val_f1_score: 0.6707
Epoch 154/500
28/28 [==============================] - 3s 97ms/step - loss: 0.5673 - f1_score:
0.8586 - val_loss: 1.4356 - val_f1_score: 0.6763
Epoch 155/500
28/28 [==============================] - 3s 95ms/step - loss: 0.5508 - f1_score:
0.8680 - val_loss: 1.4747 - val_f1_score: 0.6441
```

```
Epoch 156/500
28/28 [==============================] - 3s 97ms/step - loss: 0.5500 - f1_score:
0.8680 - val_loss: 1.4370 - val_f1_score: 0.6461
Epoch 157/500
28/28 [==============================] - 3s 96ms/step - loss: 0.5285 - f1_score:
0.8807 - val_loss: 1.4745 - val_f1_score: 0.6239
Epoch 158/500
28/28 [==============================] - 3s 100ms/step - loss: 0.5512 -
f1_score: 0.8672 - val_loss: 1.4044 - val_f1_score: 0.6469
Epoch 159/500
28/28 [==============================] - 3s 98ms/step - loss: 0.5335 - f1_score:
0.8699 - val_loss: 1.4310 - val_f1_score: 0.6540
Epoch 160/500
28/28 [==============================] - 3s 95ms/step - loss: 0.5265 - f1_score:
0.8674 - val_loss: 1.3886 - val_f1_score: 0.6528
Epoch 161/500
28/28 [==============================] - 3s 100ms/step - loss: 0.5178 -
f1_score: 0.8740 - val_loss: 1.3992 - val_f1_score: 0.6387
Epoch 162/500
28/28 [==============================] - 3s 96ms/step - loss: 0.5091 - f1_score:
0.8787 - val_loss: 1.3699 - val_f1_score: 0.6687
Epoch 163/500
28/28 [==============================] - 3s 98ms/step - loss: 0.5174 - f1_score:
0.8798 - val_loss: 1.4045 - val_f1_score: 0.6538
Epoch 164/500
28/28 [==============================] - 3s 97ms/step - loss: 0.5161 - f1_score:
0.8757 - val_loss: 1.4092 - val_f1_score: 0.6309
Epoch 165/500
28/28 [==============================] - 3s 99ms/step - loss: 0.5148 - f1_score:
0.8722 - val_loss: 1.4072 - val_f1_score: 0.6425
Epoch 166/500
28/28 [==============================] - 3s 97ms/step - loss: 0.5116 - f1_score:
0.8807 - val_loss: 1.4074 - val_f1_score: 0.6354
Epoch 167/500
28/28 [==============================] - 3s 101ms/step - loss: 0.4898 -
f1_score: 0.8854 - val_loss: 1.4445 - val_f1_score: 0.6486
Epoch 168/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4887 - f1_score:
0.8852 - val_loss: 1.4481 - val_f1_score: 0.6394
Epoch 169/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4993 - f1_score:
0.8822 - val_loss: 1.3662 - val_f1_score: 0.6567
Epoch 170/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4749 - f1_score:
0.8898 - val_loss: 1.4213 - val_f1_score: 0.6521
Epoch 171/500
28/28 [==============================] - 3s 101ms/step - loss: 0.4891 -
f1_score: 0.8788 - val_loss: 1.4210 - val_f1_score: 0.6584
```

```
Epoch 172/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4652 - f1_score:
0.8869 - val_loss: 1.4100 - val_f1_score: 0.6593
Epoch 173/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4766 - f1_score:
0.8859 - val_loss: 1.3934 - val_f1_score: 0.6670
Epoch 174/500
28/28 [==============================] - 3s 100ms/step - loss: 0.4603 -
f1_score: 0.8971 - val_loss: 1.4032 - val_f1_score: 0.6731
Epoch 175/500
28/28 [==============================] - 3s 96ms/step - loss: 0.4612 - f1_score:
0.8889 - val_loss: 1.4156 - val_f1_score: 0.6495
Epoch 176/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4409 - f1_score:
0.8979 - val_loss: 1.3996 - val_f1_score: 0.6612
Epoch 177/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4580 - f1_score:
0.8857 - val_loss: 1.4190 - val_f1_score: 0.6465
Epoch 178/500
28/28 [==============================] - ETA: 0s - loss: 0.4362 - f1_score:
0.9015

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 14s 498ms/step - loss: 0.4362 -
f1_score: 0.9015 - val_loss: 1.3486 - val_f1_score: 0.6791
Epoch 179/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4255 - f1_score:
0.9036 - val_loss: 1.3740 - val_f1_score: 0.6533
Epoch 180/500
28/28 [==============================] - 3s 95ms/step - loss: 0.4382 - f1_score:
0.8955 - val_loss: 1.4018 - val_f1_score: 0.6584
Epoch 181/500
28/28 [==============================] - 3s 95ms/step - loss: 0.4151 - f1_score:
0.9149 - val_loss: 1.3902 - val_f1_score: 0.6620
Epoch 182/500
28/28 [==============================] - 3s 94ms/step - loss: 0.4199 - f1_score:
0.9081 - val_loss: 1.4419 - val_f1_score: 0.6405
Epoch 183/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4278 - f1_score:
0.9011 - val_loss: 1.4711 - val_f1_score: 0.6629
Epoch 184/500
28/28 [==============================] - 3s 95ms/step - loss: 0.4202 - f1_score:
```

```
0.9009 - val_loss: 1.4215 - val_f1_score: 0.6544
Epoch 185/500
28/28 [==============================] - 3s 96ms/step - loss: 0.4160 - f1_score:
0.9057 - val_loss: 1.3926 - val_f1_score: 0.6639
Epoch 186/500
28/28 [==============================] - 3s 95ms/step - loss: 0.4164 - f1_score:
0.9050 - val_loss: 1.4521 - val_f1_score: 0.6464
Epoch 187/500
28/28 [==============================] - 3s 98ms/step - loss: 0.4090 - f1_score:
0.9066 - val_loss: 1.3774 - val_f1_score: 0.6680
Epoch 188/500
28/28 [==============================] - 3s 102ms/step - loss: 0.3822 -
f1_score: 0.9159 - val_loss: 1.4398 - val_f1_score: 0.6285
Epoch 189/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3931 - f1_score:
0.9171 - val_loss: 1.3955 - val_f1_score: 0.6350
Epoch 190/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4056 - f1_score:
0.9129 - val_loss: 1.3625 - val_f1_score: 0.6689
Epoch 191/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3928 - f1_score:
0.9184 - val_loss: 1.4542 - val_f1_score: 0.6485
Epoch 192/500
28/28 [==============================] - 3s 98ms/step - loss: 0.3914 - f1_score:
0.9069 - val_loss: 1.4341 - val_f1_score: 0.6540
Epoch 193/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3794 - f1_score:
0.9192 - val_loss: 1.3513 - val_f1_score: 0.6645
Epoch 194/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3842 - f1_score:
0.9120 - val_loss: 1.3672 - val_f1_score: 0.6548
Epoch 195/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3838 - f1_score:
0.9208 - val_loss: 1.3416 - val_f1_score: 0.6759
Epoch 196/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3760 -
f1_score: 0.9146 - val_loss: 1.3589 - val_f1_score: 0.6630
Epoch 197/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3527 - f1_score:
0.9286 - val_loss: 1.4487 - val_f1_score: 0.6478
Epoch 198/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3694 - f1_score:
0.9188 - val_loss: 1.4312 - val_f1_score: 0.6676
Epoch 199/500
28/28 [==============================] - 3s 103ms/step - loss: 0.3459 -
f1_score: 0.9262 - val_loss: 1.4296 - val_f1_score: 0.6471
Epoch 200/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3722 -
```

```
f1_score: 0.9198 - val_loss: 1.4267 - val_f1_score: 0.6583
Epoch 201/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3564 - f1_score:
0.9173 - val_loss: 1.3803 - val_f1_score: 0.6752
Epoch 202/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3466 - f1_score:
0.9316 - val_loss: 1.4971 - val_f1_score: 0.6569
Epoch 203/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3615 - f1_score:
0.9162 - val_loss: 1.4732 - val_f1_score: 0.6411
Epoch 204/500
28/28 [==============================] - 3s 98ms/step - loss: 0.3460 - f1_score:
0.9293 - val_loss: 1.4440 - val_f1_score: 0.6688
Epoch 205/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3255 - f1_score:
0.9352 - val_loss: 1.3646 - val_f1_score: 0.6614
Epoch 206/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3462 - f1_score:
0.9270 - val_loss: 1.4598 - val_f1_score: 0.6537
Epoch 207/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3388 -
f1_score: 0.9279 - val_loss: 1.3993 - val_f1_score: 0.6620
Epoch 208/500
28/28 [==============================] - 3s 101ms/step - loss: 0.3380 -
f1_score: 0.9242 - val_loss: 1.5281 - val_f1_score: 0.6226
Epoch 209/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3357 - f1_score:
0.9276 - val_loss: 1.4461 - val_f1_score: 0.6363
Epoch 210/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3406 -
f1_score: 0.9219 - val_loss: 1.4549 - val_f1_score: 0.6550
Epoch 211/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3144 -
f1_score: 0.9335 - val_loss: 1.4388 - val_f1_score: 0.6548
Epoch 212/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3312 -
f1_score: 0.9316 - val_loss: 1.4975 - val_f1_score: 0.6464
Epoch 213/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3211 - f1_score:
0.9340 - val_loss: 1.4734 - val_f1_score: 0.6607
Epoch 214/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3202 -
f1_score: 0.9336 - val_loss: 1.4195 - val_f1_score: 0.6531
Epoch 215/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2988 - f1_score:
0.9407 - val_loss: 1.4616 - val_f1_score: 0.6575
Epoch 216/500
28/28 [==============================] - 3s 103ms/step - loss: 0.3067 -
```

```
f1_score: 0.9355 - val_loss: 1.3940 - val_f1_score: 0.6558
Epoch 217/500
28/28 [==============================] - ETA: 0s - loss: 0.3094 - f1_score:
0.9341

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 454ms/step - loss: 0.3094 -
f1_score: 0.9341 - val_loss: 1.3690 - val_f1_score: 0.6978
Epoch 218/500
28/28 [==============================] - 3s 93ms/step - loss: 0.2906 - f1_score:
0.9409 - val_loss: 1.5140 - val_f1_score: 0.6530
Epoch 219/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3125 - f1_score:
0.9370 - val_loss: 1.4748 - val_f1_score: 0.6551
Epoch 220/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3116 - f1_score:
0.9359 - val_loss: 1.3754 - val_f1_score: 0.6709
Epoch 221/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3038 - f1_score:
0.9403 - val_loss: 1.4051 - val_f1_score: 0.6657
Epoch 222/500
28/28 [==============================] - 3s 95ms/step - loss: 0.2830 - f1_score:
0.9472 - val_loss: 1.3614 - val_f1_score: 0.6817
Epoch 223/500
28/28 [==============================] - 3s 97ms/step - loss: 0.3070 - f1_score:
0.9358 - val_loss: 1.4490 - val_f1_score: 0.6818
Epoch 224/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2869 - f1_score:
0.9469 - val_loss: 1.4293 - val_f1_score: 0.6800
Epoch 225/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2889 - f1_score:
0.9405 - val_loss: 1.4772 - val_f1_score: 0.6509
Epoch 226/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2803 - f1_score:
0.9421 - val_loss: 1.3951 - val_f1_score: 0.6625
Epoch 227/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2833 - f1_score:
0.9441 - val_loss: 1.3930 - val_f1_score: 0.6833
Epoch 228/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2890 - f1_score:
0.9389 - val_loss: 1.4203 - val_f1_score: 0.6513
Epoch 229/500
```

```
28/28 [==============================] - 3s 97ms/step - loss: 0.2914 - f1_score:
0.9407 - val_loss: 1.4838 - val_f1_score: 0.6685
Epoch 230/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2802 - f1_score:
0.9478 - val_loss: 1.4845 - val_f1_score: 0.6674
Epoch 231/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2886 - f1_score:
0.9400 - val_loss: 1.4580 - val_f1_score: 0.6609
Epoch 232/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2725 -
f1_score: 0.9494 - val_loss: 1.3599 - val_f1_score: 0.6762
Epoch 233/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2727 - f1_score:
0.9448 - val_loss: 1.3969 - val_f1_score: 0.6858
Epoch 234/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2714 - f1_score:
0.9482 - val_loss: 1.4641 - val_f1_score: 0.6681
Epoch 235/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2645 - f1_score:
0.9536 - val_loss: 1.4060 - val_f1_score: 0.6905
Epoch 236/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2692 -
f1_score: 0.9465 - val_loss: 1.3804 - val_f1_score: 0.6898
Epoch 237/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2548 - f1_score:
0.9523 - val_loss: 1.3955 - val_f1_score: 0.6761
Epoch 238/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2523 - f1_score:
0.9575 - val_loss: 1.3993 - val_f1_score: 0.6734
Epoch 239/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2670 - f1_score:
0.9497 - val_loss: 1.3751 - val_f1_score: 0.6521
Epoch 240/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2630 - f1_score:
0.9499 - val_loss: 1.4605 - val_f1_score: 0.6601
Epoch 241/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2599 - f1_score:
0.9533 - val_loss: 1.5392 - val_f1_score: 0.6542
Epoch 242/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2501 -
f1_score: 0.9520 - val_loss: 1.4377 - val_f1_score: 0.6912
Epoch 243/500
28/28 [==============================] - 3s 102ms/step - loss: 0.2468 -
f1_score: 0.9523 - val_loss: 1.5020 - val_f1_score: 0.6297
Epoch 244/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2566 - f1_score:
0.9550 - val_loss: 1.4080 - val_f1_score: 0.6796
Epoch 245/500
```

```
28/28 [==============================] - 3s 99ms/step - loss: 0.2443 - f1_score:
0.9577 - val_loss: 1.3809 - val_f1_score: 0.6656
Epoch 246/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2429 - f1_score:
0.9531 - val_loss: 1.4568 - val_f1_score: 0.6685
Epoch 247/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2344 -
f1_score: 0.9604 - val_loss: 1.4207 - val_f1_score: 0.6497
Epoch 248/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2445 - f1_score:
0.9502 - val_loss: 1.4043 - val_f1_score: 0.6794
Epoch 249/500
28/28 [==============================] - 3s 101ms/step - loss: 0.2414 -
f1_score: 0.9596 - val_loss: 1.4644 - val_f1_score: 0.6464
Epoch 250/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2341 - f1_score:
0.9559 - val_loss: 1.4953 - val_f1_score: 0.6728
Epoch 251/500
28/28 [==============================] - 3s 104ms/step - loss: 0.2299 -
f1_score: 0.9604 - val_loss: 1.3664 - val_f1_score: 0.6791
Epoch 252/500
28/28 [==============================] - 3s 102ms/step - loss: 0.2246 -
f1_score: 0.9581 - val_loss: 1.3733 - val_f1_score: 0.6741
Epoch 253/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2305 - f1_score:
0.9571 - val_loss: 1.5000 - val_f1_score: 0.6753
Epoch 254/500
28/28 [==============================] - 3s 101ms/step - loss: 0.2188 -
f1_score: 0.9630 - val_loss: 1.4333 - val_f1_score: 0.6691
Epoch 255/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2213 - f1_score:
0.9648 - val_loss: 1.4885 - val_f1_score: 0.6683
Epoch 256/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2151 - f1_score:
0.9656 - val_loss: 1.5316 - val_f1_score: 0.6644
Epoch 257/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2236 - f1_score:
0.9590 - val_loss: 1.6371 - val_f1_score: 0.6589
Epoch 258/500
28/28 [==============================] - 3s 101ms/step - loss: 0.2562 -
f1_score: 0.9490 - val_loss: 1.5164 - val_f1_score: 0.6622
Epoch 259/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2255 - f1_score:
0.9579 - val_loss: 1.4532 - val_f1_score: 0.6612
Epoch 260/500
28/28 [==============================] - 3s 103ms/step - loss: 0.2249 -
f1_score: 0.9630 - val_loss: 1.4578 - val_f1_score: 0.6697
Epoch 261/500
```

```
28/28 [==============================] - 3s 104ms/step - loss: 0.2346 -
f1_score: 0.9528 - val_loss: 1.4624 - val_f1_score: 0.6631
Epoch 262/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2010 - f1_score:
0.9687 - val_loss: 1.4097 - val_f1_score: 0.6621
Epoch 263/500
28/28 [==============================] - 3s 101ms/step - loss: 0.2176 -
f1_score: 0.9601 - val_loss: 1.4253 - val_f1_score: 0.6654
Epoch 264/500
28/28 [==============================] - 3s 97ms/step - loss: 0.2284 - f1_score:
0.9536 - val_loss: 1.4047 - val_f1_score: 0.6711
Epoch 265/500
28/28 [==============================] - 3s 106ms/step - loss: 0.2364 -
f1_score: 0.9523 - val_loss: 1.4082 - val_f1_score: 0.6868
Epoch 266/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2180 - f1_score:
0.9635 - val_loss: 1.4999 - val_f1_score: 0.6522
Epoch 267/500
28/28 [==============================] - 3s 101ms/step - loss: 0.2155 -
f1_score: 0.9615 - val_loss: 1.4506 - val_f1_score: 0.6617
Epoch 268/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2075 - f1_score:
0.9628 - val_loss: 1.3899 - val_f1_score: 0.6680
Epoch 269/500
28/28 [==============================] - 3s 98ms/step - loss: 0.2053 - f1_score:
0.9660 - val_loss: 1.4229 - val_f1_score: 0.6884
Epoch 270/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2094 -
f1_score: 0.9645 - val_loss: 1.3767 - val_f1_score: 0.6902
Epoch 271/500
28/28 [==============================] - 3s 102ms/step - loss: 0.2110 -
f1_score: 0.9667 - val_loss: 1.4745 - val_f1_score: 0.6675
Epoch 272/500
28/28 [==============================] - 3s 100ms/step - loss: 0.2129 -
f1_score: 0.9621 - val_loss: 1.3810 - val_f1_score: 0.6759
Epoch 273/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1982 - f1_score:
0.9688 - val_loss: 1.4838 - val_f1_score: 0.6626
Epoch 274/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1957 -
f1_score: 0.9647 - val_loss: 1.4417 - val_f1_score: 0.6711
Epoch 275/500
28/28 [==============================] - ETA: 0s - loss: 0.2008 - f1_score:
0.9632

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
```

```
after loading.

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 13s 482ms/step - loss: 0.2008 -
f1_score: 0.9632 - val_loss: 1.3804 - val_f1_score: 0.6998
Epoch 276/500
28/28 [==============================] - 3s 93ms/step - loss: 0.1941 - f1_score:
0.9657 - val_loss: 1.3716 - val_f1_score: 0.6603
Epoch 277/500
28/28 [==============================] - 3s 96ms/step - loss: 0.2044 - f1_score:
0.9625 - val_loss: 1.4919 - val_f1_score: 0.6654
Epoch 278/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1853 - f1_score:
0.9701 - val_loss: 1.3645 - val_f1_score: 0.6952
Epoch 279/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1810 - f1_score:
0.9720 - val_loss: 1.3820 - val_f1_score: 0.6854
Epoch 280/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1945 - f1_score:
0.9688 - val_loss: 1.4256 - val_f1_score: 0.6818
Epoch 281/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1754 - f1_score:
0.9720 - val_loss: 1.3951 - val_f1_score: 0.6779
Epoch 282/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1811 - f1_score:
0.9683 - val_loss: 1.3949 - val_f1_score: 0.6831
Epoch 283/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1881 - f1_score:
0.9706 - val_loss: 1.4082 - val_f1_score: 0.6471
Epoch 284/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1844 - f1_score:
0.9704 - val_loss: 1.3849 - val_f1_score: 0.6954
Epoch 285/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1926 - f1_score:
0.9641 - val_loss: 1.5165 - val_f1_score: 0.6552
Epoch 286/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1789 - f1_score:
0.9726 - val_loss: 1.4617 - val_f1_score: 0.6612
Epoch 287/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2121 - f1_score:
0.9572 - val_loss: 1.5508 - val_f1_score: 0.6586
Epoch 288/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1960 - f1_score:
0.9685 - val_loss: 1.4482 - val_f1_score: 0.6701
Epoch 289/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1883 -
```

```
f1_score: 0.9673 - val_loss: 1.5505 - val_f1_score: 0.6465
Epoch 290/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1818 -
f1_score: 0.9654 - val_loss: 1.4349 - val_f1_score: 0.6523
Epoch 291/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1755 - f1_score:
0.9727 - val_loss: 1.4074 - val_f1_score: 0.6656
Epoch 292/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1776 - f1_score:
0.9700 - val_loss: 1.3934 - val_f1_score: 0.6898
Epoch 293/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1646 - f1_score:
0.9764 - val_loss: 1.5060 - val_f1_score: 0.6764
Epoch 294/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1760 - f1_score:
0.9730 - val_loss: 1.4623 - val_f1_score: 0.6796
Epoch 295/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1683 - f1_score:
0.9750 - val_loss: 1.4663 - val_f1_score: 0.6909
Epoch 296/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1764 -
f1_score: 0.9712 - val_loss: 1.4402 - val_f1_score: 0.6939
Epoch 297/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1636 - f1_score:
0.9756 - val_loss: 1.3441 - val_f1_score: 0.6905
Epoch 298/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1818 -
f1_score: 0.9700 - val_loss: 1.4232 - val_f1_score: 0.6662
Epoch 299/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1658 -
f1_score: 0.9746 - val_loss: 1.4769 - val_f1_score: 0.6826
Epoch 300/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1908 - f1_score:
0.9625 - val_loss: 1.4435 - val_f1_score: 0.6766
Epoch 301/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1888 - f1_score:
0.9659 - val_loss: 1.5376 - val_f1_score: 0.6702
Epoch 302/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1658 - f1_score:
0.9735 - val_loss: 1.5269 - val_f1_score: 0.6709
Epoch 303/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1688 - f1_score:
0.9724 - val_loss: 1.4083 - val_f1_score: 0.6675
Epoch 304/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1683 - f1_score:
0.9740 - val_loss: 1.5283 - val_f1_score: 0.6831
Epoch 305/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1659 -
```

```
f1_score: 0.9754 - val_loss: 1.4616 - val_f1_score: 0.6808
Epoch 306/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1706 - f1_score:
0.9690 - val_loss: 1.4774 - val_f1_score: 0.6697
Epoch 307/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1640 -
f1_score: 0.9738 - val_loss: 1.4419 - val_f1_score: 0.6744
Epoch 308/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1659 - f1_score:
0.9712 - val_loss: 1.4629 - val_f1_score: 0.6716
Epoch 309/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1655 - f1_score:
0.9720 - val_loss: 1.6299 - val_f1_score: 0.6387
Epoch 310/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1575 -
f1_score: 0.9765 - val_loss: 1.4868 - val_f1_score: 0.6788
Epoch 311/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1648 - f1_score:
0.9732 - val_loss: 1.4928 - val_f1_score: 0.6675
Epoch 312/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1642 - f1_score:
0.9718 - val_loss: 1.5420 - val_f1_score: 0.6600
Epoch 313/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1847 - f1_score:
0.9641 - val_loss: 1.5929 - val_f1_score: 0.6589
Epoch 314/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1617 -
f1_score: 0.9742 - val_loss: 1.5079 - val_f1_score: 0.6596
Epoch 315/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1658 - f1_score:
0.9745 - val_loss: 1.4541 - val_f1_score: 0.6743
Epoch 316/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1777 -
f1_score: 0.9704 - val_loss: 1.4941 - val_f1_score: 0.6755
Epoch 317/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1486 -
f1_score: 0.9782 - val_loss: 1.3997 - val_f1_score: 0.6797
Epoch 318/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1544 - f1_score:
0.9766 - val_loss: 1.6248 - val_f1_score: 0.6421
Epoch 319/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1718 -
f1_score: 0.9706 - val_loss: 1.5476 - val_f1_score: 0.6729
Epoch 320/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1562 - f1_score:
0.9719 - val_loss: 1.4236 - val_f1_score: 0.6828
Epoch 321/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1813 -
```

```
f1_score: 0.9639 - val_loss: 1.4593 - val_f1_score: 0.6726
Epoch 322/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1582 - f1_score:
0.9725 - val_loss: 1.4069 - val_f1_score: 0.6734
Epoch 323/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1475 -
f1_score: 0.9799 - val_loss: 1.5253 - val_f1_score: 0.6543
Epoch 324/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1555 - f1_score:
0.9725 - val_loss: 1.4487 - val_f1_score: 0.6891
Epoch 325/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1519 -
f1_score: 0.9761 - val_loss: 1.4349 - val_f1_score: 0.6772
Epoch 326/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1513 - f1_score:
0.9757 - val_loss: 1.4576 - val_f1_score: 0.6824
Epoch 327/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1365 -
f1_score: 0.9829 - val_loss: 1.5246 - val_f1_score: 0.6725
Epoch 328/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1757 -
f1_score: 0.9642 - val_loss: 1.4196 - val_f1_score: 0.6791
Epoch 329/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1443 -
f1_score: 0.9802 - val_loss: 1.5214 - val_f1_score: 0.6589
Epoch 330/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1398 - f1_score:
0.9780 - val_loss: 1.5804 - val_f1_score: 0.6410
Epoch 331/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1511 - f1_score:
0.9764 - val_loss: 1.4877 - val_f1_score: 0.6659
Epoch 332/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1401 -
f1_score: 0.9818 - val_loss: 1.5256 - val_f1_score: 0.6664
Epoch 333/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1439 - f1_score:
0.9767 - val_loss: 1.5657 - val_f1_score: 0.6614
Epoch 334/500
28/28 [==============================] - 3s 107ms/step - loss: 0.1502 -
f1_score: 0.9727 - val_loss: 1.4794 - val_f1_score: 0.6863
Epoch 335/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1429 -
f1_score: 0.9748 - val_loss: 1.5465 - val_f1_score: 0.6661
Epoch 336/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1466 - f1_score:
0.9764 - val_loss: 1.4836 - val_f1_score: 0.6662
Epoch 337/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1620 -
```

```
f1_score: 0.9707 - val_loss: 1.4443 - val_f1_score: 0.6975
Epoch 338/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1418 - f1_score:
0.9814 - val_loss: 1.3442 - val_f1_score: 0.6871
Epoch 339/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1433 -
f1_score: 0.9731 - val_loss: 1.5490 - val_f1_score: 0.6566
Epoch 340/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1361 - f1_score:
0.9772 - val_loss: 1.5780 - val_f1_score: 0.6446
Epoch 341/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1380 -
f1_score: 0.9789 - val_loss: 1.3671 - val_f1_score: 0.6941
Epoch 342/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1443 - f1_score:
0.9747 - val_loss: 1.5367 - val_f1_score: 0.6450
Epoch 343/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1471 -
f1_score: 0.9766 - val_loss: 1.6633 - val_f1_score: 0.6437
Epoch 344/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1254 -
f1_score: 0.9829 - val_loss: 1.4867 - val_f1_score: 0.6628
Epoch 345/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1280 - f1_score:
0.9825 - val_loss: 1.5711 - val_f1_score: 0.6767
Epoch 346/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1281 -
f1_score: 0.9817 - val_loss: 1.4450 - val_f1_score: 0.6958
Epoch 347/500
28/28 [==============================] - 3s 103ms/step - loss: 0.1274 -
f1_score: 0.9832 - val_loss: 1.6173 - val_f1_score: 0.6760
Epoch 348/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1392 -
f1_score: 0.9762 - val_loss: 1.4374 - val_f1_score: 0.6504
Epoch 349/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1349 - f1_score:
0.9791 - val_loss: 1.4386 - val_f1_score: 0.6807
Epoch 350/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1448 -
f1_score: 0.9758 - val_loss: 1.5712 - val_f1_score: 0.6498
Epoch 351/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1396 -
f1_score: 0.9781 - val_loss: 1.4665 - val_f1_score: 0.6828
Epoch 352/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1272 - f1_score:
0.9798 - val_loss: 1.5863 - val_f1_score: 0.6745
Epoch 353/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1289 -
```

```
f1_score: 0.9804 - val_loss: 1.4783 - val_f1_score: 0.6644
Epoch 354/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1330 - f1_score:
0.9786 - val_loss: 1.5844 - val_f1_score: 0.6763
Epoch 355/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1425 -
f1_score: 0.9748 - val_loss: 1.5869 - val_f1_score: 0.6842
Epoch 356/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1500 - f1_score:
0.9716 - val_loss: 1.5845 - val_f1_score: 0.6782
Epoch 357/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1453 - f1_score:
0.9738 - val_loss: 1.6103 - val_f1_score: 0.6600
Epoch 358/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1276 - f1_score:
0.9815 - val_loss: 1.4834 - val_f1_score: 0.6802
Epoch 359/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1201 -
f1_score: 0.9843 - val_loss: 1.4749 - val_f1_score: 0.6893
Epoch 360/500
28/28 [==============================] - ETA: 0s - loss: 0.1361 - f1_score:
0.9779

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

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28/28 [==============================] - 14s 516ms/step - loss: 0.1361 -
f1_score: 0.9779 - val_loss: 1.5227 - val_f1_score: 0.7009
Epoch 361/500
28/28 [==============================] - 3s 92ms/step - loss: 0.1356 - f1_score:
0.9773 - val_loss: 1.7088 - val_f1_score: 0.6774
Epoch 362/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1367 - f1_score:
0.9753 - val_loss: 1.7441 - val_f1_score: 0.6572
Epoch 363/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1370 -
f1_score: 0.9750 - val_loss: 1.5022 - val_f1_score: 0.6953
Epoch 364/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1371 - f1_score:
0.9764 - val_loss: 1.6748 - val_f1_score: 0.6554
Epoch 365/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1309 - f1_score:
0.9776 - val_loss: 1.4860 - val_f1_score: 0.6893
Epoch 366/500
```

```
28/28 [==============================] - 3s 97ms/step - loss: 0.1254 - f1_score:
0.9796 - val_loss: 1.5062 - val_f1_score: 0.6889
Epoch 367/500
28/28 [==============================] - 3s 103ms/step - loss: 0.1290 -
f1_score: 0.9805 - val_loss: 1.4709 - val_f1_score: 0.6726
Epoch 368/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1391 - f1_score:
0.9781 - val_loss: 1.6029 - val_f1_score: 0.6730
Epoch 369/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1391 -
f1_score: 0.9711 - val_loss: 1.5781 - val_f1_score: 0.6548
Epoch 370/500
28/28 [==============================] - ETA: 0s - loss: 0.1175 - f1_score:
0.9851

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
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INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 423ms/step - loss: 0.1175 -
f1_score: 0.9851 - val_loss: 1.4634 - val_f1_score: 0.7034
Epoch 371/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1179 - f1_score:
0.9832 - val_loss: 1.5238 - val_f1_score: 0.6914
Epoch 372/500
28/28 [==============================] - 3s 94ms/step - loss: 0.1112 - f1_score:
0.9853 - val_loss: 1.5195 - val_f1_score: 0.6763
Epoch 373/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1123 - f1_score:
0.9883 - val_loss: 1.5274 - val_f1_score: 0.6790
Epoch 374/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1171 - f1_score:
0.9859 - val_loss: 1.6132 - val_f1_score: 0.6987
Epoch 375/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1218 - f1_score:
0.9831 - val_loss: 1.6677 - val_f1_score: 0.6914
Epoch 376/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1259 - f1_score:
0.9799 - val_loss: 1.5379 - val_f1_score: 0.6816
Epoch 377/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1318 - f1_score:
0.9775 - val_loss: 1.5367 - val_f1_score: 0.6901
Epoch 378/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1285 - f1_score:
0.9782 - val_loss: 1.6124 - val_f1_score: 0.6832
```

```
Epoch 379/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1271 - f1_score:
0.9817 - val_loss: 1.5001 - val_f1_score: 0.6944
Epoch 380/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1219 - f1_score:
0.9816 - val_loss: 1.4529 - val_f1_score: 0.6915
Epoch 381/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1225 - f1_score:
0.9811 - val_loss: 1.5809 - val_f1_score: 0.6491
Epoch 382/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1182 - f1_score:
0.9811 - val_loss: 1.5675 - val_f1_score: 0.6991
Epoch 383/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1127 - f1_score:
0.9835 - val_loss: 1.6396 - val_f1_score: 0.6693
Epoch 384/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1031 -
f1_score: 0.9883 - val_loss: 1.5572 - val_f1_score: 0.6477
Epoch 385/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1043 - f1_score:
0.9863 - val_loss: 1.5239 - val_f1_score: 0.6767
Epoch 386/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1211 - f1_score:
0.9821 - val_loss: 1.6215 - val_f1_score: 0.6731
Epoch 387/500
28/28 [==============================] - 3s 96ms/step - loss: 0.1136 - f1_score:
0.9830 - val_loss: 1.4993 - val_f1_score: 0.6876
Epoch 388/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1038 - f1_score:
0.9866 - val_loss: 1.5213 - val_f1_score: 0.6875
Epoch 389/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1197 - f1_score:
0.9782 - val_loss: 1.5736 - val_f1_score: 0.6712
Epoch 390/500
28/28 [==============================] - 3s 107ms/step - loss: 0.1215 -
f1_score: 0.9783 - val_loss: 1.6867 - val_f1_score: 0.6402
Epoch 391/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1229 - f1_score:
0.9768 - val_loss: 1.5369 - val_f1_score: 0.6684
Epoch 392/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1182 - f1_score:
0.9812 - val_loss: 1.7101 - val_f1_score: 0.6521
Epoch 393/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1145 -
f1_score: 0.9845 - val_loss: 1.5450 - val_f1_score: 0.6872
Epoch 394/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1141 - f1_score:
0.9825 - val_loss: 1.5682 - val_f1_score: 0.6846
```

```
Epoch 395/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1248 - f1_score:
0.9793 - val_loss: 1.6018 - val_f1_score: 0.6827
Epoch 396/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1052 - f1_score:
0.9850 - val_loss: 1.5805 - val_f1_score: 0.6569
Epoch 397/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1115 -
f1_score: 0.9843 - val_loss: 1.4836 - val_f1_score: 0.6918
Epoch 398/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1061 - f1_score:
0.9861 - val_loss: 1.6972 - val_f1_score: 0.6715
Epoch 399/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1261 - f1_score:
0.9757 - val_loss: 1.5667 - val_f1_score: 0.6851
Epoch 400/500
28/28 [==============================] - ETA: 0s - loss: 0.1186 - f1_score:
0.9823

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 LSTM/assets

28/28 [==============================] - 13s 478ms/step - loss: 0.1186 -
f1_score: 0.9823 - val_loss: 1.4886 - val_f1_score: 0.7109
Epoch 401/500
28/28 [==============================] - 3s 92ms/step - loss: 0.1219 - f1_score:
0.9828 - val_loss: 1.5921 - val_f1_score: 0.6635
Epoch 402/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1239 - f1_score:
0.9790 - val_loss: 1.5123 - val_f1_score: 0.7084
Epoch 403/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1142 - f1_score:
0.9820 - val_loss: 1.4868 - val_f1_score: 0.6770
Epoch 404/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1003 - f1_score:
0.9882 - val_loss: 1.4456 - val_f1_score: 0.7070
Epoch 405/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0978 - f1_score:
0.9887 - val_loss: 1.4499 - val_f1_score: 0.6845
Epoch 406/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1009 - f1_score:
0.9848 - val_loss: 1.6134 - val_f1_score: 0.6717
Epoch 407/500
28/28 [==============================] - 3s 95ms/step - loss: 0.1149 - f1_score:
```

```
0.9832 - val_loss: 1.5655 - val_f1_score: 0.6814
Epoch 408/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1029 - f1_score:
0.9858 - val_loss: 1.7216 - val_f1_score: 0.6596
Epoch 409/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1044 - f1_score:
0.9849 - val_loss: 1.6354 - val_f1_score: 0.6873
Epoch 410/500
28/28 [==============================] - 3s 104ms/step - loss: 0.1061 -
f1_score: 0.9860 - val_loss: 1.5840 - val_f1_score: 0.6518
Epoch 411/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1077 -
f1_score: 0.9820 - val_loss: 1.7388 - val_f1_score: 0.6830
Epoch 412/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1175 - f1_score:
0.9803 - val_loss: 1.5412 - val_f1_score: 0.7041
Epoch 413/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1097 -
f1_score: 0.9811 - val_loss: 1.7480 - val_f1_score: 0.6700
Epoch 414/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1075 - f1_score:
0.9857 - val_loss: 1.5894 - val_f1_score: 0.6890
Epoch 415/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1033 -
f1_score: 0.9825 - val_loss: 1.6103 - val_f1_score: 0.6702
Epoch 416/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1040 - f1_score:
0.9848 - val_loss: 1.5799 - val_f1_score: 0.6927
Epoch 417/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1335 -
f1_score: 0.9746 - val_loss: 1.6428 - val_f1_score: 0.6832
Epoch 418/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1040 - f1_score:
0.9852 - val_loss: 1.4711 - val_f1_score: 0.7005
Epoch 419/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1127 -
f1_score: 0.9825 - val_loss: 1.4899 - val_f1_score: 0.7072
Epoch 420/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1056 -
f1_score: 0.9844 - val_loss: 1.5611 - val_f1_score: 0.6720
Epoch 421/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1178 -
f1_score: 0.9804 - val_loss: 1.5840 - val_f1_score: 0.6912
Epoch 422/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1037 - f1_score:
0.9856 - val_loss: 1.4735 - val_f1_score: 0.6940
Epoch 423/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1182 - f1_score:
```

```
0.9791 - val_loss: 1.5735 - val_f1_score: 0.6545
Epoch 424/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1130 -
f1_score: 0.9793 - val_loss: 1.5120 - val_f1_score: 0.7014
Epoch 425/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0974 - f1_score:
0.9891 - val_loss: 1.5824 - val_f1_score: 0.7076
Epoch 426/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0997 - f1_score:
0.9872 - val_loss: 1.6230 - val_f1_score: 0.6656
Epoch 427/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0996 - f1_score:
0.9850 - val_loss: 1.5531 - val_f1_score: 0.6960
Epoch 428/500
28/28 [==============================] - 3s 105ms/step - loss: 0.0920 -
f1_score: 0.9877 - val_loss: 1.5693 - val_f1_score: 0.6699
Epoch 429/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1037 - f1_score:
0.9852 - val_loss: 1.5291 - val_f1_score: 0.6872
Epoch 430/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1040 -
f1_score: 0.9870 - val_loss: 1.6848 - val_f1_score: 0.6839
Epoch 431/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1121 -
f1_score: 0.9822 - val_loss: 1.5804 - val_f1_score: 0.6816
Epoch 432/500
28/28 [==============================] - 3s 97ms/step - loss: 0.1127 - f1_score:
0.9820 - val_loss: 1.5861 - val_f1_score: 0.6576
Epoch 433/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1027 -
f1_score: 0.9861 - val_loss: 1.6261 - val_f1_score: 0.6335
Epoch 434/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1039 -
f1_score: 0.9853 - val_loss: 1.6885 - val_f1_score: 0.6523
Epoch 435/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1163 -
f1_score: 0.9807 - val_loss: 1.6340 - val_f1_score: 0.6530
Epoch 436/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1004 - f1_score:
0.9873 - val_loss: 1.4703 - val_f1_score: 0.7033
Epoch 437/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1039 -
f1_score: 0.9838 - val_loss: 1.5808 - val_f1_score: 0.6931
Epoch 438/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0945 - f1_score:
0.9874 - val_loss: 1.7109 - val_f1_score: 0.6844
Epoch 439/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1030 - f1_score:
```

```
0.9816 - val_loss: 1.5737 - val_f1_score: 0.6953
Epoch 440/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0947 -
f1_score: 0.9886 - val_loss: 1.5599 - val_f1_score: 0.6615
Epoch 441/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0906 - f1_score:
0.9891 - val_loss: 1.6103 - val_f1_score: 0.6632
Epoch 442/500
28/28 [==============================] - 3s 100ms/step - loss: 0.1126 -
f1_score: 0.9805 - val_loss: 1.5753 - val_f1_score: 0.6754
Epoch 443/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0993 - f1_score:
0.9862 - val_loss: 1.5926 - val_f1_score: 0.6792
Epoch 444/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0953 -
f1_score: 0.9862 - val_loss: 1.5418 - val_f1_score: 0.6858
Epoch 445/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1076 - f1_score:
0.9828 - val_loss: 1.6103 - val_f1_score: 0.6910
Epoch 446/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1213 -
f1_score: 0.9752 - val_loss: 1.6257 - val_f1_score: 0.6569
Epoch 447/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1152 - f1_score:
0.9795 - val_loss: 1.7515 - val_f1_score: 0.6724
Epoch 448/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1069 - f1_score:
0.9842 - val_loss: 1.7485 - val_f1_score: 0.6707
Epoch 449/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0913 -
f1_score: 0.9874 - val_loss: 1.6520 - val_f1_score: 0.6832
Epoch 450/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1068 - f1_score:
0.9829 - val_loss: 1.6895 - val_f1_score: 0.6782
Epoch 451/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1006 -
f1_score: 0.9886 - val_loss: 1.6374 - val_f1_score: 0.6641
Epoch 452/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0911 - f1_score:
0.9892 - val_loss: 1.4363 - val_f1_score: 0.6881
Epoch 453/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0896 -
f1_score: 0.9899 - val_loss: 1.6172 - val_f1_score: 0.7094
Epoch 454/500
28/28 [==============================] - 3s 102ms/step - loss: 0.0771 -
f1_score: 0.9932 - val_loss: 1.6240 - val_f1_score: 0.6961
Epoch 455/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0882 -
```

```
f1_score: 0.9861 - val_loss: 1.6368 - val_f1_score: 0.6891
Epoch 456/500
28/28 [==============================] - 3s 103ms/step - loss: 0.0791 -
f1_score: 0.9928 - val_loss: 1.6969 - val_f1_score: 0.6836
Epoch 457/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0860 - f1_score:
0.9874 - val_loss: 1.5375 - val_f1_score: 0.6880
Epoch 458/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0922 -
f1_score: 0.9887 - val_loss: 1.8766 - val_f1_score: 0.6607
Epoch 459/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0960 - f1_score:
0.9851 - val_loss: 1.6489 - val_f1_score: 0.6716
Epoch 460/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0908 -
f1_score: 0.9871 - val_loss: 1.6261 - val_f1_score: 0.6633
Epoch 461/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0870 - f1_score:
0.9890 - val_loss: 1.6919 - val_f1_score: 0.6826
Epoch 462/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0883 -
f1_score: 0.9849 - val_loss: 1.6462 - val_f1_score: 0.6635
Epoch 463/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0796 - f1_score:
0.9911 - val_loss: 1.5538 - val_f1_score: 0.6867
Epoch 464/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0987 -
f1_score: 0.9852 - val_loss: 1.7676 - val_f1_score: 0.6595
Epoch 465/500
28/28 [==============================] - 3s 108ms/step - loss: 0.1047 -
f1_score: 0.9818 - val_loss: 1.5789 - val_f1_score: 0.6777
Epoch 466/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1017 -
f1_score: 0.9827 - val_loss: 1.7572 - val_f1_score: 0.6348
Epoch 467/500
28/28 [==============================] - 3s 107ms/step - loss: 0.1021 -
f1_score: 0.9819 - val_loss: 1.7066 - val_f1_score: 0.6406
Epoch 468/500
28/28 [==============================] - 3s 103ms/step - loss: 0.0912 -
f1_score: 0.9855 - val_loss: 1.6340 - val_f1_score: 0.7051
Epoch 469/500
28/28 [==============================] - 3s 104ms/step - loss: 0.0807 -
f1_score: 0.9923 - val_loss: 1.7388 - val_f1_score: 0.6170
Epoch 470/500
28/28 [==============================] - 3s 102ms/step - loss: 0.0877 -
f1_score: 0.9863 - val_loss: 1.5656 - val_f1_score: 0.7003
Epoch 471/500
28/28 [==============================] - 3s 102ms/step - loss: 0.0918 -
```

```
f1_score: 0.9859 - val_loss: 1.6846 - val_f1_score: 0.6864
Epoch 472/500
28/28 [==============================] - 3s 110ms/step - loss: 0.0852 -
f1_score: 0.9863 - val_loss: 1.6830 - val_f1_score: 0.6816
Epoch 473/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0963 -
f1_score: 0.9848 - val_loss: 1.7737 - val_f1_score: 0.6759
Epoch 474/500
28/28 [==============================] - 3s 105ms/step - loss: 0.0874 -
f1_score: 0.9865 - val_loss: 1.6009 - val_f1_score: 0.6733
Epoch 475/500
28/28 [==============================] - 3s 102ms/step - loss: 0.0760 -
f1_score: 0.9913 - val_loss: 1.5571 - val_f1_score: 0.7036
Epoch 476/500
28/28 [==============================] - 3s 113ms/step - loss: 0.0807 -
f1_score: 0.9867 - val_loss: 1.6433 - val_f1_score: 0.6859
Epoch 477/500
28/28 [==============================] - 3s 104ms/step - loss: 0.0753 -
f1_score: 0.9908 - val_loss: 1.6059 - val_f1_score: 0.6952
Epoch 478/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0841 - f1_score:
0.9874 - val_loss: 1.6805 - val_f1_score: 0.6734
Epoch 479/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0800 -
f1_score: 0.9904 - val_loss: 1.7787 - val_f1_score: 0.6478
Epoch 480/500
28/28 [==============================] - 3s 103ms/step - loss: 0.0878 -
f1_score: 0.9840 - val_loss: 1.5948 - val_f1_score: 0.6762
Epoch 481/500
28/28 [==============================] - 3s 109ms/step - loss: 0.0912 -
f1_score: 0.9860 - val_loss: 1.6730 - val_f1_score: 0.6640
Epoch 482/500
28/28 [==============================] - 3s 106ms/step - loss: 0.1006 -
f1_score: 0.9842 - val_loss: 1.6045 - val_f1_score: 0.6571
Epoch 483/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0909 -
f1_score: 0.9886 - val_loss: 1.5634 - val_f1_score: 0.6881
Epoch 484/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0964 -
f1_score: 0.9854 - val_loss: 1.5817 - val_f1_score: 0.6714
Epoch 485/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0852 - f1_score:
0.9912 - val_loss: 1.6894 - val_f1_score: 0.6715
Epoch 486/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0879 -
f1_score: 0.9866 - val_loss: 1.5454 - val_f1_score: 0.6851
Epoch 487/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1081 - f1_score:
```

```
0.9791 - val_loss: 1.7177 - val_f1_score: 0.6793
Epoch 488/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0888 -
f1_score: 0.9857 - val_loss: 1.7011 - val_f1_score: 0.6663
Epoch 489/500
28/28 [==============================] - 3s 98ms/step - loss: 0.0819 - f1_score:
0.9886 - val_loss: 1.6586 - val_f1_score: 0.6711
Epoch 490/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0903 - f1_score:
0.9887 - val_loss: 1.6862 - val_f1_score: 0.6702
Epoch 491/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0953 - f1_score:
0.9840 - val_loss: 1.7634 - val_f1_score: 0.6426
Epoch 492/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1117 - f1_score:
0.9775 - val_loss: 1.6685 - val_f1_score: 0.6855
Epoch 493/500
28/28 [==============================] - 3s 100ms/step - loss: 0.0992 -
f1_score: 0.9838 - val_loss: 1.6049 - val_f1_score: 0.6756
Epoch 494/500
28/28 [==============================] - 3s 97ms/step - loss: 0.0849 - f1_score:
0.9874 - val_loss: 1.6218 - val_f1_score: 0.6950
Epoch 495/500
28/28 [==============================] - 3s 99ms/step - loss: 0.0929 - f1_score:
0.9870 - val_loss: 1.6345 - val_f1_score: 0.6871
Epoch 496/500
28/28 [==============================] - 3s 104ms/step - loss: 0.0896 -
f1_score: 0.9866 - val_loss: 1.6095 - val_f1_score: 0.6685
Epoch 497/500
28/28 [==============================] - 3s 105ms/step - loss: 0.0861 -
f1_score: 0.9862 - val_loss: 1.6843 - val_f1_score: 0.6704
Epoch 498/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0834 -
f1_score: 0.9897 - val_loss: 1.6744 - val_f1_score: 0.6813
Epoch 499/500
28/28 [==============================] - 3s 105ms/step - loss: 0.0754 -
f1_score: 0.9923 - val_loss: 1.6164 - val_f1_score: 0.6971
Epoch 500/500
28/28 [==============================] - 3s 101ms/step - loss: 0.0860 -
f1_score: 0.9894 - val_loss: 1.5675 - val_f1_score: 0.6991
```

[135]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 16ms/step
```

	precision	recall	f1-score	support
AXE	0.889	1.000	0.941	8
BACKPACK	0.500	0.667	0.571	6
BASKETBALL	0.714	1.000	0.833	10
BEE	0.727	0.800	0.762	10
BELT	0.667	1.000	0.800	4
BITE	1.000	0.375	0.545	8
BREAKFAST	1.000	0.500	0.667	6
CANCER	0.800	1.000	0.889	8
CHRISTMAS	0.750	1.000	0.857	6
CONFUSED	0.714	0.833	0.769	6
DARK	1.000	1.000	1.000	4
DEAF	0.222	0.333	0.267	6
DECIDE	1.000	0.833	0.909	6
DEMAND	0.750	0.750	0.750	8
DEVELOP	0.667	0.333	0.444	6
DINNER	0.571	0.500	0.533	8
DOG	1.000	0.833	0.909	6
DOWNSIZE	0.857	0.750	0.800	8
DRAG	1.000	0.500	0.667	4
EAT	0.750	1.000	0.857	6
EDIT	0.667	1.000	0.800	6
ELEVATOR	0.429	0.750	0.545	8
FINE	1.000	0.500	0.667	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.500	0.667	0.571	6
GUESS	1.000	0.750	0.857	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.333	0.333	0.333	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.500	0.500	0.500	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.556	0.625	0.588	8
LUNCH	0.750	0.750	0.750	8
MAPLE	0.667	0.500	0.571	4
MEAT	0.750	1.000	0.857	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.727	1.000	0.842	8
NOON	0.889	1.000	0.941	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.600	0.500	0.545	6
RAZOR	1.000	0.750	0.857	4
RIVER	0.667	1.000	0.800	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	1.000	0.700	0.824	10
SINK	0.000	0.000	0.000	6

```
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.500     1.000     0.667         4
       TWINS      0.600     0.750     0.667         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.725       324
   macro avg      0.739     0.709     0.699       324
weighted avg      0.750     0.725     0.714       324


/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[124]:
```
reconstructed_model = tf.keras.models.load_model("1 1DCNN + 1 LSTM")
```

[125]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_1 (Conv1D)           (None, 121, 200)          798200

 max_pooling1d_1 (MaxPooling  (None, 24, 200)          0
 1D)

 dropout_2 (Dropout)         (None, 24, 200)           0

 lstm_1 (LSTM)               (None, 125)               163000

 dropout_3 (Dropout)         (None, 125)               0

 dense_2 (Dense)             (None, 110)               13860

 dense_3 (Dense)             (None, 50)                5550
```

```
=================================================================
Total params: 980,610
Trainable params: 980,610
Non-trainable params: 0
_________________________________________________________________
```

[126]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[126]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 121, 200)
MaxPooling1D
input:
(None, 121, 200)
output:
(None, 24, 200)
Dropout
input:
(None, 24, 200)
output:
(None, 24, 200)
LSTM
input:
(None, 24, 200)
output:
(None, 125)
Dropout
input:
(None, 125)
output:
(None, 125)
Dense
input:
(None, 125)
output:
(None, 110)
Dense
input:
(None, 110)
output:
(None, 50)

[127]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 30ms/step - loss: 1.4886 - f1_score:
0.7109
```

[127]:
```
[1.4886243343353271, 0.710884690284729]
```

[128]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 13ms/step - loss: 0.0614 - f1_score:
0.9988
```

[128]:
```
[0.06138976290822029, 0.9988435506820679]
```

[129]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
2023-09-23 11:32:33.385799: W
tensorflow/core/common_runtime/bfc_allocator.cc:360] Garbage collection:
deallocate free memory regions (i.e., allocations) so that we can re-allocate a
larger region to avoid OOM due to memory fragmentation. If you see this message
frequently, you are running near the threshold of the available device memory
and re-allocation may incur great performance overhead. You may try smaller
batch sizes to observe the performance impact. Set
TF_ENABLE_GPU_GARBAGE_COLLECTION=false if you'd like to disable this feature.

11/11 [==============================] - 1s 10ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.500     0.667     0.571         6
  BASKETBALL      0.667     1.000     0.800        10
         BEE      0.667     0.800     0.727        10
        BELT      1.000     1.000     1.000         4
        BITE      0.667     0.750     0.706         8
   BREAKFAST      0.833     0.833     0.833         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      0.750     1.000     0.857         6
    CONFUSED      0.833     0.833     0.833         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.400     0.333     0.364         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.500     0.333     0.400         6
```

```
      DINNER      0.800     0.500     0.615         8
         DOG      1.000     1.000     1.000         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      1.000     0.500     0.667         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.667     1.000     0.800         6
    ELEVATOR      0.500     0.750     0.600         8
        FINE      0.286     0.500     0.364         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.500     0.667     0.571         6
       GUESS      0.636     0.875     0.737         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      0.667     0.333     0.444         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      1.000     0.625     0.769         8
       LUNCH      0.857     0.750     0.800         8
       MAPLE      1.000     0.500     0.667         4
        MEAT      0.600     0.500     0.545         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.500     0.875     0.636         8
        NOON      0.667     1.000     0.800         8
       PARTY      0.500     0.625     0.556         8
     PATIENT      0.444     0.667     0.533         6
       RAZOR      1.000     0.500     0.667         4
       RIVER      0.462     1.000     0.632         6
ROCKINGCHAIR      0.889     1.000     0.941         8
       SHAVE      1.000     0.700     0.824        10
        SINK      0.400     0.333     0.364         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.333     0.125     0.182         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.725       324
   macro avg      0.768     0.710     0.711       324
weighted avg      0.765     0.725     0.719       324
```

3.9.1 1 1D-CNN + 1 LSTM Trial 717

[141]:
```
best_model = tuner.get_best_models(num_models=4)[3]
```

```
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
```

```
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.

WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

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object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17

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object: (root).optimizer._variables.17

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object: (root).optimizer._variables.0

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

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object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

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object: (root).optimizer._variables.8

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object: (root).optimizer._variables.9

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object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17

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object: (root).optimizer._variables.0

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object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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object: (root).optimizer._variables.8

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object: (root).optimizer._variables.9

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object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

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object: (root).optimizer._variables.13

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object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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object: (root).optimizer._variables.4

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5

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object: (root).optimizer._variables.6

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8

WARNING:tensorflow:Value in checkpoint could not be found in the restored
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object: (root).optimizer._variables.9

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17

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```
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object: (root).optimizer._variables.1

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```

```
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object: (root).optimizer._variables.8

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object: (root).optimizer._variables.9

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object: (root).optimizer._variables.10

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```

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object: (root).optimizer._variables.5

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6

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object: (root).optimizer._variables.7

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object: (root).optimizer._variables.14

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
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```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17

WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
```

[144]:
```
best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 16ms/step - loss: 0.3942 - f1_score:
0.9258
```

[144]:
```
[0.39421790838241577, 0.9257767200469971]
```

[143]:
```
best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 0s 16ms/step - loss: 1.2795 - f1_score:
0.6979
```

[143]:
```
[1.2794995307922363, 0.6979272365570068]
```

[122]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=5)[4]
```

[123]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1D-CNN + 1 LSTM Trial 717/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[125]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - 9s 100ms/step - loss: 5.2782 -
f1_score: 0.0126 - val_loss: 5.0421 - val_f1_score: 4.8780e-04
Epoch 2/500
28/28 [==============================] - 2s 70ms/step - loss: 4.8651 - f1_score:
0.0108 - val_loss: 4.6806 - val_f1_score: 0.0087
```

```
Epoch 3/500
28/28 [==============================] - 2s 70ms/step - loss: 4.5592 - f1_score:
0.0133 - val_loss: 4.4268 - val_f1_score: 0.0021
Epoch 4/500
28/28 [==============================] - 2s 71ms/step - loss: 4.3551 - f1_score:
0.0134 - val_loss: 4.2690 - val_f1_score: 0.0060
Epoch 5/500
28/28 [==============================] - 2s 72ms/step - loss: 4.2240 - f1_score:
0.0176 - val_loss: 4.1616 - val_f1_score: 0.0066
Epoch 6/500
28/28 [==============================] - 2s 71ms/step - loss: 4.1101 - f1_score:
0.0203 - val_loss: 4.0571 - val_f1_score: 0.0091
Epoch 7/500
28/28 [==============================] - 2s 72ms/step - loss: 3.9644 - f1_score:
0.0220 - val_loss: 3.7994 - val_f1_score: 0.0367
Epoch 8/500
28/28 [==============================] - 2s 72ms/step - loss: 3.7225 - f1_score:
0.0381 - val_loss: 3.4766 - val_f1_score: 0.0506
Epoch 9/500
28/28 [==============================] - 2s 73ms/step - loss: 3.4899 - f1_score:
0.0641 - val_loss: 3.2902 - val_f1_score: 0.0799
Epoch 10/500
28/28 [==============================] - 2s 73ms/step - loss: 3.2536 - f1_score:
0.1001 - val_loss: 3.1469 - val_f1_score: 0.0701
Epoch 11/500
28/28 [==============================] - 2s 73ms/step - loss: 3.0690 - f1_score:
0.1211 - val_loss: 2.8520 - val_f1_score: 0.1209
Epoch 12/500
28/28 [==============================] - 2s 73ms/step - loss: 2.9038 - f1_score:
0.1639 - val_loss: 2.8228 - val_f1_score: 0.1236
Epoch 13/500
28/28 [==============================] - 2s 74ms/step - loss: 2.7710 - f1_score:
0.1842 - val_loss: 2.6746 - val_f1_score: 0.1877
Epoch 14/500
28/28 [==============================] - 2s 74ms/step - loss: 2.6422 - f1_score:
0.2082 - val_loss: 2.5760 - val_f1_score: 0.2095
Epoch 15/500
28/28 [==============================] - 2s 73ms/step - loss: 2.5563 - f1_score:
0.2310 - val_loss: 2.4176 - val_f1_score: 0.2249
Epoch 16/500
28/28 [==============================] - 2s 73ms/step - loss: 2.4805 - f1_score:
0.2514 - val_loss: 2.3328 - val_f1_score: 0.2606
Epoch 17/500
28/28 [==============================] - 2s 80ms/step - loss: 2.4037 - f1_score:
0.2737 - val_loss: 2.2877 - val_f1_score: 0.3178
Epoch 18/500
28/28 [==============================] - 2s 73ms/step - loss: 2.3072 - f1_score:
0.3106 - val_loss: 2.3369 - val_f1_score: 0.2313
```

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Epoch 19/500
28/28 [==============================] - 2s 74ms/step - loss: 2.2599 - f1_score:
0.3253 - val_loss: 2.1762 - val_f1_score: 0.2875
Epoch 20/500
28/28 [==============================] - 2s 74ms/step - loss: 2.1833 - f1_score:
0.3456 - val_loss: 2.1448 - val_f1_score: 0.3264
Epoch 21/500
28/28 [==============================] - 2s 74ms/step - loss: 2.1228 - f1_score:
0.3637 - val_loss: 2.1514 - val_f1_score: 0.3542
Epoch 22/500
28/28 [==============================] - 2s 74ms/step - loss: 2.0731 - f1_score:
0.3680 - val_loss: 2.1059 - val_f1_score: 0.3795
Epoch 23/500
28/28 [==============================] - 2s 75ms/step - loss: 2.0323 - f1_score:
0.3781 - val_loss: 2.0913 - val_f1_score: 0.3603
Epoch 24/500
28/28 [==============================] - 2s 75ms/step - loss: 1.9664 - f1_score:
0.4110 - val_loss: 2.0514 - val_f1_score: 0.3661
Epoch 25/500
28/28 [==============================] - 2s 74ms/step - loss: 1.9248 - f1_score:
0.4187 - val_loss: 1.9504 - val_f1_score: 0.4315
Epoch 26/500
28/28 [==============================] - 2s 74ms/step - loss: 1.8371 - f1_score:
0.4511 - val_loss: 1.9159 - val_f1_score: 0.4021
Epoch 27/500
28/28 [==============================] - 2s 75ms/step - loss: 1.8071 - f1_score:
0.4536 - val_loss: 1.9648 - val_f1_score: 0.4080
Epoch 28/500
28/28 [==============================] - 2s 75ms/step - loss: 1.7496 - f1_score:
0.4843 - val_loss: 1.8923 - val_f1_score: 0.4629
Epoch 29/500
28/28 [==============================] - 2s 75ms/step - loss: 1.7215 - f1_score:
0.4775 - val_loss: 1.8206 - val_f1_score: 0.4677
Epoch 30/500
28/28 [==============================] - 2s 76ms/step - loss: 1.6745 - f1_score:
0.5009 - val_loss: 1.8742 - val_f1_score: 0.4427
Epoch 31/500
28/28 [==============================] - 2s 81ms/step - loss: 1.6460 - f1_score:
0.4909 - val_loss: 1.8588 - val_f1_score: 0.4257
Epoch 32/500
28/28 [==============================] - 2s 74ms/step - loss: 1.6141 - f1_score:
0.5029 - val_loss: 1.8416 - val_f1_score: 0.4643
Epoch 33/500
28/28 [==============================] - 2s 75ms/step - loss: 1.5556 - f1_score:
0.5292 - val_loss: 1.8271 - val_f1_score: 0.4691
Epoch 34/500
28/28 [==============================] - 2s 74ms/step - loss: 1.5374 - f1_score:
0.5319 - val_loss: 1.6473 - val_f1_score: 0.5301
```

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Epoch 35/500
28/28 [==============================] - 2s 76ms/step - loss: 1.4912 - f1_score:
0.5543 - val_loss: 1.7276 - val_f1_score: 0.4914
Epoch 36/500
28/28 [==============================] - 2s 77ms/step - loss: 1.4867 - f1_score:
0.5490 - val_loss: 1.7240 - val_f1_score: 0.4995
Epoch 37/500
28/28 [==============================] - 2s 75ms/step - loss: 1.4442 - f1_score:
0.5726 - val_loss: 1.6949 - val_f1_score: 0.5010
Epoch 38/500
28/28 [==============================] - 2s 79ms/step - loss: 1.4006 - f1_score:
0.5790 - val_loss: 1.6431 - val_f1_score: 0.5381
Epoch 39/500
28/28 [==============================] - 2s 75ms/step - loss: 1.3870 - f1_score:
0.5865 - val_loss: 1.6722 - val_f1_score: 0.5158
Epoch 40/500
28/28 [==============================] - 2s 77ms/step - loss: 1.3421 - f1_score:
0.6072 - val_loss: 1.5479 - val_f1_score: 0.5531
Epoch 41/500
28/28 [==============================] - 2s 86ms/step - loss: 1.3359 - f1_score:
0.6074 - val_loss: 1.5811 - val_f1_score: 0.5437
Epoch 42/500
28/28 [==============================] - 2s 75ms/step - loss: 1.3049 - f1_score:
0.6167 - val_loss: 1.5749 - val_f1_score: 0.5432
Epoch 43/500
28/28 [==============================] - 2s 76ms/step - loss: 1.2804 - f1_score:
0.6244 - val_loss: 1.5216 - val_f1_score: 0.5524
Epoch 44/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2588 - f1_score:
0.6186 - val_loss: 1.4964 - val_f1_score: 0.5805
Epoch 45/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2257 - f1_score:
0.6351 - val_loss: 1.5034 - val_f1_score: 0.5725
Epoch 46/500
28/28 [==============================] - 2s 76ms/step - loss: 1.2200 - f1_score:
0.6352 - val_loss: 1.4857 - val_f1_score: 0.5832
Epoch 47/500
28/28 [==============================] - 2s 74ms/step - loss: 1.1956 - f1_score:
0.6526 - val_loss: 1.4683 - val_f1_score: 0.5537
Epoch 48/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1650 - f1_score:
0.6584 - val_loss: 1.4423 - val_f1_score: 0.6029
Epoch 49/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1424 - f1_score:
0.6525 - val_loss: 1.4321 - val_f1_score: 0.5789
Epoch 50/500
28/28 [==============================] - 2s 76ms/step - loss: 1.1460 - f1_score:
0.6579 - val_loss: 1.4267 - val_f1_score: 0.5664
```

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Epoch 51/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1039 - f1_score:
0.6781 - val_loss: 1.5015 - val_f1_score: 0.5576
Epoch 52/500
28/28 [==============================] - 2s 76ms/step - loss: 1.1130 - f1_score:
0.6603 - val_loss: 1.4515 - val_f1_score: 0.5776
Epoch 53/500
28/28 [==============================] - 2s 76ms/step - loss: 1.0678 - f1_score:
0.6873 - val_loss: 1.4235 - val_f1_score: 0.6032
Epoch 54/500
28/28 [==============================] - 2s 76ms/step - loss: 1.0833 - f1_score:
0.6874 - val_loss: 1.4761 - val_f1_score: 0.5724
Epoch 55/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0498 - f1_score:
0.6809 - val_loss: 1.4246 - val_f1_score: 0.6019
Epoch 56/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0310 - f1_score:
0.6951 - val_loss: 1.4243 - val_f1_score: 0.5965
Epoch 57/500
28/28 [==============================] - 2s 76ms/step - loss: 1.0213 - f1_score:
0.6982 - val_loss: 1.4645 - val_f1_score: 0.6170
Epoch 58/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9863 - f1_score:
0.7151 - val_loss: 1.4404 - val_f1_score: 0.5917
Epoch 59/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9937 - f1_score:
0.7151 - val_loss: 1.4035 - val_f1_score: 0.6029
Epoch 60/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9772 - f1_score:
0.7097 - val_loss: 1.4128 - val_f1_score: 0.6061
Epoch 61/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9708 - f1_score:
0.7207 - val_loss: 1.4627 - val_f1_score: 0.5778
Epoch 62/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9420 - f1_score:
0.7271 - val_loss: 1.3710 - val_f1_score: 0.6395
Epoch 63/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9099 - f1_score:
0.7368 - val_loss: 1.3515 - val_f1_score: 0.6333
Epoch 64/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9181 - f1_score:
0.7362 - val_loss: 1.3451 - val_f1_score: 0.6184
Epoch 65/500
28/28 [==============================] - 2s 80ms/step - loss: 0.8872 - f1_score:
0.7472 - val_loss: 1.3854 - val_f1_score: 0.6492
Epoch 66/500
28/28 [==============================] - 3s 95ms/step - loss: 0.8868 - f1_score:
0.7352 - val_loss: 1.4096 - val_f1_score: 0.6301
```

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Epoch 67/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8561 - f1_score:
0.7569 - val_loss: 1.3921 - val_f1_score: 0.5743
Epoch 68/500
28/28 [==============================] - 2s 77ms/step - loss: 0.8966 - f1_score:
0.7425 - val_loss: 1.4128 - val_f1_score: 0.6228
Epoch 69/500
28/28 [==============================] - 2s 76ms/step - loss: 0.8697 - f1_score:
0.7437 - val_loss: 1.5474 - val_f1_score: 0.5821
Epoch 70/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8373 - f1_score:
0.7545 - val_loss: 1.3830 - val_f1_score: 0.6138
Epoch 71/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8551 - f1_score:
0.7544 - val_loss: 1.3950 - val_f1_score: 0.6305
Epoch 72/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8373 - f1_score:
0.7674 - val_loss: 1.4013 - val_f1_score: 0.6422
Epoch 73/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8568 - f1_score:
0.7426 - val_loss: 1.3974 - val_f1_score: 0.6229
Epoch 74/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8074 - f1_score:
0.7653 - val_loss: 1.3611 - val_f1_score: 0.6459
Epoch 75/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7790 - f1_score:
0.7785 - val_loss: 1.3491 - val_f1_score: 0.6389
Epoch 76/500
28/28 [==============================] - 2s 81ms/step - loss: 0.8110 - f1_score:
0.7666 - val_loss: 1.4348 - val_f1_score: 0.6289
Epoch 77/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7747 - f1_score:
0.7736 - val_loss: 1.3649 - val_f1_score: 0.6303
Epoch 78/500
28/28 [==============================] - ETA: 0s - loss: 0.7791 - f1_score:
0.7764

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

28/28 [==============================] - 13s 492ms/step - loss: 0.7791 -
f1_score: 0.7764 - val_loss: 1.3003 - val_f1_score: 0.6672
Epoch 79/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7269 - f1_score:
```

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0.8002 - val_loss: 1.3361 - val_f1_score: 0.6399
Epoch 80/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7372 - f1_score:
0.7875 - val_loss: 1.4376 - val_f1_score: 0.6350
Epoch 81/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7425 - f1_score:
0.7881 - val_loss: 1.3166 - val_f1_score: 0.6658
Epoch 82/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7401 - f1_score:
0.7813 - val_loss: 1.3921 - val_f1_score: 0.6382
Epoch 83/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7259 - f1_score:
0.7973 - val_loss: 1.3684 - val_f1_score: 0.6379
Epoch 84/500
28/28 [==============================] - 2s 73ms/step - loss: 0.7115 - f1_score:
0.7972 - val_loss: 1.2955 - val_f1_score: 0.6668
Epoch 85/500
28/28 [==============================] - ETA: 0s - loss: 0.7052 - f1_score:
0.8033

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

28/28 [==============================] - 12s 454ms/step - loss: 0.7052 -
f1_score: 0.8033 - val_loss: 1.3995 - val_f1_score: 0.6779
Epoch 86/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6923 - f1_score:
0.8057 - val_loss: 1.3706 - val_f1_score: 0.6488
Epoch 87/500
28/28 [==============================] - ETA: 0s - loss: 0.6883 - f1_score:
0.8074

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

28/28 [==============================] - 10s 373ms/step - loss: 0.6883 -
f1_score: 0.8074 - val_loss: 1.2571 - val_f1_score: 0.6908
Epoch 88/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6905 - f1_score:
0.8039 - val_loss: 1.3476 - val_f1_score: 0.6430
```

```
Epoch 89/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6818 - f1_score:
0.8102 - val_loss: 1.3367 - val_f1_score: 0.6628
Epoch 90/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6905 - f1_score:
0.8026 - val_loss: 1.3548 - val_f1_score: 0.6429
Epoch 91/500
28/28 [==============================] - ETA: 0s - loss: 0.6693 - f1_score:
0.8099

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

28/28 [==============================] - 10s 384ms/step - loss: 0.6693 -
f1_score: 0.8099 - val_loss: 1.3362 - val_f1_score: 0.6913
Epoch 92/500
28/28 [==============================] - 2s 68ms/step - loss: 0.6522 - f1_score:
0.8189 - val_loss: 1.3817 - val_f1_score: 0.6712
Epoch 93/500
28/28 [==============================] - 2s 69ms/step - loss: 0.6222 - f1_score:
0.8277 - val_loss: 1.3375 - val_f1_score: 0.6632
Epoch 94/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6270 - f1_score:
0.8308 - val_loss: 1.3205 - val_f1_score: 0.6819
Epoch 95/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6555 - f1_score:
0.8068 - val_loss: 1.3487 - val_f1_score: 0.6778
Epoch 96/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6143 - f1_score:
0.8372 - val_loss: 1.3567 - val_f1_score: 0.6381
Epoch 97/500
28/28 [==============================] - 2s 71ms/step - loss: 0.6384 - f1_score:
0.8197 - val_loss: 1.3268 - val_f1_score: 0.6560
Epoch 98/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6235 - f1_score:
0.8245 - val_loss: 1.4109 - val_f1_score: 0.6450
Epoch 99/500
28/28 [==============================] - 2s 71ms/step - loss: 0.5948 - f1_score:
0.8302 - val_loss: 1.3695 - val_f1_score: 0.6834
Epoch 100/500
28/28 [==============================] - ETA: 0s - loss: 0.5957 - f1_score:
0.8402

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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lstm_cell_1_layer_call_fn, lstm_cell_1_layer_call_and_return_conditional_losses
while saving (showing 3 of 3). These functions will not be directly callable
after loading.

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 LSTM Trial 717/assets

28/28 [==============================] - 11s 410ms/step - loss: 0.5957 -
f1_score: 0.8402 - val_loss: 1.3071 - val_f1_score: 0.6976
Epoch 101/500
28/28 [==============================] - 2s 69ms/step - loss: 0.5976 - f1_score:
0.8406 - val_loss: 1.3350 - val_f1_score: 0.6931
Epoch 102/500
28/28 [==============================] - 2s 70ms/step - loss: 0.5692 - f1_score:
0.8550 - val_loss: 1.3762 - val_f1_score: 0.6898
Epoch 103/500
28/28 [==============================] - 2s 70ms/step - loss: 0.6014 - f1_score:
0.8306 - val_loss: 1.4117 - val_f1_score: 0.6800
Epoch 104/500
28/28 [==============================] - 2s 70ms/step - loss: 0.5606 - f1_score:
0.8487 - val_loss: 1.3765 - val_f1_score: 0.6543
Epoch 105/500
28/28 [==============================] - 2s 70ms/step - loss: 0.5673 - f1_score:
0.8394 - val_loss: 1.2620 - val_f1_score: 0.6587
Epoch 106/500
28/28 [==============================] - 2s 71ms/step - loss: 0.5984 - f1_score:
0.8413 - val_loss: 1.3252 - val_f1_score: 0.6902
Epoch 107/500
28/28 [==============================] - 2s 71ms/step - loss: 0.5613 - f1_score:
0.8537 - val_loss: 1.2704 - val_f1_score: 0.6767
Epoch 108/500
28/28 [==============================] - 2s 71ms/step - loss: 0.5576 - f1_score:
0.8486 - val_loss: 1.3684 - val_f1_score: 0.6634
Epoch 109/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5464 - f1_score:
0.8577 - val_loss: 1.3853 - val_f1_score: 0.6637
Epoch 110/500
28/28 [==============================] - 2s 72ms/step - loss: 0.5575 - f1_score:
0.8463 - val_loss: 1.3832 - val_f1_score: 0.6899
Epoch 111/500
28/28 [==============================] - 2s 74ms/step - loss: 0.5724 - f1_score:
0.8408 - val_loss: 1.3646 - val_f1_score: 0.6955
Epoch 112/500
28/28 [==============================] - 2s 81ms/step - loss: 0.5277 - f1_score:
0.8616 - val_loss: 1.3912 - val_f1_score: 0.6532
Epoch 113/500
28/28 [==============================] - 2s 72ms/step - loss: 0.5230 - f1_score:
0.8666 - val_loss: 1.4353 - val_f1_score: 0.6674
```

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Epoch 114/500
28/28 [==============================] - 2s 79ms/step - loss: 0.5228 - f1_score:
0.8618 - val_loss: 1.3163 - val_f1_score: 0.6734
Epoch 115/500
28/28 [==============================] - 2s 77ms/step - loss: 0.5231 - f1_score:
0.8571 - val_loss: 1.3585 - val_f1_score: 0.6747
Epoch 116/500
28/28 [==============================] - 2s 75ms/step - loss: 0.5111 - f1_score:
0.8632 - val_loss: 1.4455 - val_f1_score: 0.6353
Epoch 117/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5023 - f1_score:
0.8757 - val_loss: 1.3484 - val_f1_score: 0.6444
Epoch 118/500
28/28 [==============================] - 2s 77ms/step - loss: 0.5031 - f1_score:
0.8678 - val_loss: 1.4852 - val_f1_score: 0.6253
Epoch 119/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4961 - f1_score:
0.8659 - val_loss: 1.4463 - val_f1_score: 0.6557
Epoch 120/500
28/28 [==============================] - 2s 73ms/step - loss: 0.5009 - f1_score:
0.8652 - val_loss: 1.4510 - val_f1_score: 0.6541
Epoch 121/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4798 - f1_score:
0.8709 - val_loss: 1.3445 - val_f1_score: 0.6701
Epoch 122/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4763 - f1_score:
0.8734 - val_loss: 1.3329 - val_f1_score: 0.6784
Epoch 123/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4759 - f1_score:
0.8771 - val_loss: 1.3783 - val_f1_score: 0.6332
Epoch 124/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4835 - f1_score:
0.8757 - val_loss: 1.4938 - val_f1_score: 0.6589
Epoch 125/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4578 - f1_score:
0.8783 - val_loss: 1.4956 - val_f1_score: 0.6602
Epoch 126/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4814 - f1_score:
0.8835 - val_loss: 1.3501 - val_f1_score: 0.6947
Epoch 127/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4764 - f1_score:
0.8777 - val_loss: 1.3687 - val_f1_score: 0.6405
Epoch 128/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4683 - f1_score:
0.8848 - val_loss: 1.4646 - val_f1_score: 0.6279
Epoch 129/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4540 - f1_score:
0.8809 - val_loss: 1.2800 - val_f1_score: 0.6822
```

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Epoch 130/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4586 - f1_score:
0.8766 - val_loss: 1.3496 - val_f1_score: 0.6828
Epoch 131/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4470 - f1_score:
0.8832 - val_loss: 1.4524 - val_f1_score: 0.6374
Epoch 132/500
28/28 [==============================] - 2s 75ms/step - loss: 0.4593 - f1_score:
0.8852 - val_loss: 1.4579 - val_f1_score: 0.6545
Epoch 133/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4355 - f1_score:
0.8913 - val_loss: 1.5088 - val_f1_score: 0.6478
Epoch 134/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4520 - f1_score:
0.8873 - val_loss: 1.4193 - val_f1_score: 0.6543
Epoch 135/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4514 - f1_score:
0.8875 - val_loss: 1.4181 - val_f1_score: 0.6565
Epoch 136/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4256 - f1_score:
0.8959 - val_loss: 1.4752 - val_f1_score: 0.6383
Epoch 137/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4399 - f1_score:
0.8930 - val_loss: 1.5680 - val_f1_score: 0.6332
Epoch 138/500
28/28 [==============================] - 2s 75ms/step - loss: 0.4386 - f1_score:
0.8882 - val_loss: 1.4647 - val_f1_score: 0.6594
Epoch 139/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4280 - f1_score:
0.8940 - val_loss: 1.4596 - val_f1_score: 0.6589
Epoch 140/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4163 - f1_score:
0.8952 - val_loss: 1.4784 - val_f1_score: 0.6596
Epoch 141/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4451 - f1_score:
0.8853 - val_loss: 1.4586 - val_f1_score: 0.6761
Epoch 142/500
28/28 [==============================] - 2s 78ms/step - loss: 0.4435 - f1_score:
0.8842 - val_loss: 1.4686 - val_f1_score: 0.6384
Epoch 143/500
28/28 [==============================] - 2s 79ms/step - loss: 0.4281 - f1_score:
0.8916 - val_loss: 1.4691 - val_f1_score: 0.6389
Epoch 144/500
28/28 [==============================] - 2s 78ms/step - loss: 0.4165 - f1_score:
0.8923 - val_loss: 1.4882 - val_f1_score: 0.6197
Epoch 145/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4106 - f1_score:
0.8951 - val_loss: 1.5023 - val_f1_score: 0.6207
```

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Epoch 146/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4147 - f1_score:
0.9010 - val_loss: 1.3521 - val_f1_score: 0.6781
Epoch 147/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3868 - f1_score:
0.9043 - val_loss: 1.3959 - val_f1_score: 0.6662
Epoch 148/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3984 - f1_score:
0.9029 - val_loss: 1.5571 - val_f1_score: 0.6496
Epoch 149/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4324 - f1_score:
0.8877 - val_loss: 1.4171 - val_f1_score: 0.6753
Epoch 150/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4065 - f1_score:
0.8964 - val_loss: 1.3554 - val_f1_score: 0.6808
Epoch 151/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3781 - f1_score:
0.9119 - val_loss: 1.5192 - val_f1_score: 0.6127
Epoch 152/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3806 - f1_score:
0.9093 - val_loss: 1.4949 - val_f1_score: 0.6655
Epoch 153/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3967 - f1_score:
0.9016 - val_loss: 1.4773 - val_f1_score: 0.6515
Epoch 154/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3973 - f1_score:
0.9022 - val_loss: 1.4179 - val_f1_score: 0.6853
Epoch 155/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3901 - f1_score:
0.9040 - val_loss: 1.5057 - val_f1_score: 0.6165
Epoch 156/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3718 - f1_score:
0.9061 - val_loss: 1.6678 - val_f1_score: 0.6194
Epoch 157/500
28/28 [==============================] - 2s 77ms/step - loss: 0.3767 - f1_score:
0.9075 - val_loss: 1.5044 - val_f1_score: 0.6709
Epoch 158/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3660 - f1_score:
0.9078 - val_loss: 1.5366 - val_f1_score: 0.6455
Epoch 159/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3712 - f1_score:
0.9125 - val_loss: 1.5766 - val_f1_score: 0.6342
Epoch 160/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3910 - f1_score:
0.9091 - val_loss: 1.4240 - val_f1_score: 0.6553
Epoch 161/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3951 - f1_score:
0.9035 - val_loss: 1.5146 - val_f1_score: 0.6637
```

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Epoch 162/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3683 - f1_score:
0.9029 - val_loss: 1.5158 - val_f1_score: 0.6577
Epoch 163/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3599 - f1_score:
0.9165 - val_loss: 1.5103 - val_f1_score: 0.6180
Epoch 164/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3594 - f1_score:
0.9163 - val_loss: 1.4695 - val_f1_score: 0.6523
Epoch 165/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3692 - f1_score:
0.9043 - val_loss: 1.5827 - val_f1_score: 0.6257
Epoch 166/500
28/28 [==============================] - 3s 104ms/step - loss: 0.3561 -
f1_score: 0.9178 - val_loss: 1.4409 - val_f1_score: 0.6696
Epoch 167/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3676 - f1_score:
0.9137 - val_loss: 1.7297 - val_f1_score: 0.6273
Epoch 168/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3756 - f1_score:
0.9087 - val_loss: 1.5389 - val_f1_score: 0.6633
Epoch 169/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3496 - f1_score:
0.9181 - val_loss: 1.6348 - val_f1_score: 0.6433
Epoch 170/500
28/28 [==============================] - 3s 105ms/step - loss: 0.3457 -
f1_score: 0.9150 - val_loss: 1.5519 - val_f1_score: 0.6485
Epoch 171/500
28/28 [==============================] - 3s 111ms/step - loss: 0.3310 -
f1_score: 0.9224 - val_loss: 1.5580 - val_f1_score: 0.6201
Epoch 172/500
28/28 [==============================] - 2s 90ms/step - loss: 0.3718 - f1_score:
0.9073 - val_loss: 1.5491 - val_f1_score: 0.6216
Epoch 173/500
28/28 [==============================] - 3s 91ms/step - loss: 0.3350 - f1_score:
0.9235 - val_loss: 1.5576 - val_f1_score: 0.6376
Epoch 174/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3465 - f1_score:
0.9162 - val_loss: 1.4991 - val_f1_score: 0.6536
Epoch 175/500
28/28 [==============================] - 3s 103ms/step - loss: 0.3169 -
f1_score: 0.9283 - val_loss: 1.4968 - val_f1_score: 0.6724
Epoch 176/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3344 - f1_score:
0.9233 - val_loss: 1.5012 - val_f1_score: 0.6518
Epoch 177/500
28/28 [==============================] - 3s 105ms/step - loss: 0.3494 -
f1_score: 0.9153 - val_loss: 1.4969 - val_f1_score: 0.6895
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Epoch 178/500
28/28 [==============================] - 2s 81ms/step - loss: 0.3268 - f1_score:
0.9278 - val_loss: 1.4967 - val_f1_score: 0.6664
Epoch 179/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3366 - f1_score:
0.9191 - val_loss: 1.4838 - val_f1_score: 0.6712
Epoch 180/500
28/28 [==============================] - 2s 90ms/step - loss: 0.3349 - f1_score:
0.9201 - val_loss: 1.4919 - val_f1_score: 0.6421
Epoch 181/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3268 - f1_score:
0.9275 - val_loss: 1.5832 - val_f1_score: 0.6584
Epoch 182/500
28/28 [==============================] - 3s 92ms/step - loss: 0.3303 - f1_score:
0.9178 - val_loss: 1.5523 - val_f1_score: 0.6523
Epoch 183/500
28/28 [==============================] - 2s 88ms/step - loss: 0.3318 - f1_score:
0.9207 - val_loss: 1.5563 - val_f1_score: 0.6401
Epoch 184/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3226 - f1_score:
0.9287 - val_loss: 1.5127 - val_f1_score: 0.6188
Epoch 185/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3140 - f1_score:
0.9273 - val_loss: 1.6245 - val_f1_score: 0.6427
Epoch 186/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3415 - f1_score:
0.9204 - val_loss: 1.5176 - val_f1_score: 0.6393
Epoch 187/500
28/28 [==============================] - 2s 88ms/step - loss: 0.3238 - f1_score:
0.9254 - val_loss: 1.5496 - val_f1_score: 0.6552
Epoch 188/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3191 - f1_score:
0.9280 - val_loss: 1.5755 - val_f1_score: 0.6300
Epoch 189/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3285 - f1_score:
0.9279 - val_loss: 1.4879 - val_f1_score: 0.6452
Epoch 190/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3074 - f1_score:
0.9316 - val_loss: 1.4914 - val_f1_score: 0.6455
Epoch 191/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3234 - f1_score:
0.9267 - val_loss: 1.5923 - val_f1_score: 0.6660
Epoch 192/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3225 - f1_score:
0.9193 - val_loss: 1.5268 - val_f1_score: 0.6709
Epoch 193/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3386 - f1_score:
0.9192 - val_loss: 1.5351 - val_f1_score: 0.6475
```

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Epoch 194/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3136 - f1_score:
0.9269 - val_loss: 1.7258 - val_f1_score: 0.6128
Epoch 195/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3173 - f1_score:
0.9263 - val_loss: 1.6281 - val_f1_score: 0.6338
Epoch 196/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3064 - f1_score:
0.9332 - val_loss: 1.5617 - val_f1_score: 0.6773
Epoch 197/500
28/28 [==============================] - 2s 87ms/step - loss: 0.2963 - f1_score:
0.9355 - val_loss: 1.6174 - val_f1_score: 0.6411
Epoch 198/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2901 - f1_score:
0.9368 - val_loss: 1.5595 - val_f1_score: 0.6429
Epoch 199/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2926 - f1_score:
0.9332 - val_loss: 1.6174 - val_f1_score: 0.6494
Epoch 200/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3287 - f1_score:
0.9214 - val_loss: 1.5865 - val_f1_score: 0.6651
Epoch 201/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2791 - f1_score:
0.9414 - val_loss: 1.5652 - val_f1_score: 0.6536
Epoch 202/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3016 - f1_score:
0.9285 - val_loss: 1.6665 - val_f1_score: 0.6797
Epoch 203/500
28/28 [==============================] - 3s 93ms/step - loss: 0.2700 - f1_score:
0.9397 - val_loss: 1.7497 - val_f1_score: 0.6199
Epoch 204/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2902 - f1_score:
0.9390 - val_loss: 1.6983 - val_f1_score: 0.6621
Epoch 205/500
28/28 [==============================] - 3s 104ms/step - loss: 0.2720 -
f1_score: 0.9403 - val_loss: 1.7405 - val_f1_score: 0.6266
Epoch 206/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2961 - f1_score:
0.9291 - val_loss: 1.6306 - val_f1_score: 0.6353
Epoch 207/500
28/28 [==============================] - 2s 89ms/step - loss: 0.2878 - f1_score:
0.9358 - val_loss: 1.5856 - val_f1_score: 0.6432
Epoch 208/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3088 - f1_score:
0.9269 - val_loss: 1.7559 - val_f1_score: 0.6240
Epoch 209/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2954 - f1_score:
0.9355 - val_loss: 1.6335 - val_f1_score: 0.6206
```

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Epoch 210/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2907 - f1_score:
0.9359 - val_loss: 1.6856 - val_f1_score: 0.6342
Epoch 211/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2916 - f1_score:
0.9359 - val_loss: 1.7074 - val_f1_score: 0.6309
Epoch 212/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2650 - f1_score:
0.9401 - val_loss: 1.7322 - val_f1_score: 0.6211
Epoch 213/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2808 - f1_score:
0.9396 - val_loss: 1.5216 - val_f1_score: 0.6649
Epoch 214/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2700 - f1_score:
0.9418 - val_loss: 1.6478 - val_f1_score: 0.6394
Epoch 215/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2863 - f1_score:
0.9309 - val_loss: 1.7448 - val_f1_score: 0.6293
Epoch 216/500
28/28 [==============================] - 2s 74ms/step - loss: 0.3086 - f1_score:
0.9236 - val_loss: 1.5073 - val_f1_score: 0.6647
Epoch 217/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2902 - f1_score:
0.9277 - val_loss: 1.7092 - val_f1_score: 0.6052
Epoch 218/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2832 - f1_score:
0.9390 - val_loss: 1.6525 - val_f1_score: 0.6488
Epoch 219/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2706 - f1_score:
0.9401 - val_loss: 1.7673 - val_f1_score: 0.6319
Epoch 220/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2916 - f1_score:
0.9305 - val_loss: 1.7039 - val_f1_score: 0.6272
Epoch 221/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2919 - f1_score:
0.9329 - val_loss: 1.6499 - val_f1_score: 0.6257
Epoch 222/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2660 - f1_score:
0.9418 - val_loss: 1.5900 - val_f1_score: 0.6663
Epoch 223/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2675 - f1_score:
0.9426 - val_loss: 1.7257 - val_f1_score: 0.6441
Epoch 224/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2608 - f1_score:
0.9413 - val_loss: 1.6379 - val_f1_score: 0.6573
Epoch 225/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2607 - f1_score:
0.9462 - val_loss: 1.6747 - val_f1_score: 0.6387
```

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Epoch 226/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2668 - f1_score:
0.9418 - val_loss: 1.7438 - val_f1_score: 0.6085
Epoch 227/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2580 - f1_score:
0.9478 - val_loss: 1.6819 - val_f1_score: 0.6439
Epoch 228/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2549 - f1_score:
0.9464 - val_loss: 1.9094 - val_f1_score: 0.5982
Epoch 229/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2646 - f1_score:
0.9400 - val_loss: 1.7151 - val_f1_score: 0.6309
Epoch 230/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2510 - f1_score:
0.9473 - val_loss: 1.7518 - val_f1_score: 0.6143
Epoch 231/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2801 - f1_score:
0.9373 - val_loss: 1.7216 - val_f1_score: 0.6002
Epoch 232/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2600 - f1_score:
0.9464 - val_loss: 1.8311 - val_f1_score: 0.6119
Epoch 233/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2658 - f1_score:
0.9424 - val_loss: 1.7173 - val_f1_score: 0.6134
Epoch 234/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2731 - f1_score:
0.9405 - val_loss: 1.7620 - val_f1_score: 0.6313
Epoch 235/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2671 - f1_score:
0.9381 - val_loss: 1.6509 - val_f1_score: 0.6412
Epoch 236/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2736 - f1_score:
0.9382 - val_loss: 1.5989 - val_f1_score: 0.6621
Epoch 237/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2525 - f1_score:
0.9486 - val_loss: 1.7003 - val_f1_score: 0.6548
Epoch 238/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2516 - f1_score:
0.9473 - val_loss: 1.7971 - val_f1_score: 0.6087
Epoch 239/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2571 - f1_score:
0.9464 - val_loss: 1.6919 - val_f1_score: 0.6531
Epoch 240/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2608 - f1_score:
0.9407 - val_loss: 1.6976 - val_f1_score: 0.6413
Epoch 241/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2620 - f1_score:
0.9414 - val_loss: 1.7355 - val_f1_score: 0.6588
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Epoch 242/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2543 - f1_score:
0.9442 - val_loss: 1.7401 - val_f1_score: 0.6316
Epoch 243/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2888 - f1_score:
0.9311 - val_loss: 1.8023 - val_f1_score: 0.6451
Epoch 244/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2637 - f1_score:
0.9446 - val_loss: 1.7806 - val_f1_score: 0.6268
Epoch 245/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2478 - f1_score:
0.9485 - val_loss: 1.6856 - val_f1_score: 0.6216
Epoch 246/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2563 - f1_score:
0.9517 - val_loss: 1.6050 - val_f1_score: 0.6531
Epoch 247/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2418 - f1_score:
0.9484 - val_loss: 1.8720 - val_f1_score: 0.6179
Epoch 248/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2569 - f1_score:
0.9407 - val_loss: 1.6939 - val_f1_score: 0.6521
Epoch 249/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2487 - f1_score:
0.9480 - val_loss: 1.9262 - val_f1_score: 0.6044
Epoch 250/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2571 - f1_score:
0.9479 - val_loss: 1.7942 - val_f1_score: 0.6367
Epoch 251/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2514 - f1_score:
0.9486 - val_loss: 1.6763 - val_f1_score: 0.6334
Epoch 252/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2456 - f1_score:
0.9455 - val_loss: 1.7556 - val_f1_score: 0.6255
Epoch 253/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2392 - f1_score:
0.9482 - val_loss: 1.7064 - val_f1_score: 0.6613
Epoch 254/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2611 - f1_score:
0.9437 - val_loss: 1.7184 - val_f1_score: 0.6335
Epoch 255/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2426 - f1_score:
0.9490 - val_loss: 1.9552 - val_f1_score: 0.6044
Epoch 256/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2430 - f1_score:
0.9496 - val_loss: 1.8536 - val_f1_score: 0.6532
Epoch 257/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2327 - f1_score:
0.9563 - val_loss: 1.8178 - val_f1_score: 0.6269
```

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Epoch 258/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2491 - f1_score:
0.9458 - val_loss: 1.7548 - val_f1_score: 0.6441
Epoch 259/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2266 - f1_score:
0.9548 - val_loss: 1.7466 - val_f1_score: 0.6467
Epoch 260/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2398 - f1_score:
0.9492 - val_loss: 1.8075 - val_f1_score: 0.6425
Epoch 261/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2342 - f1_score:
0.9524 - val_loss: 1.7729 - val_f1_score: 0.6443
Epoch 262/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2581 - f1_score:
0.9395 - val_loss: 1.7591 - val_f1_score: 0.6392
Epoch 263/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2553 - f1_score:
0.9430 - val_loss: 1.7990 - val_f1_score: 0.6547
Epoch 264/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2410 - f1_score:
0.9427 - val_loss: 1.8299 - val_f1_score: 0.6520
Epoch 265/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2439 - f1_score:
0.9468 - val_loss: 1.7558 - val_f1_score: 0.6668
Epoch 266/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2507 - f1_score:
0.9469 - val_loss: 1.7322 - val_f1_score: 0.6718
Epoch 267/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2119 - f1_score:
0.9644 - val_loss: 1.7262 - val_f1_score: 0.6643
Epoch 268/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2327 - f1_score:
0.9469 - val_loss: 1.8129 - val_f1_score: 0.6518
Epoch 269/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2467 - f1_score:
0.9446 - val_loss: 1.9389 - val_f1_score: 0.6194
Epoch 270/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2415 - f1_score:
0.9432 - val_loss: 1.8321 - val_f1_score: 0.6428
Epoch 271/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2272 - f1_score:
0.9525 - val_loss: 1.7945 - val_f1_score: 0.6486
Epoch 272/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2397 - f1_score:
0.9459 - val_loss: 1.8665 - val_f1_score: 0.6368
Epoch 273/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2214 - f1_score:
0.9545 - val_loss: 1.8109 - val_f1_score: 0.6600
```

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Epoch 274/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2258 - f1_score:
0.9523 - val_loss: 1.8911 - val_f1_score: 0.5908
Epoch 275/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2329 - f1_score:
0.9460 - val_loss: 1.8336 - val_f1_score: 0.6545
Epoch 276/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2145 - f1_score:
0.9565 - val_loss: 2.0021 - val_f1_score: 0.6113
Epoch 277/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2284 - f1_score:
0.9468 - val_loss: 1.8931 - val_f1_score: 0.6298
Epoch 278/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2292 - f1_score:
0.9499 - val_loss: 1.8597 - val_f1_score: 0.5983
Epoch 279/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2627 - f1_score:
0.9408 - val_loss: 1.6552 - val_f1_score: 0.6672
Epoch 280/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2176 - f1_score:
0.9557 - val_loss: 1.8446 - val_f1_score: 0.6326
Epoch 281/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2277 - f1_score:
0.9540 - val_loss: 1.9046 - val_f1_score: 0.6441
Epoch 282/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2656 - f1_score:
0.9406 - val_loss: 1.8926 - val_f1_score: 0.6266
Epoch 283/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2560 - f1_score:
0.9406 - val_loss: 1.7267 - val_f1_score: 0.6428
Epoch 284/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2308 - f1_score:
0.9477 - val_loss: 1.8015 - val_f1_score: 0.6423
Epoch 285/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2181 - f1_score:
0.9543 - val_loss: 1.7171 - val_f1_score: 0.6662
Epoch 286/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2039 - f1_score:
0.9591 - val_loss: 1.8927 - val_f1_score: 0.6156
Epoch 287/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2283 - f1_score:
0.9539 - val_loss: 1.8253 - val_f1_score: 0.6149
Epoch 288/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2368 - f1_score:
0.9466 - val_loss: 1.8892 - val_f1_score: 0.6011
Epoch 289/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2174 - f1_score:
0.9529 - val_loss: 2.0282 - val_f1_score: 0.5927
```

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Epoch 290/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2217 - f1_score:
0.9516 - val_loss: 1.8394 - val_f1_score: 0.6226
Epoch 291/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2213 - f1_score:
0.9511 - val_loss: 1.8054 - val_f1_score: 0.6593
Epoch 292/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2112 - f1_score:
0.9530 - val_loss: 1.9317 - val_f1_score: 0.6270
Epoch 293/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2278 - f1_score:
0.9533 - val_loss: 1.9331 - val_f1_score: 0.6302
Epoch 294/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2009 - f1_score:
0.9620 - val_loss: 1.8776 - val_f1_score: 0.6543
Epoch 295/500
28/28 [==============================] - 3s 101ms/step - loss: 0.1956 -
f1_score: 0.9596 - val_loss: 1.8710 - val_f1_score: 0.6270
Epoch 296/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2274 - f1_score:
0.9469 - val_loss: 1.9831 - val_f1_score: 0.6345
Epoch 297/500
28/28 [==============================] - 2s 87ms/step - loss: 0.2141 - f1_score:
0.9550 - val_loss: 1.9079 - val_f1_score: 0.6625
Epoch 298/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2113 - f1_score:
0.9569 - val_loss: 1.8528 - val_f1_score: 0.6163
Epoch 299/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2137 - f1_score:
0.9508 - val_loss: 2.0234 - val_f1_score: 0.6411
Epoch 300/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2154 - f1_score:
0.9543 - val_loss: 1.8997 - val_f1_score: 0.6204
Epoch 301/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2019 - f1_score:
0.9607 - val_loss: 1.9251 - val_f1_score: 0.6294
Epoch 302/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2020 - f1_score:
0.9599 - val_loss: 1.8363 - val_f1_score: 0.6294
Epoch 303/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2134 - f1_score:
0.9597 - val_loss: 1.8702 - val_f1_score: 0.6435
Epoch 304/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2238 - f1_score:
0.9537 - val_loss: 1.9826 - val_f1_score: 0.5958
Epoch 305/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2232 - f1_score:
0.9520 - val_loss: 1.7729 - val_f1_score: 0.6533
```

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Epoch 306/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2185 - f1_score:
0.9547 - val_loss: 1.8480 - val_f1_score: 0.6338
Epoch 307/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2087 - f1_score:
0.9562 - val_loss: 1.9962 - val_f1_score: 0.5905
Epoch 308/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2049 - f1_score:
0.9583 - val_loss: 1.8301 - val_f1_score: 0.6349
Epoch 309/500
28/28 [==============================] - 3s 93ms/step - loss: 0.2027 - f1_score:
0.9621 - val_loss: 1.7357 - val_f1_score: 0.6604
Epoch 310/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2065 - f1_score:
0.9600 - val_loss: 1.8793 - val_f1_score: 0.6027
Epoch 311/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2070 - f1_score:
0.9559 - val_loss: 1.9496 - val_f1_score: 0.6274
Epoch 312/500
28/28 [==============================] - 3s 92ms/step - loss: 0.2186 - f1_score:
0.9503 - val_loss: 1.8980 - val_f1_score: 0.6086
Epoch 313/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2310 - f1_score:
0.9522 - val_loss: 1.9932 - val_f1_score: 0.6378
Epoch 314/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2144 - f1_score:
0.9596 - val_loss: 1.8496 - val_f1_score: 0.6368
Epoch 315/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2023 - f1_score:
0.9563 - val_loss: 1.8129 - val_f1_score: 0.6220
Epoch 316/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2173 - f1_score:
0.9531 - val_loss: 1.9927 - val_f1_score: 0.6203
Epoch 317/500
28/28 [==============================] - 2s 80ms/step - loss: 0.1968 - f1_score:
0.9618 - val_loss: 2.0099 - val_f1_score: 0.6018
Epoch 318/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1930 - f1_score:
0.9622 - val_loss: 2.1032 - val_f1_score: 0.6243
Epoch 319/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1956 - f1_score:
0.9620 - val_loss: 1.9342 - val_f1_score: 0.6094
Epoch 320/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2278 - f1_score:
0.9493 - val_loss: 2.0934 - val_f1_score: 0.5666
Epoch 321/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2115 - f1_score:
0.9544 - val_loss: 1.9357 - val_f1_score: 0.6393
```

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Epoch 322/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2112 - f1_score:
0.9516 - val_loss: 1.9515 - val_f1_score: 0.6208
Epoch 323/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2069 - f1_score:
0.9593 - val_loss: 1.8955 - val_f1_score: 0.6091
Epoch 324/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2141 - f1_score:
0.9560 - val_loss: 1.7683 - val_f1_score: 0.6464
Epoch 325/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2023 - f1_score:
0.9609 - val_loss: 1.9828 - val_f1_score: 0.6832
Epoch 326/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2017 - f1_score:
0.9581 - val_loss: 1.8246 - val_f1_score: 0.6231
Epoch 327/500
28/28 [==============================] - 2s 72ms/step - loss: 0.2079 - f1_score:
0.9552 - val_loss: 1.9025 - val_f1_score: 0.6275
Epoch 328/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1905 - f1_score:
0.9607 - val_loss: 1.8589 - val_f1_score: 0.6335
Epoch 329/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1867 - f1_score:
0.9621 - val_loss: 1.9509 - val_f1_score: 0.6076
Epoch 330/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2052 - f1_score:
0.9515 - val_loss: 1.7574 - val_f1_score: 0.6537
Epoch 331/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2023 - f1_score:
0.9565 - val_loss: 1.8044 - val_f1_score: 0.6490
Epoch 332/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2036 - f1_score:
0.9583 - val_loss: 1.9480 - val_f1_score: 0.5965
Epoch 333/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1859 - f1_score:
0.9644 - val_loss: 1.8745 - val_f1_score: 0.6131
Epoch 334/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2163 - f1_score:
0.9516 - val_loss: 1.8724 - val_f1_score: 0.6451
Epoch 335/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2299 - f1_score:
0.9495 - val_loss: 1.9393 - val_f1_score: 0.6288
Epoch 336/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1850 - f1_score:
0.9646 - val_loss: 1.8616 - val_f1_score: 0.6084
Epoch 337/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2147 - f1_score:
0.9498 - val_loss: 1.9061 - val_f1_score: 0.6128
```

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Epoch 338/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2213 - f1_score:
0.9495 - val_loss: 2.0691 - val_f1_score: 0.5859
Epoch 339/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1991 - f1_score:
0.9594 - val_loss: 2.0899 - val_f1_score: 0.5814
Epoch 340/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1991 - f1_score:
0.9573 - val_loss: 1.8945 - val_f1_score: 0.6114
Epoch 341/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1882 - f1_score:
0.9641 - val_loss: 1.8112 - val_f1_score: 0.6376
Epoch 342/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1775 - f1_score:
0.9670 - val_loss: 1.8394 - val_f1_score: 0.6368
Epoch 343/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1817 - f1_score:
0.9628 - val_loss: 2.0407 - val_f1_score: 0.6048
Epoch 344/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1726 - f1_score:
0.9663 - val_loss: 2.0322 - val_f1_score: 0.6351
Epoch 345/500
28/28 [==============================] - 2s 80ms/step - loss: 0.1662 - f1_score:
0.9700 - val_loss: 1.8591 - val_f1_score: 0.6064
Epoch 346/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2033 - f1_score:
0.9545 - val_loss: 1.8665 - val_f1_score: 0.6494
Epoch 347/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1904 - f1_score:
0.9621 - val_loss: 2.0242 - val_f1_score: 0.5681
Epoch 348/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1743 - f1_score:
0.9668 - val_loss: 1.9989 - val_f1_score: 0.6022
Epoch 349/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1897 - f1_score:
0.9649 - val_loss: 1.9867 - val_f1_score: 0.6175
Epoch 350/500
28/28 [==============================] - 2s 81ms/step - loss: 0.1709 - f1_score:
0.9674 - val_loss: 1.9574 - val_f1_score: 0.6053
Epoch 351/500
28/28 [==============================] - 2s 83ms/step - loss: 0.1784 - f1_score:
0.9623 - val_loss: 2.0696 - val_f1_score: 0.6061
Epoch 352/500
28/28 [==============================] - 3s 102ms/step - loss: 0.1837 -
f1_score: 0.9656 - val_loss: 1.9282 - val_f1_score: 0.6269
Epoch 353/500
28/28 [==============================] - 2s 87ms/step - loss: 0.1854 - f1_score:
0.9652 - val_loss: 2.0084 - val_f1_score: 0.5786
```

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Epoch 354/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1790 - f1_score:
0.9671 - val_loss: 2.0112 - val_f1_score: 0.6271
Epoch 355/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1881 - f1_score:
0.9651 - val_loss: 2.0323 - val_f1_score: 0.5858
Epoch 356/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1706 - f1_score:
0.9638 - val_loss: 2.1192 - val_f1_score: 0.5723
Epoch 357/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2228 - f1_score:
0.9484 - val_loss: 1.8839 - val_f1_score: 0.6353
Epoch 358/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2167 - f1_score:
0.9511 - val_loss: 2.0725 - val_f1_score: 0.6057
Epoch 359/500
28/28 [==============================] - 2s 80ms/step - loss: 0.2112 - f1_score:
0.9560 - val_loss: 1.9055 - val_f1_score: 0.5879
Epoch 360/500
28/28 [==============================] - 3s 93ms/step - loss: 0.2089 - f1_score:
0.9528 - val_loss: 2.1290 - val_f1_score: 0.5956
Epoch 361/500
28/28 [==============================] - 3s 90ms/step - loss: 0.2021 - f1_score:
0.9590 - val_loss: 1.9551 - val_f1_score: 0.5998
Epoch 362/500
28/28 [==============================] - 3s 99ms/step - loss: 0.1998 - f1_score:
0.9607 - val_loss: 1.9958 - val_f1_score: 0.6172
Epoch 363/500
28/28 [==============================] - 2s 87ms/step - loss: 0.2032 - f1_score:
0.9575 - val_loss: 2.1153 - val_f1_score: 0.6163
Epoch 364/500
28/28 [==============================] - 2s 82ms/step - loss: 0.1974 - f1_score:
0.9567 - val_loss: 2.0923 - val_f1_score: 0.5686
Epoch 365/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1975 - f1_score:
0.9600 - val_loss: 2.2000 - val_f1_score: 0.6086
Epoch 366/500
28/28 [==============================] - 2s 77ms/step - loss: 0.2023 - f1_score:
0.9559 - val_loss: 2.0204 - val_f1_score: 0.5925
Epoch 367/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1868 - f1_score:
0.9660 - val_loss: 2.0325 - val_f1_score: 0.6107
Epoch 368/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1844 - f1_score:
0.9627 - val_loss: 2.0117 - val_f1_score: 0.6191
Epoch 369/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1988 - f1_score:
0.9611 - val_loss: 1.8775 - val_f1_score: 0.6521
```

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Epoch 370/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1704 - f1_score:
0.9678 - val_loss: 2.1002 - val_f1_score: 0.5976
Epoch 371/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2026 - f1_score:
0.9555 - val_loss: 2.0356 - val_f1_score: 0.6144
Epoch 372/500
28/28 [==============================] - 2s 78ms/step - loss: 0.2066 - f1_score:
0.9517 - val_loss: 1.9873 - val_f1_score: 0.5906
Epoch 373/500
28/28 [==============================] - 2s 86ms/step - loss: 0.1711 - f1_score:
0.9696 - val_loss: 2.0706 - val_f1_score: 0.6188
Epoch 374/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1813 - f1_score:
0.9629 - val_loss: 1.9885 - val_f1_score: 0.6298
Epoch 375/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1490 - f1_score:
0.9758 - val_loss: 2.1284 - val_f1_score: 0.6024
Epoch 376/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1830 - f1_score:
0.9614 - val_loss: 1.9761 - val_f1_score: 0.5719
Epoch 377/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1931 - f1_score:
0.9612 - val_loss: 2.0726 - val_f1_score: 0.6161
Epoch 378/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1892 - f1_score:
0.9615 - val_loss: 2.1934 - val_f1_score: 0.5674
Epoch 379/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1786 - f1_score:
0.9650 - val_loss: 2.0858 - val_f1_score: 0.6001
Epoch 380/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1711 - f1_score:
0.9636 - val_loss: 2.0409 - val_f1_score: 0.5988
Epoch 381/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1842 - f1_score:
0.9623 - val_loss: 2.0806 - val_f1_score: 0.6030
Epoch 382/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2073 - f1_score:
0.9603 - val_loss: 2.0800 - val_f1_score: 0.5887
Epoch 383/500
28/28 [==============================] - 2s 76ms/step - loss: 0.2066 - f1_score:
0.9543 - val_loss: 2.0878 - val_f1_score: 0.6059
Epoch 384/500
28/28 [==============================] - 2s 83ms/step - loss: 0.1741 - f1_score:
0.9655 - val_loss: 2.0583 - val_f1_score: 0.6331
Epoch 385/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1688 - f1_score:
0.9745 - val_loss: 1.8733 - val_f1_score: 0.6421
```

```
Epoch 386/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1703 - f1_score:
0.9678 - val_loss: 2.0929 - val_f1_score: 0.6269
Epoch 387/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1876 - f1_score:
0.9608 - val_loss: 1.9318 - val_f1_score: 0.6462
Epoch 388/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1794 - f1_score:
0.9625 - val_loss: 1.9944 - val_f1_score: 0.6242
Epoch 389/500
28/28 [==============================] - 2s 82ms/step - loss: 0.1744 - f1_score:
0.9659 - val_loss: 1.8969 - val_f1_score: 0.6315
Epoch 390/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1824 - f1_score:
0.9655 - val_loss: 1.8514 - val_f1_score: 0.6598
Epoch 391/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1706 - f1_score:
0.9662 - val_loss: 2.0836 - val_f1_score: 0.6139
Epoch 392/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1731 - f1_score:
0.9681 - val_loss: 2.1253 - val_f1_score: 0.6060
Epoch 393/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1761 - f1_score:
0.9681 - val_loss: 2.1159 - val_f1_score: 0.6322
Epoch 394/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1951 - f1_score:
0.9565 - val_loss: 2.1807 - val_f1_score: 0.5756
Epoch 395/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1562 - f1_score:
0.9721 - val_loss: 2.0025 - val_f1_score: 0.6144
Epoch 396/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1739 - f1_score:
0.9678 - val_loss: 2.1354 - val_f1_score: 0.5820
Epoch 397/500
28/28 [==============================] - 2s 85ms/step - loss: 0.1901 - f1_score:
0.9608 - val_loss: 1.9554 - val_f1_score: 0.6684
Epoch 398/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1801 - f1_score:
0.9633 - val_loss: 2.0755 - val_f1_score: 0.6149
Epoch 399/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1840 - f1_score:
0.9650 - val_loss: 2.1329 - val_f1_score: 0.6061
Epoch 400/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1873 - f1_score:
0.9631 - val_loss: 2.1974 - val_f1_score: 0.6106
Epoch 401/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1724 - f1_score:
0.9688 - val_loss: 1.8734 - val_f1_score: 0.6436
```

```
Epoch 402/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1544 - f1_score:
0.9744 - val_loss: 2.1261 - val_f1_score: 0.5912
Epoch 403/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1719 - f1_score:
0.9670 - val_loss: 1.9160 - val_f1_score: 0.6366
Epoch 404/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1607 - f1_score:
0.9707 - val_loss: 1.9538 - val_f1_score: 0.6178
Epoch 405/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1819 - f1_score:
0.9608 - val_loss: 1.9354 - val_f1_score: 0.6132
Epoch 406/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1701 - f1_score:
0.9676 - val_loss: 2.1208 - val_f1_score: 0.6020
Epoch 407/500
28/28 [==============================] - 2s 84ms/step - loss: 0.1773 - f1_score:
0.9650 - val_loss: 1.8995 - val_f1_score: 0.6271
Epoch 408/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1690 - f1_score:
0.9687 - val_loss: 2.1794 - val_f1_score: 0.5684
Epoch 409/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1755 - f1_score:
0.9682 - val_loss: 1.9939 - val_f1_score: 0.6160
Epoch 410/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1665 - f1_score:
0.9683 - val_loss: 2.0179 - val_f1_score: 0.6139
Epoch 411/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1634 - f1_score:
0.9699 - val_loss: 1.9577 - val_f1_score: 0.6081
Epoch 412/500
28/28 [==============================] - 3s 90ms/step - loss: 0.1785 - f1_score:
0.9644 - val_loss: 1.9393 - val_f1_score: 0.6301
Epoch 413/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1875 - f1_score:
0.9595 - val_loss: 2.2219 - val_f1_score: 0.5878
Epoch 414/500
28/28 [==============================] - 2s 81ms/step - loss: 0.1800 - f1_score:
0.9635 - val_loss: 1.9701 - val_f1_score: 0.6328
Epoch 415/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1730 - f1_score:
0.9638 - val_loss: 1.8408 - val_f1_score: 0.6280
Epoch 416/500
28/28 [==============================] - 2s 80ms/step - loss: 0.1551 - f1_score:
0.9706 - val_loss: 1.9709 - val_f1_score: 0.6447
Epoch 417/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1707 - f1_score:
0.9671 - val_loss: 1.9615 - val_f1_score: 0.6050
```

```
Epoch 418/500
28/28 [==============================] - 2s 82ms/step - loss: 0.1606 - f1_score:
0.9720 - val_loss: 1.7994 - val_f1_score: 0.6459
Epoch 419/500
28/28 [==============================] - 3s 98ms/step - loss: 0.1619 - f1_score:
0.9664 - val_loss: 2.0061 - val_f1_score: 0.5981
Epoch 420/500
28/28 [==============================] - 2s 86ms/step - loss: 0.1676 - f1_score:
0.9668 - val_loss: 2.1437 - val_f1_score: 0.5921
Epoch 421/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1667 - f1_score:
0.9722 - val_loss: 1.9969 - val_f1_score: 0.6390
Epoch 422/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1659 - f1_score:
0.9656 - val_loss: 2.1917 - val_f1_score: 0.6158
Epoch 423/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1963 - f1_score:
0.9587 - val_loss: 1.9675 - val_f1_score: 0.6326
Epoch 424/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1647 - f1_score:
0.9685 - val_loss: 1.8700 - val_f1_score: 0.6568
Epoch 425/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1663 - f1_score:
0.9697 - val_loss: 1.9052 - val_f1_score: 0.6266
Epoch 426/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1505 - f1_score:
0.9719 - val_loss: 1.8904 - val_f1_score: 0.6633
Epoch 427/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1695 - f1_score:
0.9673 - val_loss: 2.0251 - val_f1_score: 0.6185
Epoch 428/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1762 - f1_score:
0.9640 - val_loss: 2.0124 - val_f1_score: 0.6068
Epoch 429/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1797 - f1_score:
0.9653 - val_loss: 1.9958 - val_f1_score: 0.6038
Epoch 430/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1707 - f1_score:
0.9655 - val_loss: 2.1319 - val_f1_score: 0.6179
Epoch 431/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1571 - f1_score:
0.9700 - val_loss: 2.2130 - val_f1_score: 0.6074
Epoch 432/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1751 - f1_score:
0.9672 - val_loss: 2.0252 - val_f1_score: 0.6132
Epoch 433/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1639 - f1_score:
0.9690 - val_loss: 2.1174 - val_f1_score: 0.6056
```

```
Epoch 434/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1658 - f1_score:
0.9646 - val_loss: 1.9783 - val_f1_score: 0.6235
Epoch 435/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1686 - f1_score:
0.9638 - val_loss: 1.9102 - val_f1_score: 0.6348
Epoch 436/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1633 - f1_score:
0.9664 - val_loss: 2.0593 - val_f1_score: 0.6067
Epoch 437/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1501 - f1_score:
0.9734 - val_loss: 1.9376 - val_f1_score: 0.6389
Epoch 438/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1557 - f1_score:
0.9722 - val_loss: 2.2751 - val_f1_score: 0.5884
Epoch 439/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1383 - f1_score:
0.9755 - val_loss: 2.1563 - val_f1_score: 0.5925
Epoch 440/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1637 - f1_score:
0.9655 - val_loss: 2.0124 - val_f1_score: 0.6083
Epoch 441/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1686 - f1_score:
0.9664 - val_loss: 2.1635 - val_f1_score: 0.6072
Epoch 442/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1688 - f1_score:
0.9648 - val_loss: 1.9382 - val_f1_score: 0.6181
Epoch 443/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1730 - f1_score:
0.9632 - val_loss: 2.0482 - val_f1_score: 0.6142
Epoch 444/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1492 - f1_score:
0.9741 - val_loss: 1.9663 - val_f1_score: 0.6451
Epoch 445/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1585 - f1_score:
0.9667 - val_loss: 1.9795 - val_f1_score: 0.6315
Epoch 446/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1419 - f1_score:
0.9719 - val_loss: 2.0546 - val_f1_score: 0.6231
Epoch 447/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1607 - f1_score:
0.9666 - val_loss: 2.2615 - val_f1_score: 0.5473
Epoch 448/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1686 - f1_score:
0.9699 - val_loss: 1.8449 - val_f1_score: 0.6404
Epoch 449/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1562 - f1_score:
0.9721 - val_loss: 2.0002 - val_f1_score: 0.5892
```

```
Epoch 450/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1636 - f1_score:
0.9694 - val_loss: 2.0759 - val_f1_score: 0.6330
Epoch 451/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1736 - f1_score:
0.9660 - val_loss: 1.9651 - val_f1_score: 0.6289
Epoch 452/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1678 - f1_score:
0.9702 - val_loss: 1.9198 - val_f1_score: 0.6358
Epoch 453/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1690 - f1_score:
0.9686 - val_loss: 2.0757 - val_f1_score: 0.6281
Epoch 454/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1470 - f1_score:
0.9703 - val_loss: 1.9883 - val_f1_score: 0.6494
Epoch 455/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1737 - f1_score:
0.9612 - val_loss: 2.0264 - val_f1_score: 0.6139
Epoch 456/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1683 - f1_score:
0.9669 - val_loss: 2.0982 - val_f1_score: 0.6014
Epoch 457/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1692 - f1_score:
0.9659 - val_loss: 2.1221 - val_f1_score: 0.6402
Epoch 458/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1866 - f1_score:
0.9628 - val_loss: 2.0188 - val_f1_score: 0.6174
Epoch 459/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1750 - f1_score:
0.9654 - val_loss: 2.0649 - val_f1_score: 0.6051
Epoch 460/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1765 - f1_score:
0.9671 - val_loss: 2.0401 - val_f1_score: 0.5821
Epoch 461/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1582 - f1_score:
0.9722 - val_loss: 2.1094 - val_f1_score: 0.6107
Epoch 462/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1660 - f1_score:
0.9617 - val_loss: 2.0069 - val_f1_score: 0.5993
Epoch 463/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1491 - f1_score:
0.9776 - val_loss: 2.0145 - val_f1_score: 0.6242
Epoch 464/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1411 - f1_score:
0.9791 - val_loss: 2.0841 - val_f1_score: 0.5985
Epoch 465/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1456 - f1_score:
0.9690 - val_loss: 1.9822 - val_f1_score: 0.6361
```

```
Epoch 466/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1617 - f1_score:
0.9677 - val_loss: 1.9900 - val_f1_score: 0.6306
Epoch 467/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1511 - f1_score:
0.9720 - val_loss: 2.0512 - val_f1_score: 0.6124
Epoch 468/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1580 - f1_score:
0.9693 - val_loss: 1.9019 - val_f1_score: 0.6467
Epoch 469/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1556 - f1_score:
0.9704 - val_loss: 2.1314 - val_f1_score: 0.5838
Epoch 470/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1501 - f1_score:
0.9693 - val_loss: 1.9651 - val_f1_score: 0.6305
Epoch 471/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1582 - f1_score:
0.9683 - val_loss: 2.0236 - val_f1_score: 0.6545
Epoch 472/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1761 - f1_score:
0.9655 - val_loss: 2.0131 - val_f1_score: 0.6349
Epoch 473/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1734 - f1_score:
0.9652 - val_loss: 2.0638 - val_f1_score: 0.6203
Epoch 474/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1581 - f1_score:
0.9773 - val_loss: 2.0946 - val_f1_score: 0.6417
Epoch 475/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1577 - f1_score:
0.9717 - val_loss: 2.2025 - val_f1_score: 0.5857
Epoch 476/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1609 - f1_score:
0.9708 - val_loss: 2.0936 - val_f1_score: 0.6166
Epoch 477/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1469 - f1_score:
0.9715 - val_loss: 2.0016 - val_f1_score: 0.6268
Epoch 478/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1486 - f1_score:
0.9706 - val_loss: 2.1137 - val_f1_score: 0.6270
Epoch 479/500
28/28 [==============================] - 2s 84ms/step - loss: 0.1424 - f1_score:
0.9754 - val_loss: 2.0826 - val_f1_score: 0.5993
Epoch 480/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1730 - f1_score:
0.9678 - val_loss: 2.2887 - val_f1_score: 0.6065
Epoch 481/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1540 - f1_score:
0.9686 - val_loss: 2.1429 - val_f1_score: 0.5954
```

```
Epoch 482/500
28/28 [==============================] - 2s 82ms/step - loss: 0.1692 - f1_score:
0.9662 - val_loss: 2.0458 - val_f1_score: 0.6004
Epoch 483/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1522 - f1_score:
0.9727 - val_loss: 2.1438 - val_f1_score: 0.6444
Epoch 484/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1543 - f1_score:
0.9691 - val_loss: 1.9856 - val_f1_score: 0.6199
Epoch 485/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1620 - f1_score:
0.9704 - val_loss: 2.0537 - val_f1_score: 0.6180
Epoch 486/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1766 - f1_score:
0.9644 - val_loss: 2.1561 - val_f1_score: 0.6029
Epoch 487/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1536 - f1_score:
0.9690 - val_loss: 1.9587 - val_f1_score: 0.6503
Epoch 488/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1531 - f1_score:
0.9692 - val_loss: 1.8884 - val_f1_score: 0.6435
Epoch 489/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1839 - f1_score:
0.9613 - val_loss: 1.8731 - val_f1_score: 0.6166
Epoch 490/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1750 - f1_score:
0.9610 - val_loss: 2.1777 - val_f1_score: 0.6153
Epoch 491/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1576 - f1_score:
0.9707 - val_loss: 1.9955 - val_f1_score: 0.5879
Epoch 492/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1520 - f1_score:
0.9701 - val_loss: 2.0467 - val_f1_score: 0.6342
Epoch 493/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1562 - f1_score:
0.9679 - val_loss: 2.0356 - val_f1_score: 0.6021
Epoch 494/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1558 - f1_score:
0.9695 - val_loss: 2.2914 - val_f1_score: 0.5851
Epoch 495/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1387 - f1_score:
0.9770 - val_loss: 1.9719 - val_f1_score: 0.6323
Epoch 496/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1508 - f1_score:
0.9701 - val_loss: 2.0291 - val_f1_score: 0.6124
Epoch 497/500
28/28 [==============================] - 2s 79ms/step - loss: 0.1473 - f1_score:
0.9706 - val_loss: 2.1126 - val_f1_score: 0.5821
```

```
Epoch 498/500
28/28 [==============================] - 2s 78ms/step - loss: 0.1359 - f1_score:
0.9785 - val_loss: 2.1945 - val_f1_score: 0.5879
Epoch 499/500
28/28 [==============================] - 2s 76ms/step - loss: 0.1547 - f1_score:
0.9722 - val_loss: 2.1799 - val_f1_score: 0.6217
Epoch 500/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1811 - f1_score:
0.9620 - val_loss: 2.2509 - val_f1_score: 0.5870
```

[126]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 14ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.500     0.667     0.571         6
  BASKETBALL      1.000     0.900     0.947        10
         BEE      0.500     0.300     0.375        10
        BELT      0.500     1.000     0.667         4
        BITE      0.667     0.500     0.571         8
   BREAKFAST      0.571     0.667     0.615         6
      CANCER      0.615     1.000     0.762         8
   CHRISTMAS      0.750     1.000     0.857         6
    CONFUSED      0.571     0.667     0.615         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.200     0.333     0.250         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.500     0.250     0.333         8
     DEVELOP      0.000     0.000     0.000         6
      DINNER      0.800     0.500     0.615         8
         DOG      0.500     0.500     0.500         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      0.400     0.500     0.444         4
         EAT      0.385     0.833     0.526         6
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.615     1.000     0.762         8
        FINE      0.750     0.750     0.750         4
       FLOAT      0.143     0.500     0.222         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.667     0.750     0.706         8
   HALLOWEEN      0.889     1.000     0.941         8
    HOSPITAL      0.667     0.333     0.444         6
 HURDLE/TRIP      0.333     0.500     0.400         4
```

```
     JEWELRY      1.000     1.000     1.000         4
      KNIGHT      0.400     0.500     0.444         4
        LOCK      0.500     0.500     0.500         8
       LUNCH      0.500     0.500     0.500         8
       MAPLE      1.000     0.500     0.667         4
        MEAT      0.333     0.333     0.333         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      0.000     0.000     0.000         8
       MOVIE      0.333     0.250     0.286         8
        NOON      1.000     1.000     1.000         8
       PARTY      1.000     0.750     0.857         8
     PATIENT      0.000     0.000     0.000         6
       RAZOR      0.286     0.500     0.364         4
       RIVER      0.833     0.833     0.833         6
ROCKINGCHAIR      0.700     0.875     0.778         8
       SHAVE      0.667     0.400     0.500        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      0.500     0.500     0.500         4
        THEY      0.429     0.750     0.545         4
       TWINS      0.571     0.500     0.533         8
     WHATFOR      1.000     0.300     0.462        10

    accuracy                          0.611       324
   macro avg      0.597     0.621     0.587       324
weighted avg      0.615     0.611     0.591       324
```

```
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[127]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1D-CNN + 1 LSTM Trial 717/history.csv'
with open(hist_csv_file, mode='w') as f:
```

```
    hist_df.to_csv(f)
```

[128]:
```
hist_df = pd.read_csv('1 1D-CNN + 1 LSTM Trial 717/history.csv', index_col=0)
hist_df.tail()
```

[128]:

	loss	f1_score	val_loss	val_f1_score
495	0.150789	0.970118	2.029120	0.612400
496	0.147346	0.970612	2.112572	0.582086
497	0.135868	0.978456	2.194486	0.587883
498	0.154721	0.972239	2.179939	0.621738
499	0.181057	0.961961	2.250935	0.587032

[129]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[130]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[131]:
```
reconstructed_model = tf.keras.models.load_model("1 1D-CNN + 1 LSTM Trial 717")
```

[132]:
```
reconstructed_model.summary()
```

```
Model: "sequential_1"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_1 (Conv1D)           (None, 126, 175)          349300

 max_pooling1d_1 (MaxPooling  (None, 8, 175)           0
 1D)

 dropout_2 (Dropout)         (None, 8, 175)            0

 lstm_1 (LSTM)               (None, 200)               300800
```

```
 dropout_3 (Dropout)         (None, 200)               0

 dense_2 (Dense)             (None, 70)                14070

 dense_3 (Dense)             (None, 50)                3550

=================================================================
Total params: 667,720
Trainable params: 667,720
Non-trainable params: 0
_________________________________________________________________
```

[133]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[133]:

InputLayer
input:
[(None, 130, 399)]
output:
[(None, 130, 399)]
Conv1D
input:
(None, 130, 399)
output:
(None, 126, 175)
MaxPooling1D
input:
(None, 126, 175)
output:
(None, 8, 175)
Dropout
input:
(None, 8, 175)
output:
(None, 8, 175)
LSTM
input:
(None, 8, 175)
output:
(None, 200)
Dropout
input:
(None, 200)
output:
(None, 200)
Dense
input:
(None, 200)
output:
(None, 70)
Dense
input:
(None, 70)
output:
(None, 50)

[134]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[134]:

Conv1D
MaxPooling1D
Dropout
LSTM
Dense

[135]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 12ms/step - loss: 1.3071 - f1_score:
0.6976
```

[135]:
```
[1.307061791419983, 0.697600245475769]
```

[136]:
```
reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)
```

```
28/28 [==============================] - 1s 29ms/step - loss: 0.2873 - f1_score:
0.9597
```

[136]:
```
[0.2873406708240509, 0.9597119092941284]
```

[137]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 9ms/step
              precision    recall  f1-score   support

         AXE      1.000     1.000     1.000         8
    BACKPACK      0.600     1.000     0.750         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      0.250     0.200     0.222        10
        BELT      1.000     1.000     1.000         4
        BITE      0.857     0.750     0.800         8
   BREAKFAST      0.400     0.333     0.364         6
      CANCER      0.571     1.000     0.727         8
   CHRISTMAS      0.833     0.833     0.833         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.286     0.333     0.308         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.500     0.333     0.400         6
      DINNER      0.615     1.000     0.762         8
         DOG      0.667     0.333     0.444         6
    DOWNSIZE      1.000     0.750     0.857         8
        DRAG      1.000     0.500     0.667         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.615     1.000     0.762         8
        FINE      1.000     0.500     0.667         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      1.000     0.750     0.857         8
   HALLOWEEN      0.889     1.000     0.941         8
    HOSPITAL      0.600     0.500     0.545         6
 HURDLE/TRIP      0.333     0.500     0.400         4
     JEWELRY      1.000     0.750     0.857         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.667     0.750     0.706         8
       LUNCH      1.000     0.375     0.545         8
       MAPLE      0.500     1.000     0.667         4
        MEAT      0.429     0.500     0.462         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     0.375     0.545         8
       MOVIE      0.500     0.750     0.600         8
        NOON      0.727     1.000     0.842         8
       PARTY      1.000     0.625     0.769         8
     PATIENT      0.500     0.667     0.571         6
       RAZOR      0.333     0.500     0.400         4
       RIVER      0.750     1.000     0.857         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.000     0.000     0.000        10
        SINK      1.000     0.167     0.286         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.667     1.000     0.800         4
       TWINS      0.800     1.000     0.889         8
     WHATFOR      0.857     0.600     0.706        10

    accuracy                          0.713       324
   macro avg      0.749     0.715     0.698       324
weighted avg      0.740     0.713     0.694       324
```

3.10 Hyperparameter Tuning 2 1D CNN Layer + 1 LSTM

[119]:
```
from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_2423752/1222377179.py:2: DeprecationWarning: `import kerastuner`
is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

[120]:
```
from tensorflow.keras import regularizers
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten, Dense,␣
 ↪Dropout, LSTM
import keras_tuner
from keras_tuner import HyperModel
```

```python
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa


class HyperModel(HyperModel):

    def __init__(self, input_shape, num_classes):
        self.input_shape = input_shape
        self.num_classes = num_classes

    def build(self, hp):
        act_function = hp.Choice(
            'dense_activation',
            values=['selu', 'mish', 'gelu', 'elu', 'relu'],
            default='relu')
        model = Sequential()
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_1',
                       values=[3, 4, 5, 6, 7, 8, 9, 10],
                       default=5,
                   ),
                   activation=act_function,
                   input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_1',
                values=[3, 4, 5, 6, 7, 8, 9, 10],
                default=5,
            )))
        model.add(
            Conv1D(filters=hp.Int('filters_1',
                                  min_value=50,
                                  max_value=200,
                                  step=25,
                                  default=150),
                   kernel_size=hp.Choice(
                       'kernel_2',
                       values=[1, 2, 3, 4, 5],
                       default=5,
                   ),
```

```
                activation=act_function,
                input_shape=self.input_shape))
        model.add(
            MaxPooling1D(pool_size=hp.Choice(
                'pool_2',
                values=[1, 2, 3, 4, 5],
                default=5,
            )))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_1',
                min_value=0.0,
                max_value=0.9,
                default=0.8,
                step=0.05,
            )))
        model.add(
            LSTM(units=hp.Int('units_1',
                               min_value=50,
                               max_value=200,
                               step=25,
                               default=100),
                 return_sequences=False,
                 kernel_regularizer=regularizers.l2(
                     hp.Float('regularizer',
                               min_value=1e-4,
                               max_value=1e-2,
                               sampling='LOG',
                               default=.001))))
        model.add(
            Dropout(rate=hp.Float(
                'dropout_2',
                min_value=0.0,
                max_value=0.9,
                default=0.7,
                step=0.05,
            )))
        model.add(
            Dense(units=hp.Int('units_2',
                                min_value=70,
                                max_value=120,
                                step=10,
                                default=80),
                   activation=act_function))
        model.add(Dense(self.num_classes, activation='softmax'))

        model.compile(
```

```
            tf.optimizers.experimental.Nadam(
                hp.Float('learning_rate',
                         min_value=1e-4,
                         max_value=1e-2,
                         sampling='LOG',
                         default=.00062198175395800846)),
            loss='categorical_crossentropy',
            metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
        return model


hypermodel = HyperModel(input_shape=(130, 399), num_classes=50)
```

[121]:
```
HYPERBAND_MAX_EPOCHS = 300
EXECUTION_PER_TRIAL = 2

tuner = Hyperband(
    hypermodel,
    max_epochs=HYPERBAND_MAX_EPOCHS,
    objective=keras_tuner.Objective("val_f1_score", direction="max"),
    seed=10,
    executions_per_trial=EXECUTION_PER_TRIAL,
    directory='/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/',
    project_name='2_1D_CNN+1_LSTM',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN+1_LSTM/tuner0.json
```

[123]:
```
tuner.search_space_summary()
```

```
Search space summary
Default search space size: 12
dense_activation (Choice)
{'default': 'gelu', 'conditions': [], 'values': ['selu', 'mish', 'gelu', 'elu',
'relu'], 'ordered': False}
filters_1 (Int)
{'default': 150, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
kernel_1 (Choice)
{'default': 5, 'conditions': [], 'values': [3, 4, 5, 6, 7, 8, 9, 10], 'ordered':
True}
pool_1 (Choice)
{'default': 5, 'conditions': [], 'values': [3, 4, 5, 6, 7, 8, 9, 10], 'ordered':
True}
kernel_2 (Choice)
{'default': 5, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
pool_2 (Choice)
```

```
{'default': 5, 'conditions': [], 'values': [1, 2, 3, 4, 5], 'ordered': True}
dropout_1 (Float)
{'default': 0.8, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_1 (Int)
{'default': 100, 'conditions': [], 'min_value': 50, 'max_value': 200, 'step':
25, 'sampling': 'linear'}
regularizer (Float)
{'default': 0.001, 'conditions': [], 'min_value': 0.0001, 'max_value': 0.01,
'step': None, 'sampling': 'log'}
dropout_2 (Float)
{'default': 0.7, 'conditions': [], 'min_value': 0.0, 'max_value': 0.9, 'step':
0.05, 'sampling': 'linear'}
units_2 (Int)
{'default': 80, 'conditions': [], 'min_value': 70, 'max_value': 120, 'step': 10,
'sampling': 'linear'}
learning_rate (Float)
{'default': 0.0006219817539580085, 'conditions': [], 'min_value': 0.0001,
'max_value': 0.01, 'step': None, 'sampling': 'log'}
```

[124]:
```
es = EarlyStopping(monitor="val_f1_score",
                   patience=30,
                   restore_best_weights=True,
                   mode="max")
```

[126]:
```
tuner.search(Xtrain,
             Ytrain,
             epochs=1000,
             validation_data=(Xval, Yval),
             batch_size=96,
             callbacks=[es])
```

```
Trial 725 Complete [00h 04m 05s]
val_f1_score: 0.46747535467147827

Best val_f1_score So Far: 0.7492342889308929
Total elapsed time: 11h 39m 22s
INFO:tensorflow:Oracle triggered exit
```

[122]:
```
best_model = tuner.get_best_models(num_models=10)[0]
```

```
2023-09-10 11:28:41.843174: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-10 11:28:45.829128: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
```

```
/job:localhost/replica:0/task:0/device:GPU:0 with 1561 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1

WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.20
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.21
WARNING:tensorflow:Detecting that an object or model or tf.train.Checkpoint is
being deleted with unrestored values. See the following logs for the specific
values in question. To silence these warnings, use `status.expect_partial()`.
See https://www.tensorflow.org/api_docs/python/tf/train/Checkpoint#restorefor
details about the status object returned by the restore function.
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
```

```
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
```

```
IOPub message rate exceeded.
The notebook server will temporarily stop sending output
to the client in order to avoid crashing it.
To change this limit, set the config variable
`--NotebookApp.iopub_msg_rate_limit`.

Current values:
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)
NotebookApp.rate_limit_window=3.0 (secs)
```

[123]:
```
best_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 128, 150)          179700

 max_pooling1d (MaxPooling1D  (None, 21, 150)          0
 )

 conv1d_1 (Conv1D)           (None, 18, 150)           90150

 max_pooling1d_1 (MaxPooling  (None, 4, 150)           0
 1D)

 dropout (Dropout)           (None, 4, 150)            0

 lstm (LSTM)                 (None, 150)               180600
```

```
 dropout_1 (Dropout)         (None, 150)               0

 dense (Dense)               (None, 90)                13590

 dense_1 (Dense)             (None, 50)                4550

=================================================================
Total params: 468,590
Trainable params: 468,590
Non-trainable params: 0
_________________________________________________________________
```

[124]:
```
plot_model(best_model, show_shapes=True, show_layer_names=False)
```

[124]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 128, 150)
MaxPooling1D
input: (None, 128, 150)
output: (None, 21, 150)
Conv1D
input: (None, 21, 150)
output: (None, 18, 150)
MaxPooling1D
input: (None, 18, 150)
output: (None, 4, 150)
Dropout
input: (None, 4, 150)
output: (None, 4, 150)
LSTM
input: (None, 4, 150)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 90)
Dense
input: (None, 90)
output: (None, 50)

[125]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(best_model, legend=True, font=font)
```

[125]:

Conv1D
MaxPooling1D
Dropout
LSTM
Dense

[130]:
```
tuner.results_summary()
```

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/RTMPose-L/hyperband/2_1D_CNN+1_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0427 summary
Hyperparameters:
dense_activation: mish
filters_1: 150
kernel_1: 3
pool_1: 6
kernel_2: 4
pool_2: 4
dropout_1: 0.45
units_1: 150
regularizer: 0.005421195615159703
dropout_2: 0.55
units_2: 90
learning_rate: 0.0008053201250101636
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0424
Score: 0.7492342889308929

Trial 0426 summary
Hyperparameters:
dense_activation: gelu
filters_1: 200
kernel_1: 3
pool_1: 6
kernel_2: 3
pool_2: 4
dropout_1: 0.1
units_1: 50
regularizer: 0.001278553600468175
dropout_2: 0.30000000000000004
units_2: 100
learning_rate: 0.0004250525730906734
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
```

```
tuner/round: 5
tuner/trial_id: 0425
Score: 0.7470126450061798

Trial 0425 summary
Hyperparameters:
dense_activation: gelu
filters_1: 200
kernel_1: 3
pool_1: 6
kernel_2: 3
pool_2: 4
dropout_1: 0.1
units_1: 50
regularizer: 0.001278553600468175
dropout_2: 0.30000000000000004
units_2: 100
learning_rate: 0.0004250525730906734
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0415
Score: 0.7215900123119354

Trial 0670 summary
Hyperparameters:
dense_activation: mish
filters_1: 125
kernel_1: 3
pool_1: 7
kernel_2: 5
pool_2: 3
dropout_1: 0.25
units_1: 50
regularizer: 0.0003910489889455808
dropout_2: 0.30000000000000004
units_2: 70
learning_rate: 0.0007539027884617362
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.7207793295383453

Trial 0715 summary
Hyperparameters:
```

```
dense_activation: gelu
filters_1: 150
kernel_1: 6
pool_1: 10
kernel_2: 3
pool_2: 1
dropout_1: 0.75
units_1: 75
regularizer: 0.004824642245001809
dropout_2: 0.45
units_2: 110
learning_rate: 0.00023747115131631685
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0710
Score: 0.7202362716197968

Trial 0700 summary
Hyperparameters:
dense_activation: elu
filters_1: 75
kernel_1: 7
pool_1: 7
kernel_2: 1
pool_2: 1
dropout_1: 0.2
units_1: 150
regularizer: 0.0020776644996253492
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0006261461260984394
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.7128338813781738

Trial 0424 summary
Hyperparameters:
dense_activation: mish
filters_1: 150
kernel_1: 3
pool_1: 6
kernel_2: 4
pool_2: 4
```

```
dropout_1: 0.45
units_1: 150
regularizer: 0.005421195615159703
dropout_2: 0.55
units_2: 90
learning_rate: 0.0008053201250101636
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0413
Score: 0.7059725821018219

Trial 0665 summary
Hyperparameters:
dense_activation: mish
filters_1: 125
kernel_1: 3
pool_1: 7
kernel_2: 5
pool_2: 3
dropout_1: 0.25
units_1: 50
regularizer: 0.0003910489889455808
dropout_2: 0.30000000000000004
units_2: 70
learning_rate: 0.0007539027884617362
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0651
Score: 0.6984764039516449

Trial 0717 summary
Hyperparameters:
dense_activation: relu
filters_1: 100
kernel_1: 3
pool_1: 8
kernel_2: 5
pool_2: 1
dropout_1: 0.35000000000000003
units_1: 125
regularizer: 0.0038373133841621094
dropout_2: 0.65
units_2: 80
learning_rate: 0.00017278054913737677
```

```
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0707
Score: 0.6935538947582245

Trial 0693 summary
Hyperparameters:
dense_activation: elu
filters_1: 75
kernel_1: 7
pool_1: 7
kernel_2: 1
pool_2: 1
dropout_1: 0.2
units_1: 150
regularizer: 0.0020776644996253492
dropout_2: 0.6000000000000001
units_2: 80
learning_rate: 0.0006261461260984394
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0680
Score: 0.6847829222679138
```

[131]:
```
loss, accuracy = best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 2s 38ms/step - loss: 1.3475 - f1_score:
0.7625
```

[132]:
```
loss, accuracy = best_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 13ms/step - loss: 0.1221 - f1_score:
1.0000
```

[133]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(best_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 10ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.875     0.933         8
    BACKPACK      0.750     1.000     0.857         6
```

BASKETBALL	1.000	1.000	1.000	10
BEE	0.714	1.000	0.833	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.750	0.857	8
BREAKFAST	1.000	0.333	0.500	6
CANCER	1.000	1.000	1.000	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	0.600	1.000	0.750	6
DARK	0.667	1.000	0.800	4
DEAF	0.333	0.167	0.222	6
DECIDE	1.000	0.667	0.800	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.500	0.333	0.400	6
DINNER	0.889	1.000	0.941	8
DOG	0.600	0.500	0.545	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	1.000	0.500	0.667	4
EAT	0.667	1.000	0.800	6
EDIT	0.600	1.000	0.750	6
ELEVATOR	0.429	0.750	0.545	8
FINE	1.000	0.500	0.667	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	0.714	0.833	0.769	6
GUESS	0.889	1.000	0.941	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	1.000	0.667	0.800	6
HURDLE/TRIP	0.571	1.000	0.727	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	1.000	0.750	0.857	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.571	1.000	0.727	4
MEAT	1.000	0.833	0.909	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.700	0.875	0.778	8
NOON	0.800	1.000	0.889	8
PARTY	1.000	0.750	0.857	8
PATIENT	1.000	0.333	0.500	6
RAZOR	0.667	1.000	0.800	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	1.000	0.500	0.667	10
SINK	0.333	0.167	0.222	6
SQUEEZE	1.000	0.500	0.667	4
THEY	0.667	1.000	0.800	4
TWINS	0.667	1.000	0.800	8
WHATFOR	1.000	0.500	0.667	10

```
    accuracy                           0.790       324
   macro avg       0.813     0.779     0.763       324
weighted avg       0.828     0.790     0.778       324
```

[134]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

[135]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 LSTM/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[137]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
[INFO] training the best model…
Epoch 1/500
28/28 [==============================] - 11s 97ms/step - loss: 4.9852 -
f1_score: 0.0145 - val_loss: 4.7066 - val_f1_score: 4.8780e-04
Epoch 2/500
28/28 [==============================] - 2s 63ms/step - loss: 4.5154 - f1_score:
0.0128 - val_loss: 4.3306 - val_f1_score: 0.0100
Epoch 3/500
28/28 [==============================] - 2s 79ms/step - loss: 4.2145 - f1_score:
0.0228 - val_loss: 4.0675 - val_f1_score: 0.0150
Epoch 4/500
28/28 [==============================] - 2s 88ms/step - loss: 3.9174 - f1_score:
0.0268 - val_loss: 3.6295 - val_f1_score: 0.0248
Epoch 5/500
28/28 [==============================] - 3s 103ms/step - loss: 3.6697 -
f1_score: 0.0464 - val_loss: 3.4563 - val_f1_score: 0.0356
Epoch 6/500
28/28 [==============================] - 3s 96ms/step - loss: 3.4822 - f1_score:
0.0572 - val_loss: 3.2799 - val_f1_score: 0.0720
Epoch 7/500
28/28 [==============================] - 3s 108ms/step - loss: 3.3011 -
f1_score: 0.0786 - val_loss: 3.0295 - val_f1_score: 0.0945
Epoch 8/500
28/28 [==============================] - 3s 106ms/step - loss: 3.1387 -
```

```
f1_score: 0.1050 - val_loss: 2.9524 - val_f1_score: 0.1765
Epoch 9/500
28/28 [==============================] - 4s 150ms/step - loss: 2.9752 -
f1_score: 0.1377 - val_loss: 2.7828 - val_f1_score: 0.1614
Epoch 10/500
28/28 [==============================] - 4s 154ms/step - loss: 2.8238 -
f1_score: 0.1767 - val_loss: 2.6687 - val_f1_score: 0.1768
Epoch 11/500
28/28 [==============================] - 4s 131ms/step - loss: 2.6963 -
f1_score: 0.1904 - val_loss: 2.4655 - val_f1_score: 0.2437
Epoch 12/500
28/28 [==============================] - 3s 123ms/step - loss: 2.5846 -
f1_score: 0.2300 - val_loss: 2.4760 - val_f1_score: 0.2752
Epoch 13/500
28/28 [==============================] - 4s 138ms/step - loss: 2.4881 -
f1_score: 0.2674 - val_loss: 2.3408 - val_f1_score: 0.3086
Epoch 14/500
28/28 [==============================] - 5s 161ms/step - loss: 2.3855 -
f1_score: 0.2875 - val_loss: 2.3122 - val_f1_score: 0.3000
Epoch 15/500
28/28 [==============================] - 3s 125ms/step - loss: 2.2946 -
f1_score: 0.3194 - val_loss: 2.2377 - val_f1_score: 0.3186
Epoch 16/500
28/28 [==============================] - 4s 128ms/step - loss: 2.2547 -
f1_score: 0.3271 - val_loss: 2.1554 - val_f1_score: 0.3171
Epoch 17/500
28/28 [==============================] - 4s 128ms/step - loss: 2.1875 -
f1_score: 0.3493 - val_loss: 2.1342 - val_f1_score: 0.3614
Epoch 18/500
28/28 [==============================] - 4s 128ms/step - loss: 2.0977 -
f1_score: 0.3672 - val_loss: 2.1049 - val_f1_score: 0.3826
Epoch 19/500
28/28 [==============================] - 3s 121ms/step - loss: 2.0715 -
f1_score: 0.3732 - val_loss: 2.0131 - val_f1_score: 0.3735
Epoch 20/500
28/28 [==============================] - 3s 126ms/step - loss: 1.9873 -
f1_score: 0.4154 - val_loss: 1.9935 - val_f1_score: 0.3734
Epoch 21/500
28/28 [==============================] - 4s 128ms/step - loss: 1.9572 -
f1_score: 0.4098 - val_loss: 1.9425 - val_f1_score: 0.4209
Epoch 22/500
28/28 [==============================] - 3s 121ms/step - loss: 1.9146 -
f1_score: 0.4276 - val_loss: 1.9293 - val_f1_score: 0.4097
Epoch 23/500
28/28 [==============================] - 4s 132ms/step - loss: 1.8303 -
f1_score: 0.4439 - val_loss: 1.9403 - val_f1_score: 0.4335
Epoch 24/500
28/28 [==============================] - 4s 127ms/step - loss: 1.8016 -
```

```
f1_score: 0.4689 - val_loss: 1.8279 - val_f1_score: 0.4548
Epoch 25/500
28/28 [==============================] - 4s 135ms/step - loss: 1.7568 -
f1_score: 0.4721 - val_loss: 1.8911 - val_f1_score: 0.4393
Epoch 26/500
28/28 [==============================] - 3s 123ms/step - loss: 1.7291 -
f1_score: 0.4841 - val_loss: 1.8847 - val_f1_score: 0.4521
Epoch 27/500
28/28 [==============================] - 2s 69ms/step - loss: 1.6784 - f1_score:
0.4998 - val_loss: 1.7982 - val_f1_score: 0.4530
Epoch 28/500
28/28 [==============================] - 2s 65ms/step - loss: 1.6302 - f1_score:
0.5247 - val_loss: 1.8131 - val_f1_score: 0.4629
Epoch 29/500
28/28 [==============================] - 2s 63ms/step - loss: 1.5898 - f1_score:
0.5303 - val_loss: 1.6779 - val_f1_score: 0.4688
Epoch 30/500
28/28 [==============================] - 2s 66ms/step - loss: 1.5447 - f1_score:
0.5440 - val_loss: 1.8980 - val_f1_score: 0.4462
Epoch 31/500
28/28 [==============================] - 2s 67ms/step - loss: 1.5289 - f1_score:
0.5503 - val_loss: 1.8201 - val_f1_score: 0.4530
Epoch 32/500
28/28 [==============================] - 2s 64ms/step - loss: 1.4722 - f1_score:
0.5650 - val_loss: 1.6798 - val_f1_score: 0.5118
Epoch 33/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4578 - f1_score:
0.5732 - val_loss: 1.6949 - val_f1_score: 0.4884
Epoch 34/500
28/28 [==============================] - 2s 65ms/step - loss: 1.4267 - f1_score:
0.5712 - val_loss: 1.6072 - val_f1_score: 0.5229
Epoch 35/500
28/28 [==============================] - 2s 67ms/step - loss: 1.4000 - f1_score:
0.5925 - val_loss: 1.6124 - val_f1_score: 0.5167
Epoch 36/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3482 - f1_score:
0.6148 - val_loss: 1.6385 - val_f1_score: 0.4938
Epoch 37/500
28/28 [==============================] - 2s 65ms/step - loss: 1.3166 - f1_score:
0.6214 - val_loss: 1.5743 - val_f1_score: 0.5245
Epoch 38/500
28/28 [==============================] - 2s 68ms/step - loss: 1.3156 - f1_score:
0.6110 - val_loss: 1.5418 - val_f1_score: 0.5590
Epoch 39/500
28/28 [==============================] - 2s 65ms/step - loss: 1.2618 - f1_score:
0.6409 - val_loss: 1.5057 - val_f1_score: 0.5428
Epoch 40/500
28/28 [==============================] - 2s 63ms/step - loss: 1.2303 - f1_score:
```

```
0.6463 - val_loss: 1.5631 - val_f1_score: 0.5607
Epoch 41/500
28/28 [==============================] - 2s 65ms/step - loss: 1.1720 - f1_score:
0.6555 - val_loss: 1.5121 - val_f1_score: 0.5584
Epoch 42/500
28/28 [==============================] - 2s 64ms/step - loss: 1.1979 - f1_score:
0.6440 - val_loss: 1.5578 - val_f1_score: 0.5455
Epoch 43/500
28/28 [==============================] - 2s 63ms/step - loss: 1.1864 - f1_score:
0.6602 - val_loss: 1.4125 - val_f1_score: 0.5871
Epoch 44/500
28/28 [==============================] - 2s 68ms/step - loss: 1.1301 - f1_score:
0.6687 - val_loss: 1.6108 - val_f1_score: 0.5544
Epoch 45/500
28/28 [==============================] - 2s 64ms/step - loss: 1.1423 - f1_score:
0.6718 - val_loss: 1.5210 - val_f1_score: 0.5648
Epoch 46/500
28/28 [==============================] - 2s 69ms/step - loss: 1.1029 - f1_score:
0.6811 - val_loss: 1.4766 - val_f1_score: 0.5820
Epoch 47/500
28/28 [==============================] - 2s 66ms/step - loss: 1.0763 - f1_score:
0.6936 - val_loss: 1.4511 - val_f1_score: 0.5617
Epoch 48/500
28/28 [==============================] - 2s 67ms/step - loss: 1.0483 - f1_score:
0.7008 - val_loss: 1.4452 - val_f1_score: 0.5896
Epoch 49/500
28/28 [==============================] - 2s 69ms/step - loss: 1.0494 - f1_score:
0.7007 - val_loss: 1.4147 - val_f1_score: 0.5938
Epoch 50/500
28/28 [==============================] - 2s 88ms/step - loss: 1.0131 - f1_score:
0.7080 - val_loss: 1.5469 - val_f1_score: 0.6012
Epoch 51/500
28/28 [==============================] - 2s 71ms/step - loss: 1.0258 - f1_score:
0.7115 - val_loss: 1.4462 - val_f1_score: 0.6004
Epoch 52/500
28/28 [==============================] - 2s 70ms/step - loss: 1.0166 - f1_score:
0.7177 - val_loss: 1.5135 - val_f1_score: 0.5921
Epoch 53/500
28/28 [==============================] - 2s 76ms/step - loss: 0.9663 - f1_score:
0.7172 - val_loss: 1.4802 - val_f1_score: 0.5990
Epoch 54/500
28/28 [==============================] - 2s 72ms/step - loss: 0.9562 - f1_score:
0.7326 - val_loss: 1.4090 - val_f1_score: 0.5964
Epoch 55/500
28/28 [==============================] - 2s 70ms/step - loss: 0.9571 - f1_score:
0.7274 - val_loss: 1.4643 - val_f1_score: 0.5917
Epoch 56/500
28/28 [==============================] - 2s 80ms/step - loss: 0.9540 - f1_score:
```

```
0.7286 - val_loss: 1.4643 - val_f1_score: 0.6384
Epoch 57/500
28/28 [==============================] - 2s 88ms/step - loss: 0.9359 - f1_score:
0.7343 - val_loss: 1.4568 - val_f1_score: 0.6191
Epoch 58/500
28/28 [==============================] - 2s 79ms/step - loss: 0.8952 - f1_score:
0.7515 - val_loss: 1.3079 - val_f1_score: 0.6444
Epoch 59/500
28/28 [==============================] - 2s 80ms/step - loss: 0.8908 - f1_score:
0.7528 - val_loss: 1.3850 - val_f1_score: 0.6146
Epoch 60/500
28/28 [==============================] - 2s 85ms/step - loss: 0.8448 - f1_score:
0.7644 - val_loss: 1.3537 - val_f1_score: 0.6450
Epoch 61/500
28/28 [==============================] - 2s 77ms/step - loss: 0.8717 - f1_score:
0.7612 - val_loss: 1.3201 - val_f1_score: 0.6223
Epoch 62/500
28/28 [==============================] - 2s 72ms/step - loss: 0.8445 - f1_score:
0.7667 - val_loss: 1.3230 - val_f1_score: 0.6461
Epoch 63/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8339 - f1_score:
0.7767 - val_loss: 1.4010 - val_f1_score: 0.6105
Epoch 64/500
28/28 [==============================] - 2s 71ms/step - loss: 0.8265 - f1_score:
0.7659 - val_loss: 1.4849 - val_f1_score: 0.6060
Epoch 65/500
28/28 [==============================] - 2s 69ms/step - loss: 0.7985 - f1_score:
0.7885 - val_loss: 1.4122 - val_f1_score: 0.6344
Epoch 66/500
28/28 [==============================] - 2s 71ms/step - loss: 0.7997 - f1_score:
0.7775 - val_loss: 1.3280 - val_f1_score: 0.6279
Epoch 67/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8057 - f1_score:
0.7794 - val_loss: 1.2741 - val_f1_score: 0.6529
Epoch 68/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7612 - f1_score:
0.7938 - val_loss: 1.5200 - val_f1_score: 0.5854
Epoch 69/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7614 - f1_score:
0.7966 - val_loss: 1.3435 - val_f1_score: 0.6065
Epoch 70/500
28/28 [==============================] - 2s 70ms/step - loss: 0.7594 - f1_score:
0.7933 - val_loss: 1.3650 - val_f1_score: 0.6338
Epoch 71/500
28/28 [==============================] - 2s 76ms/step - loss: 0.7377 - f1_score:
0.7936 - val_loss: 1.3798 - val_f1_score: 0.6424
Epoch 72/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7237 - f1_score:
```

```
0.8063 - val_loss: 1.4522 - val_f1_score: 0.6309
Epoch 73/500
28/28 [==============================] - 2s 81ms/step - loss: 0.7140 - f1_score:
0.8037 - val_loss: 1.3888 - val_f1_score: 0.6647
Epoch 74/500
28/28 [==============================] - 2s 77ms/step - loss: 0.6866 - f1_score:
0.8165 - val_loss: 1.4146 - val_f1_score: 0.6564
Epoch 75/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6718 - f1_score:
0.8189 - val_loss: 1.4292 - val_f1_score: 0.6349
Epoch 76/500
28/28 [==============================] - 3s 93ms/step - loss: 0.7157 - f1_score:
0.8045 - val_loss: 1.3650 - val_f1_score: 0.6665
Epoch 77/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6790 - f1_score:
0.8167 - val_loss: 1.3476 - val_f1_score: 0.6447
Epoch 78/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6878 - f1_score:
0.8093 - val_loss: 1.3093 - val_f1_score: 0.6680
Epoch 79/500
28/28 [==============================] - 2s 75ms/step - loss: 0.6568 - f1_score:
0.8194 - val_loss: 1.3248 - val_f1_score: 0.6638
Epoch 80/500
28/28 [==============================] - 2s 77ms/step - loss: 0.6608 - f1_score:
0.8284 - val_loss: 1.3809 - val_f1_score: 0.6671
Epoch 81/500
28/28 [==============================] - 2s 73ms/step - loss: 0.6378 - f1_score:
0.8354 - val_loss: 1.4446 - val_f1_score: 0.6405
Epoch 82/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6342 - f1_score:
0.8323 - val_loss: 1.3468 - val_f1_score: 0.6563
Epoch 83/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6387 - f1_score:
0.8341 - val_loss: 1.3710 - val_f1_score: 0.6548
Epoch 84/500
28/28 [==============================] - 2s 74ms/step - loss: 0.6233 - f1_score:
0.8352 - val_loss: 1.3005 - val_f1_score: 0.6489
Epoch 85/500
28/28 [==============================] - ETA: 0s - loss: 0.6143 - f1_score:
0.8427

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets
```

```
28/28 [==============================] - 14s 532ms/step - loss: 0.6143 -
f1_score: 0.8427 - val_loss: 1.2954 - val_f1_score: 0.6972
Epoch 86/500
28/28 [==============================] - 2s 63ms/step - loss: 0.6380 - f1_score:
0.8298 - val_loss: 1.2819 - val_f1_score: 0.6838
Epoch 87/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6069 - f1_score:
0.8439 - val_loss: 1.2943 - val_f1_score: 0.6700
Epoch 88/500
28/28 [==============================] - 2s 58ms/step - loss: 0.6004 - f1_score:
0.8411 - val_loss: 1.2779 - val_f1_score: 0.6557
Epoch 89/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5804 - f1_score:
0.8373 - val_loss: 1.2567 - val_f1_score: 0.6707
Epoch 90/500
28/28 [==============================] - 2s 59ms/step - loss: 0.5801 - f1_score:
0.8531 - val_loss: 1.3957 - val_f1_score: 0.6498
Epoch 91/500
28/28 [==============================] - 2s 59ms/step - loss: 0.6061 - f1_score:
0.8386 - val_loss: 1.2821 - val_f1_score: 0.6852
Epoch 92/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5516 - f1_score:
0.8598 - val_loss: 1.5745 - val_f1_score: 0.6144
Epoch 93/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5913 - f1_score:
0.8436 - val_loss: 1.3743 - val_f1_score: 0.6606
Epoch 94/500
28/28 [==============================] - 2s 67ms/step - loss: 0.5910 - f1_score:
0.8489 - val_loss: 1.3047 - val_f1_score: 0.6513
Epoch 95/500
28/28 [==============================] - 2s 62ms/step - loss: 0.5626 - f1_score:
0.8490 - val_loss: 1.5035 - val_f1_score: 0.6449
Epoch 96/500
28/28 [==============================] - 2s 67ms/step - loss: 0.5609 - f1_score:
0.8567 - val_loss: 1.3490 - val_f1_score: 0.6479
Epoch 97/500
28/28 [==============================] - 2s 66ms/step - loss: 0.5647 - f1_score:
0.8569 - val_loss: 1.3360 - val_f1_score: 0.6608
Epoch 98/500
28/28 [==============================] - 2s 68ms/step - loss: 0.5425 - f1_score:
0.8536 - val_loss: 1.3696 - val_f1_score: 0.6271
Epoch 99/500
28/28 [==============================] - 2s 62ms/step - loss: 0.5410 - f1_score:
0.8610 - val_loss: 1.3681 - val_f1_score: 0.6647
Epoch 100/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5209 - f1_score:
0.8661 - val_loss: 1.3243 - val_f1_score: 0.6757
Epoch 101/500
```

```
27/28 [==========================>..] - ETA: 0s - loss: 0.4945 - f1_score:
0.8797

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 14s 514ms/step - loss: 0.4923 -
f1_score: 0.8795 - val_loss: 1.2834 - val_f1_score: 0.7100
Epoch 102/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5086 - f1_score:
0.8662 - val_loss: 1.3757 - val_f1_score: 0.6915
Epoch 103/500
28/28 [==============================] - 2s 58ms/step - loss: 0.5111 - f1_score:
0.8694 - val_loss: 1.3757 - val_f1_score: 0.6848
Epoch 104/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5042 - f1_score:
0.8790 - val_loss: 1.2947 - val_f1_score: 0.6749
Epoch 105/500
28/28 [==============================] - 2s 63ms/step - loss: 0.5031 - f1_score:
0.8686 - val_loss: 1.2960 - val_f1_score: 0.6907
Epoch 106/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4765 - f1_score:
0.8857 - val_loss: 1.4877 - val_f1_score: 0.6655
Epoch 107/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4931 - f1_score:
0.8746 - val_loss: 1.3194 - val_f1_score: 0.6591
Epoch 108/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4697 - f1_score:
0.8823 - val_loss: 1.3006 - val_f1_score: 0.6882
Epoch 109/500
28/28 [==============================] - 2s 60ms/step - loss: 0.5086 - f1_score:
0.8696 - val_loss: 1.4137 - val_f1_score: 0.6217
Epoch 110/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4957 - f1_score:
0.8734 - val_loss: 1.4579 - val_f1_score: 0.6624
Epoch 111/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4585 - f1_score:
0.8901 - val_loss: 1.2135 - val_f1_score: 0.6944
Epoch 112/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4968 - f1_score:
0.8740 - val_loss: 1.3281 - val_f1_score: 0.6834
Epoch 113/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4923 - f1_score:
0.8775 - val_loss: 1.2846 - val_f1_score: 0.6879
```

```
Epoch 114/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4653 - f1_score:
0.8812 - val_loss: 1.2371 - val_f1_score: 0.6716
Epoch 115/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4795 - f1_score:
0.8771 - val_loss: 1.3884 - val_f1_score: 0.7007
Epoch 116/500
28/28 [==============================] - 2s 62ms/step - loss: 0.4547 - f1_score:
0.8805 - val_loss: 1.2917 - val_f1_score: 0.6588
Epoch 117/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4705 - f1_score:
0.8807 - val_loss: 1.2847 - val_f1_score: 0.7066
Epoch 118/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4587 - f1_score:
0.8889 - val_loss: 1.3575 - val_f1_score: 0.6772
Epoch 119/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4597 - f1_score:
0.8918 - val_loss: 1.2333 - val_f1_score: 0.6903
Epoch 120/500
28/28 [==============================] - 2s 67ms/step - loss: 0.4434 - f1_score:
0.8937 - val_loss: 1.3245 - val_f1_score: 0.7069
Epoch 121/500
28/28 [==============================] - 2s 63ms/step - loss: 0.4215 - f1_score:
0.8985 - val_loss: 1.4098 - val_f1_score: 0.6564
Epoch 122/500
28/28 [==============================] - ETA: 0s - loss: 0.4394 - f1_score:
0.8953

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 432ms/step - loss: 0.4394 -
f1_score: 0.8953 - val_loss: 1.2978 - val_f1_score: 0.7250
Epoch 123/500
28/28 [==============================] - 2s 56ms/step - loss: 0.4434 - f1_score:
0.8859 - val_loss: 1.3219 - val_f1_score: 0.6708
Epoch 124/500
28/28 [==============================] - 2s 59ms/step - loss: 0.4219 - f1_score:
0.8973 - val_loss: 1.3530 - val_f1_score: 0.6936
Epoch 125/500
28/28 [==============================] - 2s 57ms/step - loss: 0.4387 - f1_score:
0.8972 - val_loss: 1.3639 - val_f1_score: 0.6859
Epoch 126/500
28/28 [==============================] - 2s 58ms/step - loss: 0.4151 - f1_score:
```

```
0.9008 - val_loss: 1.3691 - val_f1_score: 0.6796
Epoch 127/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3962 - f1_score:
0.9112 - val_loss: 1.2670 - val_f1_score: 0.6955
Epoch 128/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4288 - f1_score:
0.8993 - val_loss: 1.3317 - val_f1_score: 0.7096
Epoch 129/500
28/28 [==============================] - 2s 61ms/step - loss: 0.4349 - f1_score:
0.8888 - val_loss: 1.3647 - val_f1_score: 0.6521
Epoch 130/500
28/28 [==============================] - 2s 60ms/step - loss: 0.4015 - f1_score:
0.9042 - val_loss: 1.2828 - val_f1_score: 0.7070
Epoch 131/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3882 - f1_score:
0.9091 - val_loss: 1.3270 - val_f1_score: 0.7007
Epoch 132/500
28/28 [==============================] - 2s 64ms/step - loss: 0.4097 - f1_score:
0.8991 - val_loss: 1.3298 - val_f1_score: 0.7148
Epoch 133/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3860 - f1_score:
0.9099 - val_loss: 1.3689 - val_f1_score: 0.6943
Epoch 134/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3814 - f1_score:
0.9101 - val_loss: 1.3628 - val_f1_score: 0.7113
Epoch 135/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3974 - f1_score:
0.9047 - val_loss: 1.3206 - val_f1_score: 0.6933
Epoch 136/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3900 - f1_score:
0.9034 - val_loss: 1.4185 - val_f1_score: 0.6959
Epoch 137/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3842 - f1_score:
0.9097 - val_loss: 1.4081 - val_f1_score: 0.6862
Epoch 138/500
28/28 [==============================] - 2s 65ms/step - loss: 0.4181 - f1_score:
0.9034 - val_loss: 1.2716 - val_f1_score: 0.6992
Epoch 139/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3826 - f1_score:
0.9034 - val_loss: 1.3161 - val_f1_score: 0.7039
Epoch 140/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3805 - f1_score:
0.9093 - val_loss: 1.2722 - val_f1_score: 0.6947
Epoch 141/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3838 - f1_score:
0.9092 - val_loss: 1.3029 - val_f1_score: 0.6980
Epoch 142/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3703 - f1_score:
```

```
0.9146 - val_loss: 1.4526 - val_f1_score: 0.6579
Epoch 143/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3921 - f1_score:
0.9106 - val_loss: 1.3107 - val_f1_score: 0.7220
Epoch 144/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3941 - f1_score:
0.9095 - val_loss: 1.1855 - val_f1_score: 0.7201
Epoch 145/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3824 - f1_score:
0.9153 - val_loss: 1.2239 - val_f1_score: 0.7097
Epoch 146/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3661 - f1_score:
0.9156 - val_loss: 1.3413 - val_f1_score: 0.6885
Epoch 147/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3773 - f1_score:
0.9165 - val_loss: 1.2663 - val_f1_score: 0.7163
Epoch 148/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3587 - f1_score:
0.9211 - val_loss: 1.2496 - val_f1_score: 0.7122
Epoch 149/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3488 - f1_score:
0.9231 - val_loss: 1.2199 - val_f1_score: 0.7133
Epoch 150/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3639 - f1_score:
0.9161 - val_loss: 1.2850 - val_f1_score: 0.6948
Epoch 151/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3609 - f1_score:
0.9154 - val_loss: 1.3280 - val_f1_score: 0.7074
Epoch 152/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3609 - f1_score:
0.9141 - val_loss: 1.3660 - val_f1_score: 0.6738
Epoch 153/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3727 - f1_score:
0.9095 - val_loss: 1.3298 - val_f1_score: 0.7122
Epoch 154/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3725 - f1_score:
0.9088 - val_loss: 1.5409 - val_f1_score: 0.6475
Epoch 155/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3774 - f1_score:
0.9081 - val_loss: 1.4423 - val_f1_score: 0.6698
Epoch 156/500
28/28 [==============================] - 2s 69ms/step - loss: 0.3705 - f1_score:
0.9156 - val_loss: 1.4856 - val_f1_score: 0.6652
Epoch 157/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3399 - f1_score:
0.9281 - val_loss: 1.3565 - val_f1_score: 0.7142
Epoch 158/500
28/28 [==============================] - 2s 65ms/step - loss: 0.3511 - f1_score:
```

```
0.9200 - val_loss: 1.3473 - val_f1_score: 0.7090
Epoch 159/500
28/28 [==============================] - 2s 71ms/step - loss: 0.3440 - f1_score:
0.9238 - val_loss: 1.4293 - val_f1_score: 0.6924
Epoch 160/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3728 - f1_score:
0.9123 - val_loss: 1.5522 - val_f1_score: 0.6333
Epoch 161/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3355 - f1_score:
0.9178 - val_loss: 1.3563 - val_f1_score: 0.6791
Epoch 162/500
28/28 [==============================] - 2s 67ms/step - loss: 0.3722 - f1_score:
0.9210 - val_loss: 1.3364 - val_f1_score: 0.6992
Epoch 163/500
28/28 [==============================] - 2s 68ms/step - loss: 0.3296 - f1_score:
0.9297 - val_loss: 1.3555 - val_f1_score: 0.6972
Epoch 164/500
28/28 [==============================] - ETA: 0s - loss: 0.3603 - f1_score:
0.9120

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
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4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 13s 480ms/step - loss: 0.3603 -
f1_score: 0.9120 - val_loss: 1.2661 - val_f1_score: 0.7298
Epoch 165/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3187 - f1_score:
0.9355 - val_loss: 1.3705 - val_f1_score: 0.6918
Epoch 166/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3127 - f1_score:
0.9340 - val_loss: 1.4449 - val_f1_score: 0.6714
Epoch 167/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3384 - f1_score:
0.9224 - val_loss: 1.3303 - val_f1_score: 0.7017
Epoch 168/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3288 - f1_score:
0.9276 - val_loss: 1.3379 - val_f1_score: 0.6973
Epoch 169/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3167 - f1_score:
0.9308 - val_loss: 1.3155 - val_f1_score: 0.6699
Epoch 170/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3385 - f1_score:
0.9307 - val_loss: 1.4140 - val_f1_score: 0.6793
Epoch 171/500
```

```
28/28 [==============================] - 2s 59ms/step - loss: 0.3413 - f1_score:
0.9239 - val_loss: 1.4386 - val_f1_score: 0.6851
Epoch 172/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3368 - f1_score:
0.9268 - val_loss: 1.3627 - val_f1_score: 0.7037
Epoch 173/500
28/28 [==============================] - ETA: 0s - loss: 0.3006 - f1_score:
0.9333

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 11s 406ms/step - loss: 0.3006 -
f1_score: 0.9333 - val_loss: 1.2711 - val_f1_score: 0.7320
Epoch 174/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3132 - f1_score:
0.9285 - val_loss: 1.4076 - val_f1_score: 0.7119
Epoch 175/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3016 - f1_score:
0.9284 - val_loss: 1.4336 - val_f1_score: 0.6869
Epoch 176/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3567 - f1_score:
0.9161 - val_loss: 1.3393 - val_f1_score: 0.6750
Epoch 177/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3216 - f1_score:
0.9279 - val_loss: 1.3486 - val_f1_score: 0.7174
Epoch 178/500
28/28 [==============================] - 2s 62ms/step - loss: 0.3173 - f1_score:
0.9309 - val_loss: 1.4049 - val_f1_score: 0.7190
Epoch 179/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3396 - f1_score:
0.9187 - val_loss: 1.4754 - val_f1_score: 0.6738
Epoch 180/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3025 - f1_score:
0.9376 - val_loss: 1.5411 - val_f1_score: 0.6593
Epoch 181/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3094 - f1_score:
0.9341 - val_loss: 1.3583 - val_f1_score: 0.6687
Epoch 182/500
28/28 [==============================] - 2s 64ms/step - loss: 0.3274 - f1_score:
0.9229 - val_loss: 1.3723 - val_f1_score: 0.6914
Epoch 183/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3065 - f1_score:
0.9360 - val_loss: 1.3569 - val_f1_score: 0.7020
```

```
Epoch 184/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3036 - f1_score:
0.9362 - val_loss: 1.3062 - val_f1_score: 0.7087
Epoch 185/500
28/28 [==============================] - ETA: 0s - loss: 0.3036 - f1_score:
0.9301

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 13s 475ms/step - loss: 0.3036 -
f1_score: 0.9301 - val_loss: 1.2381 - val_f1_score: 0.7393
Epoch 186/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2975 - f1_score:
0.9349 - val_loss: 1.2942 - val_f1_score: 0.7065
Epoch 187/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2944 - f1_score:
0.9311 - val_loss: 1.3323 - val_f1_score: 0.6956
Epoch 188/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3271 - f1_score:
0.9169 - val_loss: 1.3573 - val_f1_score: 0.7236
Epoch 189/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3034 - f1_score:
0.9397 - val_loss: 1.2564 - val_f1_score: 0.7339
Epoch 190/500
28/28 [==============================] - 2s 57ms/step - loss: 0.3144 - f1_score:
0.9344 - val_loss: 1.3036 - val_f1_score: 0.7133
Epoch 191/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2836 - f1_score:
0.9436 - val_loss: 1.3945 - val_f1_score: 0.6969
Epoch 192/500
28/28 [==============================] - 2s 59ms/step - loss: 0.3219 - f1_score:
0.9260 - val_loss: 1.3441 - val_f1_score: 0.7303
Epoch 193/500
28/28 [==============================] - 2s 60ms/step - loss: 0.3264 - f1_score:
0.9257 - val_loss: 1.4335 - val_f1_score: 0.6449
Epoch 194/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2899 - f1_score:
0.9378 - val_loss: 1.3029 - val_f1_score: 0.7293
Epoch 195/500
28/28 [==============================] - 2s 63ms/step - loss: 0.3087 - f1_score:
0.9362 - val_loss: 1.3430 - val_f1_score: 0.6819
Epoch 196/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2975 - f1_score:
```

```
0.9331 - val_loss: 1.2769 - val_f1_score: 0.7278
Epoch 197/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2833 - f1_score:
0.9431 - val_loss: 1.4089 - val_f1_score: 0.7136
Epoch 198/500
28/28 [==============================] - 2s 61ms/step - loss: 0.3156 - f1_score:
0.9275 - val_loss: 1.3487 - val_f1_score: 0.6983
Epoch 199/500
28/28 [==============================] - 2s 66ms/step - loss: 0.3022 - f1_score:
0.9337 - val_loss: 1.3314 - val_f1_score: 0.7114
Epoch 200/500
28/28 [==============================] - ETA: 0s - loss: 0.3128 - f1_score:
0.9266

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 434ms/step - loss: 0.3128 -
f1_score: 0.9266 - val_loss: 1.3058 - val_f1_score: 0.7594
Epoch 201/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2827 - f1_score:
0.9396 - val_loss: 1.2756 - val_f1_score: 0.7191
Epoch 202/500
28/28 [==============================] - 2s 56ms/step - loss: 0.3046 - f1_score:
0.9309 - val_loss: 1.2845 - val_f1_score: 0.7361
Epoch 203/500
28/28 [==============================] - 2s 58ms/step - loss: 0.3014 - f1_score:
0.9344 - val_loss: 1.4424 - val_f1_score: 0.7024
Epoch 204/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2835 - f1_score:
0.9401 - val_loss: 1.3608 - val_f1_score: 0.7240
Epoch 205/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2805 - f1_score:
0.9372 - val_loss: 1.4475 - val_f1_score: 0.7062
Epoch 206/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2979 - f1_score:
0.9351 - val_loss: 1.2506 - val_f1_score: 0.7477
Epoch 207/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2625 - f1_score:
0.9509 - val_loss: 1.4418 - val_f1_score: 0.7395
Epoch 208/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2613 - f1_score:
0.9468 - val_loss: 1.3085 - val_f1_score: 0.7145
Epoch 209/500
```

```
28/28 [==============================] - 2s 59ms/step - loss: 0.2700 - f1_score:
0.9446 - val_loss: 1.4393 - val_f1_score: 0.7142
Epoch 210/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2985 - f1_score:
0.9362 - val_loss: 1.4864 - val_f1_score: 0.6756
Epoch 211/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2844 - f1_score:
0.9337 - val_loss: 1.4722 - val_f1_score: 0.7057
Epoch 212/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2709 - f1_score:
0.9425 - val_loss: 1.3664 - val_f1_score: 0.7188
Epoch 213/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2552 - f1_score:
0.9482 - val_loss: 1.3992 - val_f1_score: 0.7081
Epoch 214/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2782 - f1_score:
0.9385 - val_loss: 1.5131 - val_f1_score: 0.7106
Epoch 215/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2757 - f1_score:
0.9389 - val_loss: 1.7087 - val_f1_score: 0.6537
Epoch 216/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2577 - f1_score:
0.9479 - val_loss: 1.4229 - val_f1_score: 0.6839
Epoch 217/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2649 - f1_score:
0.9500 - val_loss: 1.4618 - val_f1_score: 0.7001
Epoch 218/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2687 - f1_score:
0.9439 - val_loss: 1.3398 - val_f1_score: 0.7118
Epoch 219/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2577 - f1_score:
0.9497 - val_loss: 1.4074 - val_f1_score: 0.7083
Epoch 220/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2435 - f1_score:
0.9537 - val_loss: 1.3689 - val_f1_score: 0.7171
Epoch 221/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2703 - f1_score:
0.9452 - val_loss: 1.3689 - val_f1_score: 0.7264
Epoch 222/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2525 - f1_score:
0.9501 - val_loss: 1.3144 - val_f1_score: 0.7347
Epoch 223/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2550 - f1_score:
0.9477 - val_loss: 1.3443 - val_f1_score: 0.7145
Epoch 224/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2761 - f1_score:
0.9409 - val_loss: 1.4530 - val_f1_score: 0.6992
Epoch 225/500
```

```
28/28 [==============================] - 2s 61ms/step - loss: 0.2719 - f1_score:
0.9447 - val_loss: 1.5109 - val_f1_score: 0.6955
Epoch 226/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2500 - f1_score:
0.9474 - val_loss: 1.5484 - val_f1_score: 0.7302
Epoch 227/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2672 - f1_score:
0.9473 - val_loss: 1.4369 - val_f1_score: 0.7140
Epoch 228/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2843 - f1_score:
0.9450 - val_loss: 1.5257 - val_f1_score: 0.6843
Epoch 229/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2799 - f1_score:
0.9461 - val_loss: 1.4283 - val_f1_score: 0.6993
Epoch 230/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2905 - f1_score:
0.9403 - val_loss: 1.3714 - val_f1_score: 0.7298
Epoch 231/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2884 - f1_score:
0.9423 - val_loss: 1.5403 - val_f1_score: 0.7139
Epoch 232/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2641 - f1_score:
0.9462 - val_loss: 1.3645 - val_f1_score: 0.7330
Epoch 233/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2637 - f1_score:
0.9460 - val_loss: 1.3723 - val_f1_score: 0.7085
Epoch 234/500
28/28 [==============================] - 3s 99ms/step - loss: 0.2881 - f1_score:
0.9389 - val_loss: 1.4101 - val_f1_score: 0.7201
Epoch 235/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2578 - f1_score:
0.9472 - val_loss: 1.4352 - val_f1_score: 0.7050
Epoch 236/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2419 - f1_score:
0.9552 - val_loss: 1.5443 - val_f1_score: 0.6870
Epoch 237/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2726 - f1_score:
0.9409 - val_loss: 1.3689 - val_f1_score: 0.7376
Epoch 238/500
28/28 [==============================] - 2s 88ms/step - loss: 0.2542 - f1_score:
0.9520 - val_loss: 1.3795 - val_f1_score: 0.7416
Epoch 239/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2576 - f1_score:
0.9505 - val_loss: 1.4647 - val_f1_score: 0.6903
Epoch 240/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2478 - f1_score:
0.9545 - val_loss: 1.4096 - val_f1_score: 0.7103
Epoch 241/500
```

```
28/28 [==============================] - 2s 65ms/step - loss: 0.2110 - f1_score:
0.9649 - val_loss: 1.5074 - val_f1_score: 0.6714
Epoch 242/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2414 - f1_score:
0.9537 - val_loss: 1.5692 - val_f1_score: 0.6724
Epoch 243/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2550 - f1_score:
0.9513 - val_loss: 1.3971 - val_f1_score: 0.7069
Epoch 244/500
28/28 [==============================] - 2s 79ms/step - loss: 0.2316 - f1_score:
0.9569 - val_loss: 1.4872 - val_f1_score: 0.7179
Epoch 245/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2464 - f1_score:
0.9527 - val_loss: 1.5116 - val_f1_score: 0.7228
Epoch 246/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2648 - f1_score:
0.9435 - val_loss: 1.4453 - val_f1_score: 0.6968
Epoch 247/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2644 - f1_score:
0.9431 - val_loss: 1.5681 - val_f1_score: 0.6919
Epoch 248/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2582 - f1_score:
0.9443 - val_loss: 1.4126 - val_f1_score: 0.7102
Epoch 249/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2450 - f1_score:
0.9491 - val_loss: 1.3947 - val_f1_score: 0.6838
Epoch 250/500
28/28 [==============================] - 2s 70ms/step - loss: 0.2539 - f1_score:
0.9504 - val_loss: 1.5544 - val_f1_score: 0.6778
Epoch 251/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2683 - f1_score:
0.9499 - val_loss: 1.5071 - val_f1_score: 0.6704
Epoch 252/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2505 - f1_score:
0.9536 - val_loss: 1.4044 - val_f1_score: 0.7126
Epoch 253/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2337 - f1_score:
0.9532 - val_loss: 1.5069 - val_f1_score: 0.7077
Epoch 254/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2283 - f1_score:
0.9596 - val_loss: 1.5544 - val_f1_score: 0.7144
Epoch 255/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2420 - f1_score:
0.9498 - val_loss: 1.6060 - val_f1_score: 0.7004
Epoch 256/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2420 - f1_score:
0.9561 - val_loss: 1.4210 - val_f1_score: 0.7110
Epoch 257/500
```

```
28/28 [==============================] - 2s 58ms/step - loss: 0.2352 - f1_score:
0.9538 - val_loss: 1.4578 - val_f1_score: 0.6972
Epoch 258/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2380 - f1_score:
0.9542 - val_loss: 1.5007 - val_f1_score: 0.6926
Epoch 259/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2590 - f1_score:
0.9463 - val_loss: 1.4596 - val_f1_score: 0.7238
Epoch 260/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2413 - f1_score:
0.9560 - val_loss: 1.4764 - val_f1_score: 0.7149
Epoch 261/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2354 - f1_score:
0.9517 - val_loss: 1.4562 - val_f1_score: 0.6988
Epoch 262/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2501 - f1_score:
0.9510 - val_loss: 1.3805 - val_f1_score: 0.7229
Epoch 263/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2626 - f1_score:
0.9443 - val_loss: 1.4461 - val_f1_score: 0.6888
Epoch 264/500
28/28 [==============================] - ETA: 0s - loss: 0.2305 - f1_score:
0.9557

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 457ms/step - loss: 0.2305 -
f1_score: 0.9557 - val_loss: 1.3668 - val_f1_score: 0.7657
Epoch 265/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2324 - f1_score:
0.9541 - val_loss: 1.3940 - val_f1_score: 0.7141
Epoch 266/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2601 - f1_score:
0.9472 - val_loss: 1.5413 - val_f1_score: 0.6771
Epoch 267/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2716 - f1_score:
0.9423 - val_loss: 1.3783 - val_f1_score: 0.6929
Epoch 268/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2484 - f1_score:
0.9519 - val_loss: 1.4571 - val_f1_score: 0.6980
Epoch 269/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2408 - f1_score:
0.9502 - val_loss: 1.3767 - val_f1_score: 0.7055
```

```
Epoch 270/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2658 - f1_score:
0.9435 - val_loss: 1.4534 - val_f1_score: 0.6896
Epoch 271/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2413 - f1_score:
0.9521 - val_loss: 1.5122 - val_f1_score: 0.7105
Epoch 272/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2376 - f1_score:
0.9519 - val_loss: 1.3945 - val_f1_score: 0.7437
Epoch 273/500
28/28 [==============================] - 2s 56ms/step - loss: 0.2448 - f1_score:
0.9523 - val_loss: 1.3706 - val_f1_score: 0.7450
Epoch 274/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2343 - f1_score:
0.9537 - val_loss: 1.3849 - val_f1_score: 0.7615
Epoch 275/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2293 - f1_score:
0.9558 - val_loss: 1.5737 - val_f1_score: 0.6939
Epoch 276/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2289 - f1_score:
0.9536 - val_loss: 1.5453 - val_f1_score: 0.7188
Epoch 277/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2523 - f1_score:
0.9439 - val_loss: 1.4484 - val_f1_score: 0.7189
Epoch 278/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2323 - f1_score:
0.9528 - val_loss: 1.4141 - val_f1_score: 0.7179
Epoch 279/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2621 - f1_score:
0.9467 - val_loss: 1.3526 - val_f1_score: 0.7330
Epoch 280/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2631 - f1_score:
0.9475 - val_loss: 1.4480 - val_f1_score: 0.7233
Epoch 281/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2420 - f1_score:
0.9522 - val_loss: 1.4098 - val_f1_score: 0.7206
Epoch 282/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2379 - f1_score:
0.9542 - val_loss: 1.4143 - val_f1_score: 0.7254
Epoch 283/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2716 - f1_score:
0.9412 - val_loss: 1.3721 - val_f1_score: 0.7476
Epoch 284/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2337 - f1_score:
0.9549 - val_loss: 1.3779 - val_f1_score: 0.7267
Epoch 285/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2338 - f1_score:
0.9579 - val_loss: 1.3665 - val_f1_score: 0.7241
```

```
Epoch 286/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2368 - f1_score:
0.9572 - val_loss: 1.5215 - val_f1_score: 0.6892
Epoch 287/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2435 - f1_score:
0.9501 - val_loss: 1.2947 - val_f1_score: 0.7332
Epoch 288/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2571 - f1_score:
0.9474 - val_loss: 1.4092 - val_f1_score: 0.7303
Epoch 289/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2488 - f1_score:
0.9506 - val_loss: 1.5382 - val_f1_score: 0.6940
Epoch 290/500
28/28 [==============================] - 2s 57ms/step - loss: 0.2340 - f1_score:
0.9566 - val_loss: 1.4747 - val_f1_score: 0.7015
Epoch 291/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2347 - f1_score:
0.9584 - val_loss: 1.3679 - val_f1_score: 0.7194
Epoch 292/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2203 - f1_score:
0.9645 - val_loss: 1.3414 - val_f1_score: 0.6891
Epoch 293/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2331 - f1_score:
0.9542 - val_loss: 1.5569 - val_f1_score: 0.7098
Epoch 294/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2139 - f1_score:
0.9632 - val_loss: 1.3398 - val_f1_score: 0.7157
Epoch 295/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2255 - f1_score:
0.9543 - val_loss: 1.3393 - val_f1_score: 0.7396
Epoch 296/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2825 - f1_score:
0.9392 - val_loss: 1.3920 - val_f1_score: 0.7158
Epoch 297/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2508 - f1_score:
0.9499 - val_loss: 1.3534 - val_f1_score: 0.6950
Epoch 298/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2327 - f1_score:
0.9542 - val_loss: 1.4479 - val_f1_score: 0.7266
Epoch 299/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2315 - f1_score:
0.9563 - val_loss: 1.4484 - val_f1_score: 0.6716
Epoch 300/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2284 - f1_score:
0.9555 - val_loss: 1.2824 - val_f1_score: 0.7028
Epoch 301/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2307 - f1_score:
0.9555 - val_loss: 1.4030 - val_f1_score: 0.7151
```

```
Epoch 302/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2183 - f1_score:
0.9597 - val_loss: 1.4312 - val_f1_score: 0.7242
Epoch 303/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2096 - f1_score:
0.9553 - val_loss: 1.3920 - val_f1_score: 0.7058
Epoch 304/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2150 - f1_score:
0.9611 - val_loss: 1.4017 - val_f1_score: 0.7274
Epoch 305/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2126 - f1_score:
0.9613 - val_loss: 1.2496 - val_f1_score: 0.7531
Epoch 306/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2110 - f1_score:
0.9540 - val_loss: 1.4199 - val_f1_score: 0.7349
Epoch 307/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2103 - f1_score:
0.9583 - val_loss: 1.2922 - val_f1_score: 0.7266
Epoch 308/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2045 - f1_score:
0.9601 - val_loss: 1.4969 - val_f1_score: 0.7221
Epoch 309/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2307 - f1_score:
0.9572 - val_loss: 1.4990 - val_f1_score: 0.7128
Epoch 310/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2292 - f1_score:
0.9533 - val_loss: 1.4524 - val_f1_score: 0.6968
Epoch 311/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2222 - f1_score:
0.9547 - val_loss: 1.4209 - val_f1_score: 0.7264
Epoch 312/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2191 - f1_score:
0.9560 - val_loss: 1.4513 - val_f1_score: 0.7113
Epoch 313/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2108 - f1_score:
0.9614 - val_loss: 1.5401 - val_f1_score: 0.6911
Epoch 314/500
27/28 [===========================>..] - ETA: 0s - loss: 0.2201 - f1_score:
0.9578

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_2_layer_call_fn,
lstm_cell_2_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM/assets

28/28 [==============================] - 12s 439ms/step - loss: 0.2203 -
```

```
f1_score: 0.9572 - val_loss: 1.2420 - val_f1_score: 0.7745
Epoch 315/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2452 - f1_score:
0.9531 - val_loss: 1.3016 - val_f1_score: 0.7249
Epoch 316/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2379 - f1_score:
0.9535 - val_loss: 1.5169 - val_f1_score: 0.7509
Epoch 317/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2113 - f1_score:
0.9635 - val_loss: 1.4182 - val_f1_score: 0.7287
Epoch 318/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2126 - f1_score:
0.9615 - val_loss: 1.5527 - val_f1_score: 0.7163
Epoch 319/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2098 - f1_score:
0.9649 - val_loss: 1.4365 - val_f1_score: 0.7212
Epoch 320/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2203 - f1_score:
0.9567 - val_loss: 1.6019 - val_f1_score: 0.7107
Epoch 321/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2032 - f1_score:
0.9674 - val_loss: 1.3320 - val_f1_score: 0.7360
Epoch 322/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2308 - f1_score:
0.9530 - val_loss: 1.4040 - val_f1_score: 0.7142
Epoch 323/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2298 - f1_score:
0.9547 - val_loss: 1.4491 - val_f1_score: 0.7041
Epoch 324/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2195 - f1_score:
0.9609 - val_loss: 1.4121 - val_f1_score: 0.7134
Epoch 325/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2125 - f1_score:
0.9562 - val_loss: 1.3275 - val_f1_score: 0.7273
Epoch 326/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2241 - f1_score:
0.9561 - val_loss: 1.3665 - val_f1_score: 0.7295
Epoch 327/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1999 - f1_score:
0.9666 - val_loss: 1.4192 - val_f1_score: 0.7144
Epoch 328/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1956 - f1_score:
0.9652 - val_loss: 1.5124 - val_f1_score: 0.7014
Epoch 329/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2228 - f1_score:
0.9586 - val_loss: 1.3805 - val_f1_score: 0.7475
Epoch 330/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2096 - f1_score:
```

```
0.9594 - val_loss: 1.4121 - val_f1_score: 0.7398
Epoch 331/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2096 - f1_score:
0.9620 - val_loss: 1.5054 - val_f1_score: 0.7019
Epoch 332/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2217 - f1_score:
0.9548 - val_loss: 1.4719 - val_f1_score: 0.7162
Epoch 333/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2100 - f1_score:
0.9593 - val_loss: 1.3985 - val_f1_score: 0.7497
Epoch 334/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2009 - f1_score:
0.9619 - val_loss: 1.4506 - val_f1_score: 0.7176
Epoch 335/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2237 - f1_score:
0.9589 - val_loss: 1.4820 - val_f1_score: 0.7317
Epoch 336/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2059 - f1_score:
0.9618 - val_loss: 1.4010 - val_f1_score: 0.7387
Epoch 337/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2005 - f1_score:
0.9610 - val_loss: 1.4729 - val_f1_score: 0.6968
Epoch 338/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2214 - f1_score:
0.9585 - val_loss: 1.5492 - val_f1_score: 0.7140
Epoch 339/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2144 - f1_score:
0.9593 - val_loss: 1.3299 - val_f1_score: 0.7401
Epoch 340/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2048 - f1_score:
0.9616 - val_loss: 1.5067 - val_f1_score: 0.7104
Epoch 341/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2119 - f1_score:
0.9624 - val_loss: 1.4958 - val_f1_score: 0.7446
Epoch 342/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1903 - f1_score:
0.9657 - val_loss: 1.3723 - val_f1_score: 0.7364
Epoch 343/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2084 - f1_score:
0.9666 - val_loss: 1.4343 - val_f1_score: 0.7487
Epoch 344/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2003 - f1_score:
0.9600 - val_loss: 1.4568 - val_f1_score: 0.7249
Epoch 345/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2191 - f1_score:
0.9552 - val_loss: 1.3624 - val_f1_score: 0.7559
Epoch 346/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2000 - f1_score:
```

```
0.9593 - val_loss: 1.4174 - val_f1_score: 0.7438
Epoch 347/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2164 - f1_score:
0.9610 - val_loss: 1.5445 - val_f1_score: 0.7046
Epoch 348/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1800 - f1_score:
0.9720 - val_loss: 1.4470 - val_f1_score: 0.7307
Epoch 349/500
28/28 [==============================] - 2s 58ms/step - loss: 0.1935 - f1_score:
0.9637 - val_loss: 1.4597 - val_f1_score: 0.7541
Epoch 350/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2044 - f1_score:
0.9649 - val_loss: 1.4285 - val_f1_score: 0.7134
Epoch 351/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1689 - f1_score:
0.9753 - val_loss: 1.3774 - val_f1_score: 0.7512
Epoch 352/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2017 - f1_score:
0.9656 - val_loss: 1.6556 - val_f1_score: 0.7097
Epoch 353/500
28/28 [==============================] - 2s 58ms/step - loss: 0.1967 - f1_score:
0.9623 - val_loss: 1.4748 - val_f1_score: 0.7136
Epoch 354/500
28/28 [==============================] - 2s 59ms/step - loss: 0.1816 - f1_score:
0.9704 - val_loss: 1.3733 - val_f1_score: 0.7437
Epoch 355/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2248 - f1_score:
0.9539 - val_loss: 1.3001 - val_f1_score: 0.7224
Epoch 356/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2076 - f1_score:
0.9610 - val_loss: 1.3019 - val_f1_score: 0.7716
Epoch 357/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2187 - f1_score:
0.9569 - val_loss: 1.5624 - val_f1_score: 0.7213
Epoch 358/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2236 - f1_score:
0.9560 - val_loss: 1.4992 - val_f1_score: 0.7407
Epoch 359/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2402 - f1_score:
0.9543 - val_loss: 1.4213 - val_f1_score: 0.7251
Epoch 360/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2405 - f1_score:
0.9520 - val_loss: 1.4238 - val_f1_score: 0.7270
Epoch 361/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2251 - f1_score:
0.9568 - val_loss: 1.3405 - val_f1_score: 0.7427
Epoch 362/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2011 - f1_score:
```

```
0.9628 - val_loss: 1.4073 - val_f1_score: 0.7393
Epoch 363/500
28/28 [==============================] - 2s 58ms/step - loss: 0.1963 - f1_score:
0.9660 - val_loss: 1.3460 - val_f1_score: 0.7486
Epoch 364/500
28/28 [==============================] - 2s 58ms/step - loss: 0.1948 - f1_score:
0.9640 - val_loss: 1.3177 - val_f1_score: 0.7148
Epoch 365/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2063 - f1_score:
0.9625 - val_loss: 1.4626 - val_f1_score: 0.7326
Epoch 366/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2344 - f1_score:
0.9516 - val_loss: 1.5231 - val_f1_score: 0.7180
Epoch 367/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2297 - f1_score:
0.9547 - val_loss: 1.5511 - val_f1_score: 0.7139
Epoch 368/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2272 - f1_score:
0.9569 - val_loss: 1.2676 - val_f1_score: 0.7579
Epoch 369/500
28/28 [==============================] - 2s 59ms/step - loss: 0.2257 - f1_score:
0.9584 - val_loss: 1.4591 - val_f1_score: 0.7090
Epoch 370/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2315 - f1_score:
0.9567 - val_loss: 1.5538 - val_f1_score: 0.7175
Epoch 371/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2290 - f1_score:
0.9604 - val_loss: 1.4527 - val_f1_score: 0.7525
Epoch 372/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2278 - f1_score:
0.9578 - val_loss: 1.8295 - val_f1_score: 0.6860
Epoch 373/500
28/28 [==============================] - 2s 71ms/step - loss: 0.2136 - f1_score:
0.9611 - val_loss: 1.4445 - val_f1_score: 0.7511
Epoch 374/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2087 - f1_score:
0.9617 - val_loss: 1.4484 - val_f1_score: 0.7147
Epoch 375/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2062 - f1_score:
0.9606 - val_loss: 1.4685 - val_f1_score: 0.7237
Epoch 376/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2116 - f1_score:
0.9561 - val_loss: 1.4900 - val_f1_score: 0.7085
Epoch 377/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2271 - f1_score:
0.9604 - val_loss: 1.4933 - val_f1_score: 0.7305
Epoch 378/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1987 - f1_score:
```

```
0.9641 - val_loss: 1.4343 - val_f1_score: 0.7013
Epoch 379/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1822 - f1_score:
0.9729 - val_loss: 1.3130 - val_f1_score: 0.7608
Epoch 380/500
28/28 [==============================] - 2s 62ms/step - loss: 0.1807 - f1_score:
0.9656 - val_loss: 1.4456 - val_f1_score: 0.7422
Epoch 381/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1873 - f1_score:
0.9682 - val_loss: 1.4829 - val_f1_score: 0.7075
Epoch 382/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1877 - f1_score:
0.9663 - val_loss: 1.4736 - val_f1_score: 0.7160
Epoch 383/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1866 - f1_score:
0.9689 - val_loss: 1.4438 - val_f1_score: 0.7151
Epoch 384/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2059 - f1_score:
0.9617 - val_loss: 1.4273 - val_f1_score: 0.7352
Epoch 385/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1850 - f1_score:
0.9720 - val_loss: 1.4947 - val_f1_score: 0.7177
Epoch 386/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1720 - f1_score:
0.9742 - val_loss: 1.3902 - val_f1_score: 0.7406
Epoch 387/500
28/28 [==============================] - 2s 62ms/step - loss: 0.1643 - f1_score:
0.9746 - val_loss: 1.3951 - val_f1_score: 0.7531
Epoch 388/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1849 - f1_score:
0.9678 - val_loss: 1.3677 - val_f1_score: 0.7573
Epoch 389/500
28/28 [==============================] - 2s 73ms/step - loss: 0.1928 - f1_score:
0.9624 - val_loss: 1.4135 - val_f1_score: 0.7287
Epoch 390/500
28/28 [==============================] - 2s 84ms/step - loss: 0.1735 - f1_score:
0.9718 - val_loss: 1.4395 - val_f1_score: 0.7523
Epoch 391/500
28/28 [==============================] - 2s 87ms/step - loss: 0.1939 - f1_score:
0.9642 - val_loss: 1.5086 - val_f1_score: 0.7298
Epoch 392/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2077 - f1_score:
0.9589 - val_loss: 1.6865 - val_f1_score: 0.7046
Epoch 393/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2019 - f1_score:
0.9633 - val_loss: 1.3458 - val_f1_score: 0.7622
Epoch 394/500
28/28 [==============================] - 2s 58ms/step - loss: 0.2011 - f1_score:
```

```
0.9611 - val_loss: 1.6022 - val_f1_score: 0.6820
Epoch 395/500
28/28 [==============================] - 2s 60ms/step - loss: 0.2037 - f1_score:
0.9615 - val_loss: 1.9771 - val_f1_score: 0.6838
Epoch 396/500
28/28 [==============================] - 2s 64ms/step - loss: 0.2228 - f1_score:
0.9495 - val_loss: 1.4781 - val_f1_score: 0.7702
Epoch 397/500
28/28 [==============================] - 2s 61ms/step - loss: 0.2506 - f1_score:
0.9482 - val_loss: 1.3750 - val_f1_score: 0.7391
Epoch 398/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2209 - f1_score:
0.9556 - val_loss: 1.3207 - val_f1_score: 0.7289
Epoch 399/500
28/28 [==============================] - 2s 67ms/step - loss: 0.2025 - f1_score:
0.9630 - val_loss: 1.4585 - val_f1_score: 0.7365
Epoch 400/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2037 - f1_score:
0.9665 - val_loss: 1.5026 - val_f1_score: 0.7062
Epoch 401/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1986 - f1_score:
0.9633 - val_loss: 1.5319 - val_f1_score: 0.7210
Epoch 402/500
28/28 [==============================] - 2s 73ms/step - loss: 0.2320 - f1_score:
0.9545 - val_loss: 1.4251 - val_f1_score: 0.7501
Epoch 403/500
28/28 [==============================] - 2s 68ms/step - loss: 0.2012 - f1_score:
0.9644 - val_loss: 1.3820 - val_f1_score: 0.7311
Epoch 404/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1937 - f1_score:
0.9680 - val_loss: 1.5000 - val_f1_score: 0.7079
Epoch 405/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1821 - f1_score:
0.9706 - val_loss: 1.4863 - val_f1_score: 0.7305
Epoch 406/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1971 - f1_score:
0.9631 - val_loss: 1.4660 - val_f1_score: 0.7233
Epoch 407/500
28/28 [==============================] - 2s 66ms/step - loss: 0.2144 - f1_score:
0.9569 - val_loss: 1.3744 - val_f1_score: 0.7492
Epoch 408/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1989 - f1_score:
0.9625 - val_loss: 1.4982 - val_f1_score: 0.7079
Epoch 409/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1995 - f1_score:
0.9613 - val_loss: 1.5844 - val_f1_score: 0.7246
Epoch 410/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2073 - f1_score:
```

```
0.9619 - val_loss: 1.3057 - val_f1_score: 0.7392
Epoch 411/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2134 - f1_score:
0.9602 - val_loss: 1.2817 - val_f1_score: 0.7644
Epoch 412/500
28/28 [==============================] - 2s 62ms/step - loss: 0.1907 - f1_score:
0.9703 - val_loss: 1.5470 - val_f1_score: 0.7282
Epoch 413/500
28/28 [==============================] - 2s 61ms/step - loss: 0.1890 - f1_score:
0.9679 - val_loss: 1.4225 - val_f1_score: 0.7336
Epoch 414/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2017 - f1_score:
0.9591 - val_loss: 1.3918 - val_f1_score: 0.7404
Epoch 415/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2411 - f1_score:
0.9522 - val_loss: 1.3968 - val_f1_score: 0.7353
Epoch 416/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2048 - f1_score:
0.9650 - val_loss: 1.6211 - val_f1_score: 0.7383
Epoch 417/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2149 - f1_score:
0.9582 - val_loss: 1.3408 - val_f1_score: 0.7003
Epoch 418/500
28/28 [==============================] - 2s 75ms/step - loss: 0.2155 - f1_score:
0.9613 - val_loss: 1.4084 - val_f1_score: 0.7169
Epoch 419/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1974 - f1_score:
0.9654 - val_loss: 1.4423 - val_f1_score: 0.7202
Epoch 420/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1942 - f1_score:
0.9644 - val_loss: 1.4121 - val_f1_score: 0.7158
Epoch 421/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1723 - f1_score:
0.9765 - val_loss: 1.4373 - val_f1_score: 0.7206
Epoch 422/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1785 - f1_score:
0.9705 - val_loss: 1.4972 - val_f1_score: 0.7282
Epoch 423/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1828 - f1_score:
0.9704 - val_loss: 1.5852 - val_f1_score: 0.7237
Epoch 424/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2096 - f1_score:
0.9597 - val_loss: 1.2826 - val_f1_score: 0.7508
Epoch 425/500
28/28 [==============================] - 2s 61ms/step - loss: 0.1955 - f1_score:
0.9653 - val_loss: 1.3793 - val_f1_score: 0.7246
Epoch 426/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1830 - f1_score:
```

```
0.9718 - val_loss: 1.4390 - val_f1_score: 0.7003
Epoch 427/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2144 - f1_score:
0.9599 - val_loss: 1.4355 - val_f1_score: 0.7313
Epoch 428/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1862 - f1_score:
0.9683 - val_loss: 1.4330 - val_f1_score: 0.7446
Epoch 429/500
28/28 [==============================] - 2s 74ms/step - loss: 0.2156 - f1_score:
0.9568 - val_loss: 1.3872 - val_f1_score: 0.7518
Epoch 430/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1944 - f1_score:
0.9682 - val_loss: 1.4531 - val_f1_score: 0.7376
Epoch 431/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1875 - f1_score:
0.9662 - val_loss: 1.3394 - val_f1_score: 0.7350
Epoch 432/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1946 - f1_score:
0.9660 - val_loss: 1.5192 - val_f1_score: 0.7115
Epoch 433/500
28/28 [==============================] - 2s 59ms/step - loss: 0.1867 - f1_score:
0.9664 - val_loss: 1.6235 - val_f1_score: 0.7349
Epoch 434/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1909 - f1_score:
0.9694 - val_loss: 1.6397 - val_f1_score: 0.7071
Epoch 435/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1785 - f1_score:
0.9735 - val_loss: 1.7088 - val_f1_score: 0.6966
Epoch 436/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2094 - f1_score:
0.9577 - val_loss: 1.5469 - val_f1_score: 0.7151
Epoch 437/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2088 - f1_score:
0.9608 - val_loss: 1.5917 - val_f1_score: 0.7230
Epoch 438/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1944 - f1_score:
0.9660 - val_loss: 1.4531 - val_f1_score: 0.7193
Epoch 439/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1849 - f1_score:
0.9697 - val_loss: 1.4531 - val_f1_score: 0.6909
Epoch 440/500
28/28 [==============================] - 2s 69ms/step - loss: 0.2178 - f1_score:
0.9563 - val_loss: 1.4242 - val_f1_score: 0.7377
Epoch 441/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1993 - f1_score:
0.9614 - val_loss: 1.5072 - val_f1_score: 0.7034
Epoch 442/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1939 - f1_score:
```

```
0.9656 - val_loss: 1.3352 - val_f1_score: 0.7561
Epoch 443/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1762 - f1_score:
0.9710 - val_loss: 1.5001 - val_f1_score: 0.7190
Epoch 444/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1880 - f1_score:
0.9684 - val_loss: 1.4862 - val_f1_score: 0.7307
Epoch 445/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1983 - f1_score:
0.9616 - val_loss: 1.4330 - val_f1_score: 0.7542
Epoch 446/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1646 - f1_score:
0.9772 - val_loss: 1.5711 - val_f1_score: 0.7067
Epoch 447/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1841 - f1_score:
0.9670 - val_loss: 1.4364 - val_f1_score: 0.7555
Epoch 448/500
28/28 [==============================] - 2s 68ms/step - loss: 0.1788 - f1_score:
0.9717 - val_loss: 1.6150 - val_f1_score: 0.7254
Epoch 449/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1948 - f1_score:
0.9625 - val_loss: 1.7268 - val_f1_score: 0.6902
Epoch 450/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2223 - f1_score:
0.9532 - val_loss: 1.6840 - val_f1_score: 0.7110
Epoch 451/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1907 - f1_score:
0.9652 - val_loss: 1.4900 - val_f1_score: 0.7572
Epoch 452/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1767 - f1_score:
0.9733 - val_loss: 1.5635 - val_f1_score: 0.7270
Epoch 453/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1900 - f1_score:
0.9674 - val_loss: 1.4510 - val_f1_score: 0.7283
Epoch 454/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2213 - f1_score:
0.9602 - val_loss: 1.4371 - val_f1_score: 0.7168
Epoch 455/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1950 - f1_score:
0.9647 - val_loss: 1.5427 - val_f1_score: 0.7270
Epoch 456/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2162 - f1_score:
0.9590 - val_loss: 1.4688 - val_f1_score: 0.7542
Epoch 457/500
28/28 [==============================] - 2s 63ms/step - loss: 0.2017 - f1_score:
0.9647 - val_loss: 1.4957 - val_f1_score: 0.7359
Epoch 458/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1759 - f1_score:
```

```
0.9732 - val_loss: 1.5444 - val_f1_score: 0.7610
Epoch 459/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1832 - f1_score:
0.9677 - val_loss: 1.5151 - val_f1_score: 0.7307
Epoch 460/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1860 - f1_score:
0.9731 - val_loss: 1.5059 - val_f1_score: 0.7275
Epoch 461/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1908 - f1_score:
0.9663 - val_loss: 1.5062 - val_f1_score: 0.7409
Epoch 462/500
28/28 [==============================] - 2s 63ms/step - loss: 0.1856 - f1_score:
0.9681 - val_loss: 1.5144 - val_f1_score: 0.7265
Epoch 463/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1801 - f1_score:
0.9703 - val_loss: 1.3601 - val_f1_score: 0.7327
Epoch 464/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1774 - f1_score:
0.9672 - val_loss: 1.5561 - val_f1_score: 0.7184
Epoch 465/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1964 - f1_score:
0.9621 - val_loss: 1.5711 - val_f1_score: 0.6915
Epoch 466/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1674 - f1_score:
0.9741 - val_loss: 1.3884 - val_f1_score: 0.7540
Epoch 467/500
28/28 [==============================] - 2s 66ms/step - loss: 0.1577 - f1_score:
0.9775 - val_loss: 1.5249 - val_f1_score: 0.7191
Epoch 468/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1794 - f1_score:
0.9687 - val_loss: 1.5989 - val_f1_score: 0.6962
Epoch 469/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1650 - f1_score:
0.9734 - val_loss: 1.2734 - val_f1_score: 0.7480
Epoch 470/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1681 - f1_score:
0.9752 - val_loss: 1.5139 - val_f1_score: 0.7215
Epoch 471/500
28/28 [==============================] - 2s 72ms/step - loss: 0.1866 - f1_score:
0.9627 - val_loss: 1.4731 - val_f1_score: 0.7425
Epoch 472/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1946 - f1_score:
0.9613 - val_loss: 1.8445 - val_f1_score: 0.6920
Epoch 473/500
28/28 [==============================] - 2s 77ms/step - loss: 0.1800 - f1_score:
0.9690 - val_loss: 1.5138 - val_f1_score: 0.7183
Epoch 474/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2128 - f1_score:
```

```
0.9576 - val_loss: 1.4885 - val_f1_score: 0.7364
Epoch 475/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1933 - f1_score:
0.9640 - val_loss: 1.4953 - val_f1_score: 0.7122
Epoch 476/500
28/28 [==============================] - 2s 65ms/step - loss: 0.2054 - f1_score:
0.9616 - val_loss: 1.4121 - val_f1_score: 0.7089
Epoch 477/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1854 - f1_score:
0.9691 - val_loss: 1.4598 - val_f1_score: 0.7218
Epoch 478/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1928 - f1_score:
0.9642 - val_loss: 1.4910 - val_f1_score: 0.7423
Epoch 479/500
28/28 [==============================] - 2s 82ms/step - loss: 0.2209 - f1_score:
0.9585 - val_loss: 1.4132 - val_f1_score: 0.7403
Epoch 480/500
28/28 [==============================] - 2s 82ms/step - loss: 0.1956 - f1_score:
0.9636 - val_loss: 1.5813 - val_f1_score: 0.7318
Epoch 481/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1979 - f1_score:
0.9662 - val_loss: 1.3309 - val_f1_score: 0.7609
Epoch 482/500
28/28 [==============================] - 2s 74ms/step - loss: 0.1989 - f1_score:
0.9622 - val_loss: 1.7311 - val_f1_score: 0.6941
Epoch 483/500
28/28 [==============================] - 2s 61ms/step - loss: 0.1647 - f1_score:
0.9776 - val_loss: 1.4552 - val_f1_score: 0.7113
Epoch 484/500
28/28 [==============================] - 2s 59ms/step - loss: 0.1791 - f1_score:
0.9689 - val_loss: 1.5280 - val_f1_score: 0.7190
Epoch 485/500
28/28 [==============================] - 2s 58ms/step - loss: 0.1841 - f1_score:
0.9663 - val_loss: 1.6737 - val_f1_score: 0.7204
Epoch 486/500
28/28 [==============================] - 2s 59ms/step - loss: 0.1888 - f1_score:
0.9662 - val_loss: 1.5860 - val_f1_score: 0.6946
Epoch 487/500
28/28 [==============================] - 2s 59ms/step - loss: 0.1707 - f1_score:
0.9718 - val_loss: 1.5015 - val_f1_score: 0.7411
Epoch 488/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1989 - f1_score:
0.9671 - val_loss: 1.3576 - val_f1_score: 0.7445
Epoch 489/500
28/28 [==============================] - 2s 60ms/step - loss: 0.1901 - f1_score:
0.9681 - val_loss: 1.4117 - val_f1_score: 0.7213
Epoch 490/500
28/28 [==============================] - 2s 65ms/step - loss: 0.1750 - f1_score:
```

```
0.9710 - val_loss: 1.4528 - val_f1_score: 0.7236
Epoch 491/500
28/28 [==============================] - 2s 64ms/step - loss: 0.1808 - f1_score:
0.9696 - val_loss: 1.4851 - val_f1_score: 0.6935
Epoch 492/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2000 - f1_score:
0.9659 - val_loss: 1.5284 - val_f1_score: 0.6984
Epoch 493/500
28/28 [==============================] - 2s 61ms/step - loss: 0.1809 - f1_score:
0.9677 - val_loss: 1.3173 - val_f1_score: 0.7686
Epoch 494/500
28/28 [==============================] - 2s 62ms/step - loss: 0.2024 - f1_score:
0.9607 - val_loss: 1.7563 - val_f1_score: 0.7007
Epoch 495/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1957 - f1_score:
0.9672 - val_loss: 1.5037 - val_f1_score: 0.7089
Epoch 496/500
28/28 [==============================] - 2s 70ms/step - loss: 0.1690 - f1_score:
0.9776 - val_loss: 1.7166 - val_f1_score: 0.6943
Epoch 497/500
28/28 [==============================] - 2s 69ms/step - loss: 0.1691 - f1_score:
0.9726 - val_loss: 1.5799 - val_f1_score: 0.6955
Epoch 498/500
28/28 [==============================] - 2s 71ms/step - loss: 0.1853 - f1_score:
0.9705 - val_loss: 1.7387 - val_f1_score: 0.6909
Epoch 499/500
28/28 [==============================] - 2s 67ms/step - loss: 0.1873 - f1_score:
0.9713 - val_loss: 1.4507 - val_f1_score: 0.7414
Epoch 500/500
28/28 [==============================] - 2s 75ms/step - loss: 0.1983 - f1_score:
0.9667 - val_loss: 1.5827 - val_f1_score: 0.7363
```

[138]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 9ms/step
              precision    recall  f1-score   support

         AXE      0.875     0.875     0.875         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.750     0.600     0.667        10
        BELT      1.000     1.000     1.000         4
        BITE      0.857     0.750     0.800         8
   BREAKFAST      0.500     0.500     0.500         6
```

CANCER	0.875	0.875	0.875	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.600	1.000	0.750	6
DARK	1.000	1.000	1.000	4
DEAF	0.333	0.333	0.333	6
DECIDE	1.000	1.000	1.000	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	1.000	0.333	0.500	6
DINNER	1.000	1.000	1.000	8
DOG	0.500	0.333	0.400	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	0.800	1.000	0.889	4
EAT	0.714	0.833	0.769	6
EDIT	0.857	1.000	0.923	6
ELEVATOR	0.500	0.875	0.636	8
FINE	1.000	0.500	0.667	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	0.714	0.833	0.769	6
GUESS	1.000	1.000	1.000	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.800	0.667	0.727	6
HURDLE/TRIP	0.250	0.250	0.250	4
JEWELRY	0.800	1.000	0.889	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.545	0.750	0.632	8
LUNCH	1.000	0.500	0.667	8
MAPLE	0.600	0.750	0.667	4
MEAT	0.600	1.000	0.750	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.727	1.000	0.842	8
NOON	1.000	0.875	0.933	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.500	0.333	0.400	6
RAZOR	0.250	0.500	0.333	4
RIVER	1.000	0.667	0.800	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.571	0.400	0.471	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.667	0.500	0.571	4
THEY	0.667	1.000	0.800	4
TWINS	0.375	0.750	0.500	8
WHATFOR	1.000	0.600	0.750	10
accuracy			0.750	324
macro avg	0.781	0.745	0.736	324
weighted avg	0.796	0.750	0.747	324

[139]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '2 1DCNN + 1 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[60]:
```
hist_df = pd.read_csv('2 1DCNN + 1 LSTM/history.csv', index_col=0)
hist_df.tail()
```

[60]:

	loss	f1_score	val_loss	val_f1_score
495	0.169014	0.977602	1.716578	0.694314
496	0.169110	0.972625	1.579869	0.695536
497	0.185274	0.970491	1.738750	0.690854
498	0.187349	0.971281	1.450697	0.741395
499	0.198287	0.966673	1.582714	0.736278

[61]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[62]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[142]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 LSTM")
```

[143]:
```
reconstructed_model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_4 (Conv1D)           (None, 128, 150)          179700

 max_pooling1d_4 (MaxPooling  (None, 21, 150)          0
 1D)

 conv1d_5 (Conv1D)           (None, 18, 150)           90150

 max_pooling1d_5 (MaxPooling  (None, 4, 150)           0
```

```
 1D)

 dropout_4 (Dropout)         (None, 4, 150)            0

 lstm_2 (LSTM)               (None, 150)               180600

 dropout_5 (Dropout)         (None, 150)               0

 dense_4 (Dense)             (None, 90)                13590

 dense_5 (Dense)             (None, 50)                4550

=================================================================
Total params: 468,590
Trainable params: 468,590
Non-trainable params: 0
_________________________________________________________________
```

[145]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[145]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 128, 150)
MaxPooling1D
input: (None, 128, 150)
output: (None, 21, 150)
Conv1D
input: (None, 21, 150)
output: (None, 18, 150)
MaxPooling1D
input: (None, 18, 150)
output: (None, 4, 150)
Dropout
input: (None, 4, 150)
output: (None, 4, 150)
LSTM
input: (None, 4, 150)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 90)
Dense
input: (None, 90)
output: (None, 50)

[146]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 13ms/step - loss: 1.2420 - f1_score:
0.7745
```

[146]:
```
[1.2419642210006714, 0.7745026350021362]
```

[147]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-23 11:55:48.021660: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
```

```
84/84 [==============================] - 1s 10ms/step - loss: 0.1019 - f1_score:
0.9993
```

[147]:
```
[0.10191482305526733, 0.9992672204971313]
```

[148]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 0s 8ms/step
              precision    recall  f1-score   support

         AXE      0.800     1.000     0.889         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      0.692     0.900     0.783        10
        BELT      1.000     1.000     1.000         4
        BITE      1.000     0.500     0.667         8
   BREAKFAST      0.429     0.500     0.462         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.750     1.000     0.857         6
        DARK      1.000     1.000     1.000         4
        DEAF      0.500     0.333     0.400         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      1.000     1.000     1.000         8
     DEVELOP      0.667     0.333     0.444         6
      DINNER      1.000     1.000     1.000         8
         DOG      0.429     0.500     0.462         6
    DOWNSIZE      0.800     1.000     0.889         8
        DRAG      1.000     0.750     0.857         4
         EAT      0.857     1.000     0.923         6
```

```
        EDIT      0.750     1.000     0.857         6
    ELEVATOR      0.500     0.750     0.600         8
        FINE      0.667     0.500     0.571         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.889     1.000     0.941         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.667     0.800         6
 HURDLE/TRIP      0.375     0.750     0.500         4
     JEWELRY      1.000     1.000     1.000         4
      KNIGHT      1.000     0.500     0.667         4
        LOCK      0.750     0.750     0.750         8
       LUNCH      0.667     0.500     0.571         8
       MAPLE      0.750     0.750     0.750         4
        MEAT      0.750     1.000     0.857         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.500     0.667         8
       MOVIE      0.636     0.875     0.737         8
        NOON      1.000     0.750     0.857         8
       PARTY      0.750     0.750     0.750         8
     PATIENT      0.600     0.500     0.545         6
       RAZOR      1.000     0.500     0.667         4
       RIVER      0.750     1.000     0.857         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      0.692     0.900     0.783        10
        SINK      1.000     0.167     0.286         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.600     0.750     0.667         8
     WHATFOR      1.000     0.700     0.824        10

    accuracy                          0.790       324
   macro avg      0.824     0.777     0.775       324
weighted avg      0.821     0.790     0.782       324
```

3.10.1 2 1D-CNN + 1 LSTM Trial 715

[126]:
```
best_model = tuner.get_best_models(num_models=5)[4]
```

```
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object: (root).optimizer._u_product
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.0
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.1
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.2
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.3
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.4
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.6
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.7
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.8
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.9
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.10
```

```
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.11
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.12
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.13
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.14
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.15
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.16
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.17
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.18
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.19
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.20
WARNING:tensorflow:Value in checkpoint could not be found in the restored
object: (root).optimizer._variables.21
```

[127]:
```
best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-10 11:30:01.433863: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

84/84 [==============================] - 14s 15ms/step - loss: 0.4285 -
f1_score: 0.8761
```

[127]:
```
[0.42848339676856995, 0.8761171102523804]
```

[128]:
```
best_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 46ms/step - loss: 1.2463 - f1_score:
0.7204
```

[128]:
```
[1.246279001235962, 0.7203800678253174]
```

[122]:
```
bestHP = tuner.get_best_hyperparameters(num_trials=5)[4]
```

[123]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 LSTM Trial 715/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[124]:
```
print("[INFO] training the best model...")
model = tuner.hypermodel.build(bestHP)
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
#History = model.fit(x=Xtrain, y=Ytrain,validation_data= (Xval,Yval),␣
 ↪batch_size=96,epochs=500, verbose=1)
```

```
[INFO] training the best model…

2023-09-10 11:33:52.866778: I tensorflow/core/platform/cpu_feature_guard.cc:193]
This TensorFlow binary is optimized with oneAPI Deep Neural Network Library
(oneDNN) to use the following CPU instructions in performance-critical
operations:  AVX2 FMA
To enable them in other operations, rebuild TensorFlow with the appropriate
compiler flags.
2023-09-10 11:33:52.947217: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1561 MB memory:  -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1

Epoch 1/500

2023-09-10 11:33:58.449740: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
2023-09-10 11:34:01.137563: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x7fdaf190beb0 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
2023-09-10 11:34:01.137597: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-10 11:34:01.166755: I
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-10 11:34:01.596441: I
tensorflow/compiler/jit/xla_compilation_cache.cc:476] Compiled cluster using
XLA!  This line is logged at most once for the lifetime of the process.

28/28 [==============================] - ETA: 0s - loss: 4.8264 - f1_score:
0.0160

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 21s 471ms/step - loss: 4.8264 -
f1_score: 0.0160 - val_loss: 4.7650 - val_f1_score: 0.0072
Epoch 2/500
28/28 [==============================] - 2s 70ms/step - loss: 4.7126 - f1_score:
0.0120 - val_loss: 4.6493 - val_f1_score: 0.0057
Epoch 3/500
28/28 [==============================] - 2s 70ms/step - loss: 4.6002 - f1_score:
0.0165 - val_loss: 4.5517 - val_f1_score: 0.0025
Epoch 4/500
28/28 [==============================] - ETA: 0s - loss: 4.5046 - f1_score:
0.0210

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 9s 337ms/step - loss: 4.5046 -
f1_score: 0.0210 - val_loss: 4.4458 - val_f1_score: 0.0115
Epoch 5/500
28/28 [==============================] - 2s 70ms/step - loss: 4.4121 - f1_score:
0.0196 - val_loss: 4.3453 - val_f1_score: 0.0045
Epoch 6/500
28/28 [==============================] - 2s 71ms/step - loss: 4.2984 - f1_score:
0.0237 - val_loss: 4.2242 - val_f1_score: 0.0043
Epoch 7/500
28/28 [==============================] - 2s 73ms/step - loss: 4.1673 - f1_score:
0.0251 - val_loss: 4.0148 - val_f1_score: 0.0115
Epoch 8/500
28/28 [==============================] - 2s 73ms/step - loss: 4.0263 - f1_score:
0.0219 - val_loss: 3.8563 - val_f1_score: 0.0055
Epoch 9/500
28/28 [==============================] - ETA: 0s - loss: 3.9013 - f1_score:
0.0273

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 384ms/step - loss: 3.9013 -
f1_score: 0.0273 - val_loss: 3.7639 - val_f1_score: 0.0146
```

```
Epoch 10/500
28/28 [==============================] - ETA: 0s - loss: 3.7934 - f1_score:
0.0395

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 380ms/step - loss: 3.7934 -
f1_score: 0.0395 - val_loss: 3.6003 - val_f1_score: 0.0378
Epoch 11/500
28/28 [==============================] - ETA: 0s - loss: 3.6920 - f1_score:
0.0496

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 9s 348ms/step - loss: 3.6920 -
f1_score: 0.0496 - val_loss: 3.4915 - val_f1_score: 0.0463
Epoch 12/500
28/28 [==============================] - 2s 71ms/step - loss: 3.5949 - f1_score:
0.0502 - val_loss: 3.3761 - val_f1_score: 0.0402
Epoch 13/500
28/28 [==============================] - ETA: 0s - loss: 3.4821 - f1_score:
0.0603

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 405ms/step - loss: 3.4821 -
f1_score: 0.0603 - val_loss: 3.2583 - val_f1_score: 0.0526
Epoch 14/500
28/28 [==============================] - ETA: 0s - loss: 3.3814 - f1_score:
0.0749

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
```

```
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 9s 330ms/step - loss: 3.3814 -
f1_score: 0.0749 - val_loss: 3.1951 - val_f1_score: 0.0671
Epoch 15/500
28/28 [==============================] - ETA: 0s - loss: 3.2907 - f1_score:
0.0926

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 9s 341ms/step - loss: 3.2907 -
f1_score: 0.0926 - val_loss: 3.0850 - val_f1_score: 0.1099
Epoch 16/500
28/28 [==============================] - ETA: 0s - loss: 3.1942 - f1_score:
0.0962

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 413ms/step - loss: 3.1942 -
f1_score: 0.0962 - val_loss: 2.9979 - val_f1_score: 0.1118
Epoch 17/500
28/28 [==============================] - 2s 72ms/step - loss: 3.1157 - f1_score:
0.1150 - val_loss: 2.9325 - val_f1_score: 0.1001
Epoch 18/500
28/28 [==============================] - 2s 73ms/step - loss: 3.0584 - f1_score:
0.1274 - val_loss: 2.8534 - val_f1_score: 0.1055
Epoch 19/500
28/28 [==============================] - ETA: 0s - loss: 2.9779 - f1_score:
0.1275

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 353ms/step - loss: 2.9779 -
f1_score: 0.1275 - val_loss: 2.8193 - val_f1_score: 0.1321
Epoch 20/500
28/28 [==============================] - ETA: 0s - loss: 2.9183 - f1_score:
0.1502

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 383ms/step - loss: 2.9183 -
f1_score: 0.1502 - val_loss: 2.7642 - val_f1_score: 0.1372
Epoch 21/500
28/28 [==============================] - 2s 72ms/step - loss: 2.8610 - f1_score:
0.1559 - val_loss: 2.7494 - val_f1_score: 0.1196
Epoch 22/500
28/28 [==============================] - ETA: 0s - loss: 2.8173 - f1_score:
0.1623

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 351ms/step - loss: 2.8173 -
f1_score: 0.1623 - val_loss: 2.6991 - val_f1_score: 0.1543
Epoch 23/500
28/28 [==============================] - ETA: 0s - loss: 2.7766 - f1_score:
0.1737

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 351ms/step - loss: 2.7766 -
f1_score: 0.1737 - val_loss: 2.6731 - val_f1_score: 0.1545
Epoch 24/500
```

```
28/28 [==============================] - 2s 72ms/step - loss: 2.7311 - f1_score:
0.1722 - val_loss: 2.6356 - val_f1_score: 0.1476
Epoch 25/500
28/28 [==============================] - ETA: 0s - loss: 2.7133 - f1_score:
0.1709

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 395ms/step - loss: 2.7133 -
f1_score: 0.1709 - val_loss: 2.5997 - val_f1_score: 0.1985
Epoch 26/500
28/28 [==============================] - 2s 71ms/step - loss: 2.6620 - f1_score:
0.1889 - val_loss: 2.5884 - val_f1_score: 0.1892
Epoch 27/500
28/28 [==============================] - 2s 72ms/step - loss: 2.6297 - f1_score:
0.1907 - val_loss: 2.5848 - val_f1_score: 0.1982
Epoch 28/500
28/28 [==============================] - ETA: 0s - loss: 2.6012 - f1_score:
0.2005

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 380ms/step - loss: 2.6012 -
f1_score: 0.2005 - val_loss: 2.5360 - val_f1_score: 0.2018
Epoch 29/500
28/28 [==============================] - ETA: 0s - loss: 2.5623 - f1_score:
0.2142

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 451ms/step - loss: 2.5623 -
f1_score: 0.2142 - val_loss: 2.4828 - val_f1_score: 0.2073
Epoch 30/500
```

```
28/28 [==============================] - ETA: 0s - loss: 2.5376 - f1_score:
0.2281

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 383ms/step - loss: 2.5376 -
f1_score: 0.2281 - val_loss: 2.4787 - val_f1_score: 0.2285
Epoch 31/500
28/28 [==============================] - 2s 73ms/step - loss: 2.5049 - f1_score:
0.2239 - val_loss: 2.6027 - val_f1_score: 0.1777
Epoch 32/500
28/28 [==============================] - 2s 74ms/step - loss: 2.4552 - f1_score:
0.2418 - val_loss: 2.4596 - val_f1_score: 0.2283
Epoch 33/500
28/28 [==============================] - ETA: 0s - loss: 2.4586 - f1_score:
0.2371

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 384ms/step - loss: 2.4586 -
f1_score: 0.2371 - val_loss: 2.4316 - val_f1_score: 0.2499
Epoch 34/500
28/28 [==============================] - ETA: 0s - loss: 2.4195 - f1_score:
0.2529

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 438ms/step - loss: 2.4195 -
f1_score: 0.2529 - val_loss: 2.3910 - val_f1_score: 0.2803
Epoch 35/500
28/28 [==============================] - ETA: 0s - loss: 2.3861 - f1_score:
0.2527
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 384ms/step - loss: 2.3861 -
f1_score: 0.2527 - val_loss: 2.3809 - val_f1_score: 0.2872
Epoch 36/500
28/28 [==============================] - ETA: 0s - loss: 2.3749 - f1_score:
0.2606

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 408ms/step - loss: 2.3749 -
f1_score: 0.2606 - val_loss: 2.4265 - val_f1_score: 0.2901
Epoch 37/500
28/28 [==============================] - ETA: 0s - loss: 2.3515 - f1_score:
0.2569

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 383ms/step - loss: 2.3515 -
f1_score: 0.2569 - val_loss: 2.3442 - val_f1_score: 0.2914
Epoch 38/500
28/28 [==============================] - ETA: 0s - loss: 2.3504 - f1_score:
0.2781

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets
```

```
28/28 [==============================] - 11s 411ms/step - loss: 2.3504 -
f1_score: 0.2781 - val_loss: 2.3563 - val_f1_score: 0.3068
Epoch 39/500
28/28 [==============================] - 2s 73ms/step - loss: 2.3211 - f1_score:
0.2688 - val_loss: 2.3872 - val_f1_score: 0.2872
Epoch 40/500
28/28 [==============================] - 2s 73ms/step - loss: 2.2816 - f1_score:
0.2901 - val_loss: 2.3302 - val_f1_score: 0.2682
Epoch 41/500
28/28 [==============================] - 2s 74ms/step - loss: 2.2533 - f1_score:
0.2937 - val_loss: 2.3127 - val_f1_score: 0.2918
Epoch 42/500
28/28 [==============================] - 2s 73ms/step - loss: 2.2697 - f1_score:
0.2945 - val_loss: 2.2733 - val_f1_score: 0.3041
Epoch 43/500
28/28 [==============================] - ETA: 0s - loss: 2.2149 - f1_score:
0.3002

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 397ms/step - loss: 2.2149 -
f1_score: 0.3002 - val_loss: 2.2375 - val_f1_score: 0.3099
Epoch 44/500
28/28 [==============================] - ETA: 0s - loss: 2.1968 - f1_score:
0.3064

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 376ms/step - loss: 2.1968 -
f1_score: 0.3064 - val_loss: 2.2598 - val_f1_score: 0.3459
Epoch 45/500
28/28 [==============================] - 2s 72ms/step - loss: 2.1879 - f1_score:
0.3119 - val_loss: 2.2510 - val_f1_score: 0.3018
Epoch 46/500
28/28 [==============================] - 2s 72ms/step - loss: 2.1657 - f1_score:
0.3141 - val_loss: 2.2104 - val_f1_score: 0.3432
Epoch 47/500
28/28 [==============================] - 2s 73ms/step - loss: 2.1321 - f1_score:
```

```
0.3312 - val_loss: 2.2137 - val_f1_score: 0.3146
Epoch 48/500
28/28 [==============================] - 2s 74ms/step - loss: 2.1307 - f1_score:
0.3243 - val_loss: 2.2171 - val_f1_score: 0.3237
Epoch 49/500
28/28 [==============================] - ETA: 0s - loss: 2.1075 - f1_score:
0.3382

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 419ms/step - loss: 2.1075 -
f1_score: 0.3382 - val_loss: 2.1842 - val_f1_score: 0.3500
Epoch 50/500
28/28 [==============================] - 2s 71ms/step - loss: 2.0871 - f1_score:
0.3497 - val_loss: 2.2313 - val_f1_score: 0.3299
Epoch 51/500
28/28 [==============================] - 2s 75ms/step - loss: 2.0860 - f1_score:
0.3494 - val_loss: 2.1575 - val_f1_score: 0.3495
Epoch 52/500
28/28 [==============================] - 2s 76ms/step - loss: 2.0727 - f1_score:
0.3526 - val_loss: 2.2058 - val_f1_score: 0.3256
Epoch 53/500
28/28 [==============================] - ETA: 0s - loss: 2.0559 - f1_score:
0.3514

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 429ms/step - loss: 2.0559 -
f1_score: 0.3514 - val_loss: 2.1675 - val_f1_score: 0.3736
Epoch 54/500
28/28 [==============================] - 2s 72ms/step - loss: 2.0064 - f1_score:
0.3674 - val_loss: 2.1713 - val_f1_score: 0.3570
Epoch 55/500
28/28 [==============================] - 2s 72ms/step - loss: 2.0246 - f1_score:
0.3596 - val_loss: 2.1316 - val_f1_score: 0.3453
Epoch 56/500
28/28 [==============================] - 2s 75ms/step - loss: 1.9857 - f1_score:
0.3778 - val_loss: 2.1068 - val_f1_score: 0.3735
```

```
Epoch 57/500
28/28 [==============================] - ETA: 0s - loss: 1.9955 - f1_score:
0.3716

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 452ms/step - loss: 1.9955 -
f1_score: 0.3716 - val_loss: 2.1141 - val_f1_score: 0.3964
Epoch 58/500
28/28 [==============================] - 2s 74ms/step - loss: 1.9567 - f1_score:
0.3829 - val_loss: 2.1086 - val_f1_score: 0.3549
Epoch 59/500
28/28 [==============================] - 2s 73ms/step - loss: 1.9447 - f1_score:
0.3924 - val_loss: 2.0660 - val_f1_score: 0.3904
Epoch 60/500
28/28 [==============================] - 2s 74ms/step - loss: 1.9376 - f1_score:
0.3838 - val_loss: 2.0931 - val_f1_score: 0.3800
Epoch 61/500
28/28 [==============================] - 2s 73ms/step - loss: 1.8964 - f1_score:
0.4026 - val_loss: 2.0289 - val_f1_score: 0.3827
Epoch 62/500
28/28 [==============================] - 2s 74ms/step - loss: 1.9156 - f1_score:
0.3931 - val_loss: 2.0140 - val_f1_score: 0.3770
Epoch 63/500
28/28 [==============================] - 2s 77ms/step - loss: 1.8793 - f1_score:
0.4066 - val_loss: 2.0439 - val_f1_score: 0.3809
Epoch 64/500
28/28 [==============================] - 2s 75ms/step - loss: 1.8751 - f1_score:
0.4038 - val_loss: 2.0074 - val_f1_score: 0.3805
Epoch 65/500
28/28 [==============================] - 2s 75ms/step - loss: 1.8610 - f1_score:
0.4157 - val_loss: 2.0507 - val_f1_score: 0.3964
Epoch 66/500
28/28 [==============================] - 2s 76ms/step - loss: 1.8247 - f1_score:
0.4300 - val_loss: 1.9811 - val_f1_score: 0.3680
Epoch 67/500
28/28 [==============================] - ETA: 0s - loss: 1.8394 - f1_score:
0.4162

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 461ms/step - loss: 1.8394 -
f1_score: 0.4162 - val_loss: 1.9561 - val_f1_score: 0.4085
Epoch 68/500
28/28 [==============================] - ETA: 0s - loss: 1.8046 - f1_score:
0.4261

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 453ms/step - loss: 1.8046 -
f1_score: 0.4261 - val_loss: 1.9855 - val_f1_score: 0.4210
Epoch 69/500
28/28 [==============================] - 2s 79ms/step - loss: 1.8087 - f1_score:
0.4323 - val_loss: 1.9520 - val_f1_score: 0.3863
Epoch 70/500
28/28 [==============================] - 2s 75ms/step - loss: 1.8193 - f1_score:
0.4304 - val_loss: 1.9410 - val_f1_score: 0.3983
Epoch 71/500
28/28 [==============================] - 2s 75ms/step - loss: 1.7711 - f1_score:
0.4418 - val_loss: 1.9550 - val_f1_score: 0.4070
Epoch 72/500
28/28 [==============================] - 2s 75ms/step - loss: 1.7875 - f1_score:
0.4293 - val_loss: 1.9647 - val_f1_score: 0.4095
Epoch 73/500
28/28 [==============================] - 2s 76ms/step - loss: 1.7615 - f1_score:
0.4485 - val_loss: 1.9060 - val_f1_score: 0.4178
Epoch 74/500
28/28 [==============================] - 2s 75ms/step - loss: 1.7504 - f1_score:
0.4504 - val_loss: 1.9653 - val_f1_score: 0.4155
Epoch 75/500
28/28 [==============================] - 2s 74ms/step - loss: 1.7127 - f1_score:
0.4649 - val_loss: 1.9947 - val_f1_score: 0.4112
Epoch 76/500
28/28 [==============================] - 2s 74ms/step - loss: 1.7479 - f1_score:
0.4521 - val_loss: 1.8897 - val_f1_score: 0.4168
Epoch 77/500
28/28 [==============================] - ETA: 0s - loss: 1.7112 - f1_score:
0.4724

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
```

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lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 458ms/step - loss: 1.7112 -
f1_score: 0.4724 - val_loss: 1.9561 - val_f1_score: 0.4346
Epoch 78/500
28/28 [==============================] - 2s 76ms/step - loss: 1.6896 - f1_score:
0.4640 - val_loss: 1.8667 - val_f1_score: 0.4276
Epoch 79/500
28/28 [==============================] - ETA: 0s - loss: 1.6837 - f1_score:
0.4643

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 473ms/step - loss: 1.6837 -
f1_score: 0.4643 - val_loss: 1.8189 - val_f1_score: 0.4469
Epoch 80/500
28/28 [==============================] - 2s 74ms/step - loss: 1.6608 - f1_score:
0.4622 - val_loss: 1.8552 - val_f1_score: 0.4211
Epoch 81/500
28/28 [==============================] - 2s 73ms/step - loss: 1.6568 - f1_score:
0.4724 - val_loss: 1.8280 - val_f1_score: 0.4299
Epoch 82/500
28/28 [==============================] - ETA: 0s - loss: 1.6579 - f1_score:
0.4809

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 489ms/step - loss: 1.6579 -
f1_score: 0.4809 - val_loss: 1.8152 - val_f1_score: 0.4631
Epoch 83/500
28/28 [==============================] - 2s 75ms/step - loss: 1.6536 - f1_score:
0.4828 - val_loss: 1.7893 - val_f1_score: 0.4624
Epoch 84/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.6139 - f1_score:
0.4819

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 481ms/step - loss: 1.6139 -
f1_score: 0.4819 - val_loss: 1.8011 - val_f1_score: 0.4690
Epoch 85/500
28/28 [==============================] - ETA: 0s - loss: 1.5900 - f1_score:
0.4911

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 395ms/step - loss: 1.5900 -
f1_score: 0.4911 - val_loss: 1.7712 - val_f1_score: 0.4823
Epoch 86/500
28/28 [==============================] - 2s 72ms/step - loss: 1.6005 - f1_score:
0.4849 - val_loss: 1.8366 - val_f1_score: 0.4589
Epoch 87/500
28/28 [==============================] - ETA: 0s - loss: 1.5739 - f1_score:
0.5027

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 395ms/step - loss: 1.5739 -
f1_score: 0.5027 - val_loss: 1.7712 - val_f1_score: 0.4875
Epoch 88/500
28/28 [==============================] - 2s 72ms/step - loss: 1.5888 - f1_score:
0.5028 - val_loss: 1.7914 - val_f1_score: 0.4792
Epoch 89/500
28/28 [==============================] - 2s 73ms/step - loss: 1.5546 - f1_score:
0.5195 - val_loss: 1.7294 - val_f1_score: 0.4788
Epoch 90/500
```

```
28/28 [==============================] - ETA: 0s - loss: 1.5577 - f1_score:
0.4957

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 9s 343ms/step - loss: 1.5577 -
f1_score: 0.4957 - val_loss: 1.7666 - val_f1_score: 0.5099
Epoch 91/500
28/28 [==============================] - 2s 72ms/step - loss: 1.5587 - f1_score:
0.5145 - val_loss: 1.7242 - val_f1_score: 0.5028
Epoch 92/500
28/28 [==============================] - ETA: 0s - loss: 1.5712 - f1_score:
0.4963

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 471ms/step - loss: 1.5712 -
f1_score: 0.4963 - val_loss: 1.7153 - val_f1_score: 0.5197
Epoch 93/500
28/28 [==============================] - 2s 73ms/step - loss: 1.5297 - f1_score:
0.5202 - val_loss: 1.7368 - val_f1_score: 0.4986
Epoch 94/500
28/28 [==============================] - 2s 73ms/step - loss: 1.5071 - f1_score:
0.5242 - val_loss: 1.7079 - val_f1_score: 0.4717
Epoch 95/500
28/28 [==============================] - 2s 73ms/step - loss: 1.4825 - f1_score:
0.5358 - val_loss: 1.6967 - val_f1_score: 0.4958
Epoch 96/500
28/28 [==============================] - 2s 73ms/step - loss: 1.4796 - f1_score:
0.5460 - val_loss: 1.6893 - val_f1_score: 0.5151
Epoch 97/500
28/28 [==============================] - 2s 73ms/step - loss: 1.4666 - f1_score:
0.5296 - val_loss: 1.6313 - val_f1_score: 0.5097
Epoch 98/500
28/28 [==============================] - 2s 75ms/step - loss: 1.4713 - f1_score:
0.5396 - val_loss: 1.7138 - val_f1_score: 0.4943
Epoch 99/500
28/28 [==============================] - 2s 79ms/step - loss: 1.4567 - f1_score:
```

```
0.5466 - val_loss: 1.6492 - val_f1_score: 0.4970
Epoch 100/500
28/28 [==============================] - ETA: 0s - loss: 1.4566 - f1_score:
0.5369

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 393ms/step - loss: 1.4566 -
f1_score: 0.5369 - val_loss: 1.6615 - val_f1_score: 0.5257
Epoch 101/500
28/28 [==============================] - ETA: 0s - loss: 1.4501 - f1_score:
0.5476

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 433ms/step - loss: 1.4501 -
f1_score: 0.5476 - val_loss: 1.6382 - val_f1_score: 0.5270
Epoch 102/500
28/28 [==============================] - 2s 72ms/step - loss: 1.4446 - f1_score:
0.5403 - val_loss: 1.6860 - val_f1_score: 0.5029
Epoch 103/500
28/28 [==============================] - ETA: 0s - loss: 1.4485 - f1_score:
0.5431

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 409ms/step - loss: 1.4485 -
f1_score: 0.5431 - val_loss: 1.6348 - val_f1_score: 0.5344
Epoch 104/500
28/28 [==============================] - 2s 72ms/step - loss: 1.4334 - f1_score:
0.5422 - val_loss: 1.6297 - val_f1_score: 0.5113
Epoch 105/500
28/28 [==============================] - 2s 72ms/step - loss: 1.3761 - f1_score:
```

```
0.5530 - val_loss: 1.6104 - val_f1_score: 0.5074
Epoch 106/500
28/28 [==============================] - 2s 73ms/step - loss: 1.3918 - f1_score:
0.5608 - val_loss: 1.6388 - val_f1_score: 0.5023
Epoch 107/500
28/28 [==============================] - 2s 74ms/step - loss: 1.4053 - f1_score:
0.5598 - val_loss: 1.6479 - val_f1_score: 0.5306
Epoch 108/500
28/28 [==============================] - 2s 73ms/step - loss: 1.3632 - f1_score:
0.5774 - val_loss: 1.6806 - val_f1_score: 0.4985
Epoch 109/500
28/28 [==============================] - ETA: 0s - loss: 1.3686 - f1_score:
0.5683

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 417ms/step - loss: 1.3686 -
f1_score: 0.5683 - val_loss: 1.6163 - val_f1_score: 0.5485
Epoch 110/500
28/28 [==============================] - 2s 73ms/step - loss: 1.3720 - f1_score:
0.5689 - val_loss: 1.6101 - val_f1_score: 0.5267
Epoch 111/500
28/28 [==============================] - 2s 72ms/step - loss: 1.3583 - f1_score:
0.5642 - val_loss: 1.5977 - val_f1_score: 0.5173
Epoch 112/500
28/28 [==============================] - ETA: 0s - loss: 1.3126 - f1_score:
0.5966

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 426ms/step - loss: 1.3126 -
f1_score: 0.5966 - val_loss: 1.5460 - val_f1_score: 0.5514
Epoch 113/500
28/28 [==============================] - ETA: 0s - loss: 1.3168 - f1_score:
0.5859

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
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```
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 10s 377ms/step - loss: 1.3168 -
f1_score: 0.5859 - val_loss: 1.5368 - val_f1_score: 0.5650
Epoch 114/500
28/28 [==============================] - 2s 74ms/step - loss: 1.3246 - f1_score:
0.5770 - val_loss: 1.6076 - val_f1_score: 0.5456
Epoch 115/500
28/28 [==============================] - 2s 73ms/step - loss: 1.3066 - f1_score:
0.5955 - val_loss: 1.5431 - val_f1_score: 0.5635
Epoch 116/500
28/28 [==============================] - 2s 74ms/step - loss: 1.3094 - f1_score:
0.5902 - val_loss: 1.5484 - val_f1_score: 0.5530
Epoch 117/500
28/28 [==============================] - 2s 74ms/step - loss: 1.3055 - f1_score:
0.5884 - val_loss: 1.6049 - val_f1_score: 0.5302
Epoch 118/500
28/28 [==============================] - 2s 74ms/step - loss: 1.2818 - f1_score:
0.5971 - val_loss: 1.5984 - val_f1_score: 0.5376
Epoch 119/500
28/28 [==============================] - 2s 74ms/step - loss: 1.2745 - f1_score:
0.5949 - val_loss: 1.5687 - val_f1_score: 0.5316
Epoch 120/500
28/28 [==============================] - 2s 73ms/step - loss: 1.2673 - f1_score:
0.6040 - val_loss: 1.6401 - val_f1_score: 0.5088
Epoch 121/500
28/28 [==============================] - 2s 74ms/step - loss: 1.2676 - f1_score:
0.5865 - val_loss: 1.5851 - val_f1_score: 0.5196
Epoch 122/500
28/28 [==============================] - 2s 73ms/step - loss: 1.2690 - f1_score:
0.6002 - val_loss: 1.6019 - val_f1_score: 0.5528
Epoch 123/500
28/28 [==============================] - 2s 76ms/step - loss: 1.2415 - f1_score:
0.6148 - val_loss: 1.5318 - val_f1_score: 0.5447
Epoch 124/500
28/28 [==============================] - ETA: 0s - loss: 1.2050 - f1_score:
0.6253

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets
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```
28/28 [==============================] - 13s 485ms/step - loss: 1.2050 -
f1_score: 0.6253 - val_loss: 1.4951 - val_f1_score: 0.5919
Epoch 125/500
28/28 [==============================] - 2s 74ms/step - loss: 1.2092 - f1_score:
0.6135 - val_loss: 1.4933 - val_f1_score: 0.5667
Epoch 126/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2388 - f1_score:
0.6125 - val_loss: 1.4951 - val_f1_score: 0.5541
Epoch 127/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2114 - f1_score:
0.6165 - val_loss: 1.4716 - val_f1_score: 0.5732
Epoch 128/500
28/28 [==============================] - 2s 75ms/step - loss: 1.2037 - f1_score:
0.6244 - val_loss: 1.4762 - val_f1_score: 0.5874
Epoch 129/500
28/28 [==============================] - 2s 76ms/step - loss: 1.2118 - f1_score:
0.6183 - val_loss: 1.4527 - val_f1_score: 0.5704
Epoch 130/500
28/28 [==============================] - 2s 77ms/step - loss: 1.2051 - f1_score:
0.6169 - val_loss: 1.5507 - val_f1_score: 0.5832
Epoch 131/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1865 - f1_score:
0.6327 - val_loss: 1.5152 - val_f1_score: 0.5365
Epoch 132/500
28/28 [==============================] - 2s 76ms/step - loss: 1.1708 - f1_score:
0.6324 - val_loss: 1.4421 - val_f1_score: 0.5789
Epoch 133/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1800 - f1_score:
0.6262 - val_loss: 1.4958 - val_f1_score: 0.5618
Epoch 134/500
28/28 [==============================] - 2s 80ms/step - loss: 1.1661 - f1_score:
0.6314 - val_loss: 1.5071 - val_f1_score: 0.5578
Epoch 135/500
28/28 [==============================] - 2s 82ms/step - loss: 1.1640 - f1_score:
0.6306 - val_loss: 1.4494 - val_f1_score: 0.5823
Epoch 136/500
28/28 [==============================] - ETA: 0s - loss: 1.1597 - f1_score:
0.6309

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 480ms/step - loss: 1.1597 -
f1_score: 0.6309 - val_loss: 1.4261 - val_f1_score: 0.5920
```

```
Epoch 137/500
28/28 [==============================] - 2s 74ms/step - loss: 1.1399 - f1_score:
0.6386 - val_loss: 1.4259 - val_f1_score: 0.5738
Epoch 138/500
28/28 [==============================] - 2s 74ms/step - loss: 1.1215 - f1_score:
0.6533 - val_loss: 1.5245 - val_f1_score: 0.5644
Epoch 139/500
28/28 [==============================] - ETA: 0s - loss: 1.1310 - f1_score:
0.6460

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 427ms/step - loss: 1.1310 -
f1_score: 0.6460 - val_loss: 1.4385 - val_f1_score: 0.5923
Epoch 140/500
28/28 [==============================] - 2s 73ms/step - loss: 1.1093 - f1_score:
0.6603 - val_loss: 1.4635 - val_f1_score: 0.5814
Epoch 141/500
28/28 [==============================] - 2s 75ms/step - loss: 1.1225 - f1_score:
0.6511 - val_loss: 1.4527 - val_f1_score: 0.5831
Epoch 142/500
28/28 [==============================] - 2s 74ms/step - loss: 1.0891 - f1_score:
0.6671 - val_loss: 1.4648 - val_f1_score: 0.5853
Epoch 143/500
28/28 [==============================] - ETA: 0s - loss: 1.0885 - f1_score:
0.6460

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 14s 522ms/step - loss: 1.0885 -
f1_score: 0.6460 - val_loss: 1.5117 - val_f1_score: 0.5984
Epoch 144/500
28/28 [==============================] - ETA: 0s - loss: 1.1056 - f1_score:
0.6405

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
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```
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 415ms/step - loss: 1.1056 -
f1_score: 0.6405 - val_loss: 1.4481 - val_f1_score: 0.6061
Epoch 145/500
28/28 [==============================] - 2s 73ms/step - loss: 1.0916 - f1_score:
0.6583 - val_loss: 1.4911 - val_f1_score: 0.5754
Epoch 146/500
28/28 [==============================] - ETA: 0s - loss: 1.0895 - f1_score:
0.6549

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 432ms/step - loss: 1.0895 -
f1_score: 0.6549 - val_loss: 1.4082 - val_f1_score: 0.6129
Epoch 147/500
28/28 [==============================] - 2s 72ms/step - loss: 1.0677 - f1_score:
0.6665 - val_loss: 1.4260 - val_f1_score: 0.6032
Epoch 148/500
28/28 [==============================] - 2s 73ms/step - loss: 1.0837 - f1_score:
0.6567 - val_loss: 1.4516 - val_f1_score: 0.5819
Epoch 149/500
28/28 [==============================] - 2s 74ms/step - loss: 1.0633 - f1_score:
0.6608 - val_loss: 1.4254 - val_f1_score: 0.6084
Epoch 150/500
28/28 [==============================] - ETA: 0s - loss: 1.0574 - f1_score:
0.6692

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 402ms/step - loss: 1.0574 -
f1_score: 0.6692 - val_loss: 1.3823 - val_f1_score: 0.6204
Epoch 151/500
28/28 [==============================] - 2s 74ms/step - loss: 1.0183 - f1_score:
```

```
0.6798 - val_loss: 1.4182 - val_f1_score: 0.6168
Epoch 152/500
28/28 [==============================] - 2s 72ms/step - loss: 1.0152 - f1_score:
0.6805 - val_loss: 1.4598 - val_f1_score: 0.5943
Epoch 153/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0304 - f1_score:
0.6855 - val_loss: 1.3972 - val_f1_score: 0.6181
Epoch 154/500
28/28 [==============================] - 2s 77ms/step - loss: 1.0441 - f1_score:
0.6654 - val_loss: 1.4334 - val_f1_score: 0.5906
Epoch 155/500
28/28 [==============================] - 2s 80ms/step - loss: 1.0405 - f1_score:
0.6701 - val_loss: 1.3650 - val_f1_score: 0.6097
Epoch 156/500
28/28 [==============================] - 2s 75ms/step - loss: 1.0114 - f1_score:
0.6781 - val_loss: 1.4312 - val_f1_score: 0.6122
Epoch 157/500
28/28 [==============================] - ETA: 0s - loss: 1.0133 - f1_score:
0.6898

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 422ms/step - loss: 1.0133 -
f1_score: 0.6898 - val_loss: 1.3682 - val_f1_score: 0.6205
Epoch 158/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9936 - f1_score:
0.6861 - val_loss: 1.3663 - val_f1_score: 0.6045
Epoch 159/500
28/28 [==============================] - ETA: 0s - loss: 1.0205 - f1_score:
0.6757

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 476ms/step - loss: 1.0205 -
f1_score: 0.6757 - val_loss: 1.3275 - val_f1_score: 0.6491
Epoch 160/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9885 - f1_score:
0.6852 - val_loss: 1.3368 - val_f1_score: 0.5983
```

```
Epoch 161/500
28/28 [==============================] - ETA: 0s - loss: 0.9942 - f1_score:
0.6944

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 436ms/step - loss: 0.9942 -
f1_score: 0.6944 - val_loss: 1.3146 - val_f1_score: 0.6589
Epoch 162/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9991 - f1_score:
0.6862 - val_loss: 1.3945 - val_f1_score: 0.6170
Epoch 163/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9686 - f1_score:
0.6995 - val_loss: 1.3055 - val_f1_score: 0.6450
Epoch 164/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9908 - f1_score:
0.6928 - val_loss: 1.3518 - val_f1_score: 0.6308
Epoch 165/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9710 - f1_score:
0.7030 - val_loss: 1.3234 - val_f1_score: 0.6252
Epoch 166/500
28/28 [==============================] - 2s 72ms/step - loss: 0.9543 - f1_score:
0.6990 - val_loss: 1.3713 - val_f1_score: 0.6179
Epoch 167/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9703 - f1_score:
0.6967 - val_loss: 1.3770 - val_f1_score: 0.5924
Epoch 168/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9401 - f1_score:
0.7096 - val_loss: 1.3310 - val_f1_score: 0.6418
Epoch 169/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9279 - f1_score:
0.7036 - val_loss: 1.4225 - val_f1_score: 0.6218
Epoch 170/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9399 - f1_score:
0.7082 - val_loss: 1.3097 - val_f1_score: 0.6303
Epoch 171/500
28/28 [==============================] - 2s 77ms/step - loss: 0.9231 - f1_score:
0.7073 - val_loss: 1.4560 - val_f1_score: 0.6246
Epoch 172/500
28/28 [==============================] - 2s 76ms/step - loss: 0.9406 - f1_score:
0.7032 - val_loss: 1.3244 - val_f1_score: 0.6547
Epoch 173/500
28/28 [==============================] - 2s 73ms/step - loss: 0.9099 - f1_score:
```

```
0.7111 - val_loss: 1.3461 - val_f1_score: 0.6386
Epoch 174/500
28/28 [==============================] - ETA: 0s - loss: 0.9049 - f1_score:
0.7089

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 462ms/step - loss: 0.9049 -
f1_score: 0.7089 - val_loss: 1.3051 - val_f1_score: 0.6617
Epoch 175/500
28/28 [==============================] - 2s 72ms/step - loss: 0.9209 - f1_score:
0.7228 - val_loss: 1.3151 - val_f1_score: 0.6535
Epoch 176/500
28/28 [==============================] - 2s 71ms/step - loss: 0.9098 - f1_score:
0.7136 - val_loss: 1.3413 - val_f1_score: 0.6296
Epoch 177/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8787 - f1_score:
0.7249 - val_loss: 1.3621 - val_f1_score: 0.6281
Epoch 178/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8882 - f1_score:
0.7189 - val_loss: 1.3131 - val_f1_score: 0.6395
Epoch 179/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8863 - f1_score:
0.7197 - val_loss: 1.2923 - val_f1_score: 0.6269
Epoch 180/500
28/28 [==============================] - 2s 74ms/step - loss: 0.9043 - f1_score:
0.7173 - val_loss: 1.3477 - val_f1_score: 0.6280
Epoch 181/500
28/28 [==============================] - 2s 75ms/step - loss: 0.9150 - f1_score:
0.6980 - val_loss: 1.3302 - val_f1_score: 0.6515
Epoch 182/500
28/28 [==============================] - 2s 82ms/step - loss: 0.8751 - f1_score:
0.7299 - val_loss: 1.2976 - val_f1_score: 0.6406
Epoch 183/500
28/28 [==============================] - ETA: 0s - loss: 0.8598 - f1_score:
0.7387

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 405ms/step - loss: 0.8598 -
f1_score: 0.7387 - val_loss: 1.2950 - val_f1_score: 0.6649
Epoch 184/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8982 - f1_score:
0.7191 - val_loss: 1.3270 - val_f1_score: 0.6510
Epoch 185/500
28/28 [==============================] - 2s 76ms/step - loss: 0.8549 - f1_score:
0.7321 - val_loss: 1.3574 - val_f1_score: 0.6507
Epoch 186/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8730 - f1_score:
0.7180 - val_loss: 1.3110 - val_f1_score: 0.6527
Epoch 187/500
28/28 [==============================] - ETA: 0s - loss: 0.8650 - f1_score:
0.7257

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 440ms/step - loss: 0.8650 -
f1_score: 0.7257 - val_loss: 1.2698 - val_f1_score: 0.6659
Epoch 188/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8434 - f1_score:
0.7412 - val_loss: 1.3264 - val_f1_score: 0.6644
Epoch 189/500
28/28 [==============================] - ETA: 0s - loss: 0.8427 - f1_score:
0.7304

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 427ms/step - loss: 0.8427 -
f1_score: 0.7304 - val_loss: 1.2693 - val_f1_score: 0.6909
Epoch 190/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8312 - f1_score:
0.7481 - val_loss: 1.3170 - val_f1_score: 0.6553
Epoch 191/500
28/28 [==============================] - 2s 76ms/step - loss: 0.8553 - f1_score:
0.7319 - val_loss: 1.3492 - val_f1_score: 0.6269
```

```
Epoch 192/500
28/28 [==============================] - 2s 77ms/step - loss: 0.8495 - f1_score:
0.7285 - val_loss: 1.3126 - val_f1_score: 0.6497
Epoch 193/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8484 - f1_score:
0.7237 - val_loss: 1.4063 - val_f1_score: 0.6199
Epoch 194/500
28/28 [==============================] - 2s 75ms/step - loss: 0.8332 - f1_score:
0.7455 - val_loss: 1.3149 - val_f1_score: 0.6542
Epoch 195/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8538 - f1_score:
0.7290 - val_loss: 1.3474 - val_f1_score: 0.6625
Epoch 196/500
28/28 [==============================] - 2s 73ms/step - loss: 0.8175 - f1_score:
0.7425 - val_loss: 1.4085 - val_f1_score: 0.6134
Epoch 197/500
28/28 [==============================] - 2s 74ms/step - loss: 0.8050 - f1_score:
0.7436 - val_loss: 1.3282 - val_f1_score: 0.6688
Epoch 198/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7922 - f1_score:
0.7413 - val_loss: 1.3019 - val_f1_score: 0.6499
Epoch 199/500
28/28 [==============================] - 2s 78ms/step - loss: 0.7960 - f1_score:
0.7463 - val_loss: 1.2787 - val_f1_score: 0.6677
Epoch 200/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7931 - f1_score:
0.7460 - val_loss: 1.2692 - val_f1_score: 0.6762
Epoch 201/500
28/28 [==============================] - 2s 77ms/step - loss: 0.8010 - f1_score:
0.7483 - val_loss: 1.3026 - val_f1_score: 0.6602
Epoch 202/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7764 - f1_score:
0.7661 - val_loss: 1.3529 - val_f1_score: 0.6208
Epoch 203/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7857 - f1_score:
0.7681 - val_loss: 1.2942 - val_f1_score: 0.6719
Epoch 204/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7800 - f1_score:
0.7562 - val_loss: 1.2681 - val_f1_score: 0.6542
Epoch 205/500
28/28 [==============================] - 2s 76ms/step - loss: 0.7646 - f1_score:
0.7689 - val_loss: 1.2631 - val_f1_score: 0.6497
Epoch 206/500
28/28 [==============================] - 2s 75ms/step - loss: 0.7497 - f1_score:
0.7672 - val_loss: 1.2756 - val_f1_score: 0.6591
Epoch 207/500
28/28 [==============================] - 2s 74ms/step - loss: 0.7695 - f1_score:
0.7561 - val_loss: 1.3163 - val_f1_score: 0.6435
```

```
Epoch 208/500
28/28 [==============================] - 2s 76ms/step - loss: 0.7733 - f1_score:
0.7497 - val_loss: 1.2774 - val_f1_score: 0.6657
Epoch 209/500
28/28 [==============================] - 2s 81ms/step - loss: 0.7646 - f1_score:
0.7625 - val_loss: 1.2647 - val_f1_score: 0.6344
Epoch 210/500
28/28 [==============================] - 2s 89ms/step - loss: 0.7614 - f1_score:
0.7666 - val_loss: 1.2399 - val_f1_score: 0.6669
Epoch 211/500
28/28 [==============================] - 2s 82ms/step - loss: 0.7343 - f1_score:
0.7715 - val_loss: 1.3407 - val_f1_score: 0.6697
Epoch 212/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7432 - f1_score:
0.7596 - val_loss: 1.3340 - val_f1_score: 0.6469
Epoch 213/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7559 - f1_score:
0.7685 - val_loss: 1.2989 - val_f1_score: 0.6584
Epoch 214/500
28/28 [==============================] - 2s 81ms/step - loss: 0.7482 - f1_score:
0.7719 - val_loss: 1.3629 - val_f1_score: 0.6415
Epoch 215/500
28/28 [==============================] - 2s 82ms/step - loss: 0.7582 - f1_score:
0.7672 - val_loss: 1.3227 - val_f1_score: 0.6282
Epoch 216/500
28/28 [==============================] - 2s 82ms/step - loss: 0.7472 - f1_score:
0.7663 - val_loss: 1.2765 - val_f1_score: 0.6577
Epoch 217/500
28/28 [==============================] - 2s 78ms/step - loss: 0.7529 - f1_score:
0.7540 - val_loss: 1.2470 - val_f1_score: 0.6485
Epoch 218/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7266 - f1_score:
0.7756 - val_loss: 1.2681 - val_f1_score: 0.6636
Epoch 219/500
28/28 [==============================] - 2s 76ms/step - loss: 0.7501 - f1_score:
0.7597 - val_loss: 1.2967 - val_f1_score: 0.6649
Epoch 220/500
28/28 [==============================] - 2s 76ms/step - loss: 0.7343 - f1_score:
0.7820 - val_loss: 1.2651 - val_f1_score: 0.6780
Epoch 221/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7432 - f1_score:
0.7709 - val_loss: 1.3067 - val_f1_score: 0.6397
Epoch 222/500
28/28 [==============================] - 2s 77ms/step - loss: 0.7319 - f1_score:
0.7775 - val_loss: 1.2658 - val_f1_score: 0.6817
Epoch 223/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6981 - f1_score:
0.7784 - val_loss: 1.3144 - val_f1_score: 0.6402
```

```
Epoch 224/500
28/28 [==============================] - 2s 78ms/step - loss: 0.7210 - f1_score:
0.7740 - val_loss: 1.2478 - val_f1_score: 0.6761
Epoch 225/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7169 - f1_score:
0.7727 - val_loss: 1.2660 - val_f1_score: 0.6504
Epoch 226/500
28/28 [==============================] - 2s 79ms/step - loss: 0.7216 - f1_score:
0.7753 - val_loss: 1.3512 - val_f1_score: 0.6484
Epoch 227/500
28/28 [==============================] - 2s 84ms/step - loss: 0.7203 - f1_score:
0.7695 - val_loss: 1.3028 - val_f1_score: 0.6630
Epoch 228/500
28/28 [==============================] - 2s 80ms/step - loss: 0.7412 - f1_score:
0.7744 - val_loss: 1.2546 - val_f1_score: 0.6725
Epoch 229/500
28/28 [==============================] - 2s 80ms/step - loss: 0.6994 - f1_score:
0.7840 - val_loss: 1.2464 - val_f1_score: 0.6756
Epoch 230/500
28/28 [==============================] - 2s 84ms/step - loss: 0.6867 - f1_score:
0.7914 - val_loss: 1.3447 - val_f1_score: 0.6516
Epoch 231/500
28/28 [==============================] - 3s 91ms/step - loss: 0.7121 - f1_score:
0.7739 - val_loss: 1.2492 - val_f1_score: 0.6786
Epoch 232/500
28/28 [==============================] - 2s 87ms/step - loss: 0.6832 - f1_score:
0.7865 - val_loss: 1.3231 - val_f1_score: 0.6400
Epoch 233/500
28/28 [==============================] - 2s 80ms/step - loss: 0.6785 - f1_score:
0.7971 - val_loss: 1.2753 - val_f1_score: 0.6844
Epoch 234/500
28/28 [==============================] - 2s 79ms/step - loss: 0.7062 - f1_score:
0.7714 - val_loss: 1.2943 - val_f1_score: 0.6897
Epoch 235/500
28/28 [==============================] - 2s 80ms/step - loss: 0.6868 - f1_score:
0.7917 - val_loss: 1.3228 - val_f1_score: 0.6670
Epoch 236/500
28/28 [==============================] - 2s 85ms/step - loss: 0.6989 - f1_score:
0.7829 - val_loss: 1.2967 - val_f1_score: 0.6797
Epoch 237/500
28/28 [==============================] - ETA: 0s - loss: 0.6929 - f1_score:
0.7849

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 491ms/step - loss: 0.6929 -
f1_score: 0.7849 - val_loss: 1.2471 - val_f1_score: 0.6951
Epoch 238/500
28/28 [==============================] - ETA: 0s - loss: 0.6861 - f1_score:
0.7918

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 11s 402ms/step - loss: 0.6861 -
f1_score: 0.7918 - val_loss: 1.2738 - val_f1_score: 0.7047
Epoch 239/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6692 - f1_score:
0.7959 - val_loss: 1.1937 - val_f1_score: 0.6895
Epoch 240/500
28/28 [==============================] - 2s 72ms/step - loss: 0.6665 - f1_score:
0.7951 - val_loss: 1.2127 - val_f1_score: 0.6733
Epoch 241/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6613 - f1_score:
0.7987 - val_loss: 1.2664 - val_f1_score: 0.6594
Epoch 242/500
28/28 [==============================] - 2s 73ms/step - loss: 0.6614 - f1_score:
0.7993 - val_loss: 1.2861 - val_f1_score: 0.6962
Epoch 243/500
28/28 [==============================] - 2s 74ms/step - loss: 0.6685 - f1_score:
0.7935 - val_loss: 1.2829 - val_f1_score: 0.6804
Epoch 244/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6590 - f1_score:
0.8001 - val_loss: 1.2721 - val_f1_score: 0.6866
Epoch 245/500
28/28 [==============================] - 2s 75ms/step - loss: 0.6389 - f1_score:
0.8014 - val_loss: 1.2632 - val_f1_score: 0.6796
Epoch 246/500
28/28 [==============================] - 2s 77ms/step - loss: 0.6544 - f1_score:
0.7918 - val_loss: 1.2200 - val_f1_score: 0.6783
Epoch 247/500
28/28 [==============================] - 2s 76ms/step - loss: 0.6329 - f1_score:
0.8004 - val_loss: 1.3429 - val_f1_score: 0.6850
Epoch 248/500
28/28 [==============================] - 2s 75ms/step - loss: 0.6453 - f1_score:
0.7948 - val_loss: 1.2968 - val_f1_score: 0.6566
Epoch 249/500
```

```
28/28 [==============================] - 2s 80ms/step - loss: 0.6799 - f1_score:
0.7896 - val_loss: 1.2976 - val_f1_score: 0.6713
Epoch 250/500
28/28 [==============================] - 2s 79ms/step - loss: 0.6382 - f1_score:
0.8093 - val_loss: 1.2940 - val_f1_score: 0.6763
Epoch 251/500
28/28 [==============================] - 2s 80ms/step - loss: 0.6161 - f1_score:
0.8133 - val_loss: 1.2466 - val_f1_score: 0.6488
Epoch 252/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6583 - f1_score:
0.7923 - val_loss: 1.2714 - val_f1_score: 0.6725
Epoch 253/500
28/28 [==============================] - 2s 79ms/step - loss: 0.6128 - f1_score:
0.8055 - val_loss: 1.2687 - val_f1_score: 0.6755
Epoch 254/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6352 - f1_score:
0.8077 - val_loss: 1.2379 - val_f1_score: 0.6918
Epoch 255/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6142 - f1_score:
0.8141 - val_loss: 1.2378 - val_f1_score: 0.6563
Epoch 256/500
28/28 [==============================] - 2s 83ms/step - loss: 0.6115 - f1_score:
0.8083 - val_loss: 1.2942 - val_f1_score: 0.6868
Epoch 257/500
28/28 [==============================] - 2s 77ms/step - loss: 0.6393 - f1_score:
0.8054 - val_loss: 1.2807 - val_f1_score: 0.6641
Epoch 258/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6221 - f1_score:
0.8128 - val_loss: 1.2376 - val_f1_score: 0.7019
Epoch 259/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6247 - f1_score:
0.8041 - val_loss: 1.2658 - val_f1_score: 0.6703
Epoch 260/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6169 - f1_score:
0.8055 - val_loss: 1.2145 - val_f1_score: 0.6905
Epoch 261/500
28/28 [==============================] - 2s 79ms/step - loss: 0.5932 - f1_score:
0.8165 - val_loss: 1.2138 - val_f1_score: 0.6489
Epoch 262/500
28/28 [==============================] - 2s 80ms/step - loss: 0.6283 - f1_score:
0.8076 - val_loss: 1.3024 - val_f1_score: 0.6907
Epoch 263/500
28/28 [==============================] - 2s 77ms/step - loss: 0.5851 - f1_score:
0.8195 - val_loss: 1.2187 - val_f1_score: 0.6928
Epoch 264/500
28/28 [==============================] - 2s 78ms/step - loss: 0.6103 - f1_score:
0.8098 - val_loss: 1.2938 - val_f1_score: 0.6684
Epoch 265/500
```

```
28/28 [==============================] - 3s 91ms/step - loss: 0.5914 - f1_score:
0.8219 - val_loss: 1.2633 - val_f1_score: 0.6946
Epoch 266/500
28/28 [==============================] - 3s 89ms/step - loss: 0.5929 - f1_score:
0.8213 - val_loss: 1.2982 - val_f1_score: 0.6910
Epoch 267/500
28/28 [==============================] - 2s 81ms/step - loss: 0.6107 - f1_score:
0.8110 - val_loss: 1.2956 - val_f1_score: 0.6898
Epoch 268/500
28/28 [==============================] - 2s 88ms/step - loss: 0.6160 - f1_score:
0.8133 - val_loss: 1.2771 - val_f1_score: 0.6729
Epoch 269/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5820 - f1_score:
0.8220 - val_loss: 1.3164 - val_f1_score: 0.6898
Epoch 270/500
28/28 [==============================] - 2s 87ms/step - loss: 0.5991 - f1_score:
0.8164 - val_loss: 1.2976 - val_f1_score: 0.6791
Epoch 271/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5908 - f1_score:
0.8176 - val_loss: 1.2992 - val_f1_score: 0.7005
Epoch 272/500
28/28 [==============================] - 2s 81ms/step - loss: 0.5892 - f1_score:
0.8195 - val_loss: 1.3541 - val_f1_score: 0.6703
Epoch 273/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5645 - f1_score:
0.8287 - val_loss: 1.3090 - val_f1_score: 0.6745
Epoch 274/500
28/28 [==============================] - 2s 87ms/step - loss: 0.6195 - f1_score:
0.8084 - val_loss: 1.2907 - val_f1_score: 0.6917
Epoch 275/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5662 - f1_score:
0.8239 - val_loss: 1.2573 - val_f1_score: 0.6578
Epoch 276/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5646 - f1_score:
0.8262 - val_loss: 1.3612 - val_f1_score: 0.6767
Epoch 277/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5696 - f1_score:
0.8257 - val_loss: 1.3737 - val_f1_score: 0.6588
Epoch 278/500
28/28 [==============================] - 2s 86ms/step - loss: 0.5674 - f1_score:
0.8207 - val_loss: 1.2382 - val_f1_score: 0.6958
Epoch 279/500
28/28 [==============================] - 2s 80ms/step - loss: 0.5508 - f1_score:
0.8299 - val_loss: 1.2579 - val_f1_score: 0.6867
Epoch 280/500
28/28 [==============================] - 2s 85ms/step - loss: 0.5416 - f1_score:
0.8293 - val_loss: 1.3558 - val_f1_score: 0.6577
Epoch 281/500
```

```
28/28 [==============================] - 2s 82ms/step - loss: 0.5421 - f1_score:
0.8312 - val_loss: 1.3509 - val_f1_score: 0.6589
Epoch 282/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5730 - f1_score:
0.8226 - val_loss: 1.3018 - val_f1_score: 0.6891
Epoch 283/500
28/28 [==============================] - 2s 81ms/step - loss: 0.5514 - f1_score:
0.8247 - val_loss: 1.2954 - val_f1_score: 0.6932
Epoch 284/500
28/28 [==============================] - 2s 81ms/step - loss: 0.5636 - f1_score:
0.8259 - val_loss: 1.2549 - val_f1_score: 0.6894
Epoch 285/500
28/28 [==============================] - 2s 90ms/step - loss: 0.5579 - f1_score:
0.8328 - val_loss: 1.2462 - val_f1_score: 0.6791
Epoch 286/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5575 - f1_score:
0.8235 - val_loss: 1.4037 - val_f1_score: 0.6574
Epoch 287/500
28/28 [==============================] - 2s 88ms/step - loss: 0.5453 - f1_score:
0.8359 - val_loss: 1.3037 - val_f1_score: 0.6850
Epoch 288/500
28/28 [==============================] - 3s 96ms/step - loss: 0.5277 - f1_score:
0.8421 - val_loss: 1.3187 - val_f1_score: 0.6705
Epoch 289/500
28/28 [==============================] - 3s 93ms/step - loss: 0.5581 - f1_score:
0.8234 - val_loss: 1.3026 - val_f1_score: 0.6790
Epoch 290/500
28/28 [==============================] - 3s 90ms/step - loss: 0.5616 - f1_score:
0.8277 - val_loss: 1.2935 - val_f1_score: 0.6769
Epoch 291/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5155 - f1_score:
0.8474 - val_loss: 1.2966 - val_f1_score: 0.6694
Epoch 292/500
28/28 [==============================] - 2s 85ms/step - loss: 0.5626 - f1_score:
0.8261 - val_loss: 1.2585 - val_f1_score: 0.6723
Epoch 293/500
28/28 [==============================] - 2s 90ms/step - loss: 0.5571 - f1_score:
0.8260 - val_loss: 1.3091 - val_f1_score: 0.6665
Epoch 294/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5167 - f1_score:
0.8447 - val_loss: 1.2279 - val_f1_score: 0.6973
Epoch 295/500
28/28 [==============================] - 2s 87ms/step - loss: 0.5125 - f1_score:
0.8492 - val_loss: 1.3600 - val_f1_score: 0.6747
Epoch 296/500
28/28 [==============================] - 2s 86ms/step - loss: 0.5725 - f1_score:
0.8209 - val_loss: 1.2551 - val_f1_score: 0.6691
Epoch 297/500
```

```
28/28 [==============================] - 3s 90ms/step - loss: 0.5447 - f1_score:
0.8269 - val_loss: 1.2459 - val_f1_score: 0.6674
Epoch 298/500
28/28 [==============================] - 2s 86ms/step - loss: 0.5181 - f1_score:
0.8438 - val_loss: 1.3300 - val_f1_score: 0.6546
Epoch 299/500
28/28 [==============================] - 2s 87ms/step - loss: 0.5245 - f1_score:
0.8360 - val_loss: 1.3207 - val_f1_score: 0.6868
Epoch 300/500
28/28 [==============================] - 3s 93ms/step - loss: 0.5022 - f1_score:
0.8477 - val_loss: 1.3447 - val_f1_score: 0.6685
Epoch 301/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5396 - f1_score:
0.8346 - val_loss: 1.2879 - val_f1_score: 0.7029
Epoch 302/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5312 - f1_score:
0.8379 - val_loss: 1.2727 - val_f1_score: 0.7019
Epoch 303/500
28/28 [==============================] - 2s 86ms/step - loss: 0.5225 - f1_score:
0.8395 - val_loss: 1.3328 - val_f1_score: 0.6752
Epoch 304/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5051 - f1_score:
0.8412 - val_loss: 1.3274 - val_f1_score: 0.6775
Epoch 305/500
28/28 [==============================] - 2s 82ms/step - loss: 0.5323 - f1_score:
0.8379 - val_loss: 1.3480 - val_f1_score: 0.6994
Epoch 306/500
28/28 [==============================] - 2s 88ms/step - loss: 0.5444 - f1_score:
0.8330 - val_loss: 1.4203 - val_f1_score: 0.6879
Epoch 307/500
28/28 [==============================] - 3s 99ms/step - loss: 0.5293 - f1_score:
0.8386 - val_loss: 1.2502 - val_f1_score: 0.7003
Epoch 308/500
28/28 [==============================] - 2s 83ms/step - loss: 0.5082 - f1_score:
0.8435 - val_loss: 1.3691 - val_f1_score: 0.6633
Epoch 309/500
28/28 [==============================] - 2s 89ms/step - loss: 0.5000 - f1_score:
0.8463 - val_loss: 1.2655 - val_f1_score: 0.6938
Epoch 310/500
28/28 [==============================] - 2s 80ms/step - loss: 0.5074 - f1_score:
0.8471 - val_loss: 1.3886 - val_f1_score: 0.6733
Epoch 311/500
28/28 [==============================] - 2s 78ms/step - loss: 0.5124 - f1_score:
0.8481 - val_loss: 1.3776 - val_f1_score: 0.6749
Epoch 312/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4860 - f1_score:
0.8532 - val_loss: 1.2896 - val_f1_score: 0.6797
Epoch 313/500
```

```
28/28 [==============================] - 2s 79ms/step - loss: 0.4749 - f1_score:
0.8536 - val_loss: 1.3504 - val_f1_score: 0.6588
Epoch 314/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4971 - f1_score:
0.8458 - val_loss: 1.2763 - val_f1_score: 0.6901
Epoch 315/500
28/28 [==============================] - 2s 79ms/step - loss: 0.4966 - f1_score:
0.8508 - val_loss: 1.3335 - val_f1_score: 0.6649
Epoch 316/500
28/28 [==============================] - 2s 78ms/step - loss: 0.4829 - f1_score:
0.8528 - val_loss: 1.3343 - val_f1_score: 0.6655
Epoch 317/500
28/28 [==============================] - 2s 80ms/step - loss: 0.5297 - f1_score:
0.8392 - val_loss: 1.2927 - val_f1_score: 0.6861
Epoch 318/500
28/28 [==============================] - 2s 86ms/step - loss: 0.5134 - f1_score:
0.8488 - val_loss: 1.3122 - val_f1_score: 0.6753
Epoch 319/500
28/28 [==============================] - 2s 83ms/step - loss: 0.4732 - f1_score:
0.8576 - val_loss: 1.3827 - val_f1_score: 0.6918
Epoch 320/500
28/28 [==============================] - 3s 92ms/step - loss: 0.5050 - f1_score:
0.8350 - val_loss: 1.3897 - val_f1_score: 0.6639
Epoch 321/500
28/28 [==============================] - 2s 84ms/step - loss: 0.5063 - f1_score:
0.8474 - val_loss: 1.2533 - val_f1_score: 0.6828
Epoch 322/500
28/28 [==============================] - 2s 84ms/step - loss: 0.4989 - f1_score:
0.8490 - val_loss: 1.2271 - val_f1_score: 0.6943
Epoch 323/500
28/28 [==============================] - ETA: 0s - loss: 0.4878 - f1_score:
0.8491

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 15s 538ms/step - loss: 0.4878 -
f1_score: 0.8491 - val_loss: 1.1872 - val_f1_score: 0.7069
Epoch 324/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4809 - f1_score:
0.8480 - val_loss: 1.2696 - val_f1_score: 0.6937
Epoch 325/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4795 - f1_score:
0.8588 - val_loss: 1.3200 - val_f1_score: 0.6724
```

```
Epoch 326/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4762 - f1_score:
0.8598 - val_loss: 1.3247 - val_f1_score: 0.6752
Epoch 327/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4807 - f1_score:
0.8554 - val_loss: 1.3124 - val_f1_score: 0.6899
Epoch 328/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4737 - f1_score:
0.8481 - val_loss: 1.3361 - val_f1_score: 0.6971
Epoch 329/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4531 - f1_score:
0.8681 - val_loss: 1.2860 - val_f1_score: 0.6936
Epoch 330/500
28/28 [==============================] - ETA: 0s - loss: 0.4681 - f1_score:
0.8537

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 12s 437ms/step - loss: 0.4681 -
f1_score: 0.8537 - val_loss: 1.4102 - val_f1_score: 0.7133
Epoch 331/500
28/28 [==============================] - 2s 73ms/step - loss: 0.4723 - f1_score:
0.8635 - val_loss: 1.3100 - val_f1_score: 0.6799
Epoch 332/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4557 - f1_score:
0.8604 - val_loss: 1.3333 - val_f1_score: 0.6765
Epoch 333/500
28/28 [==============================] - 2s 74ms/step - loss: 0.4761 - f1_score:
0.8584 - val_loss: 1.2447 - val_f1_score: 0.6862
Epoch 334/500
28/28 [==============================] - 2s 75ms/step - loss: 0.4586 - f1_score:
0.8659 - val_loss: 1.2988 - val_f1_score: 0.6738
Epoch 335/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4479 - f1_score:
0.8639 - val_loss: 1.2483 - val_f1_score: 0.6780
Epoch 336/500
28/28 [==============================] - 2s 76ms/step - loss: 0.4700 - f1_score:
0.8538 - val_loss: 1.2411 - val_f1_score: 0.6899
Epoch 337/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4706 - f1_score:
0.8633 - val_loss: 1.2787 - val_f1_score: 0.6903
Epoch 338/500
28/28 [==============================] - 2s 77ms/step - loss: 0.4540 - f1_score:
```

```
0.8571 - val_loss: 1.3752 - val_f1_score: 0.6958
Epoch 339/500
28/28 [==============================] - ETA: 0s - loss: 0.4727 - f1_score:
0.8617

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 13s 486ms/step - loss: 0.4727 -
f1_score: 0.8617 - val_loss: 1.2006 - val_f1_score: 0.7195
Epoch 340/500
28/28 [==============================] - 2s 79ms/step - loss: 0.4750 - f1_score:
0.8490 - val_loss: 1.2722 - val_f1_score: 0.6874
Epoch 341/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4324 - f1_score:
0.8673 - val_loss: 1.2754 - val_f1_score: 0.6893
Epoch 342/500
28/28 [==============================] - 2s 83ms/step - loss: 0.4554 - f1_score:
0.8639 - val_loss: 1.2387 - val_f1_score: 0.7176
Epoch 343/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4714 - f1_score:
0.8592 - val_loss: 1.2620 - val_f1_score: 0.7038
Epoch 344/500
28/28 [==============================] - 2s 78ms/step - loss: 0.4543 - f1_score:
0.8644 - val_loss: 1.3091 - val_f1_score: 0.6859
Epoch 345/500
28/28 [==============================] - 2s 81ms/step - loss: 0.4594 - f1_score:
0.8642 - val_loss: 1.2751 - val_f1_score: 0.6933
Epoch 346/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4502 - f1_score:
0.8578 - val_loss: 1.4018 - val_f1_score: 0.6679
Epoch 347/500
28/28 [==============================] - 2s 81ms/step - loss: 0.4459 - f1_score:
0.8641 - val_loss: 1.2657 - val_f1_score: 0.7039
Epoch 348/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4684 - f1_score:
0.8530 - val_loss: 1.1979 - val_f1_score: 0.7190
Epoch 349/500
28/28 [==============================] - 2s 85ms/step - loss: 0.4681 - f1_score:
0.8552 - val_loss: 1.3212 - val_f1_score: 0.6899
Epoch 350/500
28/28 [==============================] - 2s 85ms/step - loss: 0.4349 - f1_score:
0.8642 - val_loss: 1.2137 - val_f1_score: 0.6979
Epoch 351/500
```

```
28/28 [==============================] - 2s 84ms/step - loss: 0.4462 - f1_score:
0.8643 - val_loss: 1.3171 - val_f1_score: 0.6769
Epoch 352/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4277 - f1_score:
0.8704 - val_loss: 1.2721 - val_f1_score: 0.6962
Epoch 353/500
28/28 [==============================] - 2s 83ms/step - loss: 0.4335 - f1_score:
0.8707 - val_loss: 1.3161 - val_f1_score: 0.6943
Epoch 354/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4188 - f1_score:
0.8726 - val_loss: 1.2705 - val_f1_score: 0.6907
Epoch 355/500
28/28 [==============================] - 2s 87ms/step - loss: 0.4233 - f1_score:
0.8778 - val_loss: 1.3958 - val_f1_score: 0.6630
Epoch 356/500
28/28 [==============================] - 2s 79ms/step - loss: 0.4495 - f1_score:
0.8677 - val_loss: 1.3456 - val_f1_score: 0.6951
Epoch 357/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4353 - f1_score:
0.8651 - val_loss: 1.3277 - val_f1_score: 0.6723
Epoch 358/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4341 - f1_score:
0.8697 - val_loss: 1.3702 - val_f1_score: 0.6464
Epoch 359/500
28/28 [==============================] - 2s 81ms/step - loss: 0.4003 - f1_score:
0.8820 - val_loss: 1.3307 - val_f1_score: 0.6814
Epoch 360/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4190 - f1_score:
0.8755 - val_loss: 1.2667 - val_f1_score: 0.7092
Epoch 361/500
28/28 [==============================] - 2s 83ms/step - loss: 0.4186 - f1_score:
0.8752 - val_loss: 1.2693 - val_f1_score: 0.6910
Epoch 362/500
28/28 [==============================] - 2s 90ms/step - loss: 0.4082 - f1_score:
0.8778 - val_loss: 1.3314 - val_f1_score: 0.6953
Epoch 363/500
28/28 [==============================] - 2s 88ms/step - loss: 0.4257 - f1_score:
0.8712 - val_loss: 1.2585 - val_f1_score: 0.6957
Epoch 364/500
28/28 [==============================] - 2s 84ms/step - loss: 0.4585 - f1_score:
0.8574 - val_loss: 1.3510 - val_f1_score: 0.6758
Epoch 365/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3969 - f1_score:
0.8803 - val_loss: 1.3565 - val_f1_score: 0.6998
Epoch 366/500
28/28 [==============================] - 2s 85ms/step - loss: 0.4315 - f1_score:
0.8717 - val_loss: 1.2812 - val_f1_score: 0.6841
Epoch 367/500
```

```
28/28 [==============================] - 2s 87ms/step - loss: 0.4301 - f1_score:
0.8776 - val_loss: 1.3008 - val_f1_score: 0.7005
Epoch 368/500
28/28 [==============================] - 2s 87ms/step - loss: 0.4143 - f1_score:
0.8772 - val_loss: 1.3174 - val_f1_score: 0.6762
Epoch 369/500
28/28 [==============================] - 2s 89ms/step - loss: 0.4236 - f1_score:
0.8680 - val_loss: 1.3193 - val_f1_score: 0.6939
Epoch 370/500
28/28 [==============================] - 2s 85ms/step - loss: 0.4324 - f1_score:
0.8722 - val_loss: 1.2774 - val_f1_score: 0.6941
Epoch 371/500
28/28 [==============================] - 2s 86ms/step - loss: 0.4305 - f1_score:
0.8694 - val_loss: 1.2712 - val_f1_score: 0.6825
Epoch 372/500
28/28 [==============================] - 2s 82ms/step - loss: 0.4368 - f1_score:
0.8690 - val_loss: 1.2711 - val_f1_score: 0.6784
Epoch 373/500
28/28 [==============================] - 3s 99ms/step - loss: 0.4144 - f1_score:
0.8814 - val_loss: 1.3685 - val_f1_score: 0.6835
Epoch 374/500
28/28 [==============================] - 2s 88ms/step - loss: 0.4159 - f1_score:
0.8747 - val_loss: 1.4009 - val_f1_score: 0.7076
Epoch 375/500
28/28 [==============================] - 2s 90ms/step - loss: 0.3957 - f1_score:
0.8756 - val_loss: 1.5152 - val_f1_score: 0.6565
Epoch 376/500
28/28 [==============================] - 3s 97ms/step - loss: 0.4296 - f1_score:
0.8735 - val_loss: 1.2583 - val_f1_score: 0.6976
Epoch 377/500
28/28 [==============================] - 3s 96ms/step - loss: 0.4135 - f1_score:
0.8719 - val_loss: 1.2918 - val_f1_score: 0.6870
Epoch 378/500
28/28 [==============================] - 2s 81ms/step - loss: 0.3686 - f1_score:
0.8941 - val_loss: 1.3058 - val_f1_score: 0.7076
Epoch 379/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3876 - f1_score:
0.8819 - val_loss: 1.2588 - val_f1_score: 0.7100
Epoch 380/500
28/28 [==============================] - 2s 80ms/step - loss: 0.4003 - f1_score:
0.8801 - val_loss: 1.2730 - val_f1_score: 0.6783
Epoch 381/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3934 - f1_score:
0.8784 - val_loss: 1.3488 - val_f1_score: 0.6909
Epoch 382/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3907 - f1_score:
0.8858 - val_loss: 1.3012 - val_f1_score: 0.6894
Epoch 383/500
```

```
28/28 [==============================] - 2s 83ms/step - loss: 0.3883 - f1_score:
0.8838 - val_loss: 1.4142 - val_f1_score: 0.6540
Epoch 384/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3931 - f1_score:
0.8768 - val_loss: 1.2731 - val_f1_score: 0.6855
Epoch 385/500
28/28 [==============================] - 2s 90ms/step - loss: 0.3648 - f1_score:
0.8888 - val_loss: 1.3109 - val_f1_score: 0.6935
Epoch 386/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3755 - f1_score:
0.8950 - val_loss: 1.4056 - val_f1_score: 0.6682
Epoch 387/500
28/28 [==============================] - 2s 83ms/step - loss: 0.4181 - f1_score:
0.8767 - val_loss: 1.2879 - val_f1_score: 0.6917
Epoch 388/500
28/28 [==============================] - 2s 84ms/step - loss: 0.4139 - f1_score:
0.8808 - val_loss: 1.3167 - val_f1_score: 0.7004
Epoch 389/500
28/28 [==============================] - 2s 88ms/step - loss: 0.3986 - f1_score:
0.8819 - val_loss: 1.4172 - val_f1_score: 0.6714
Epoch 390/500
28/28 [==============================] - 2s 79ms/step - loss: 0.3779 - f1_score:
0.8946 - val_loss: 1.3007 - val_f1_score: 0.6893
Epoch 391/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3935 - f1_score:
0.8830 - val_loss: 1.3845 - val_f1_score: 0.6695
Epoch 392/500
28/28 [==============================] - 3s 93ms/step - loss: 0.4030 - f1_score:
0.8848 - val_loss: 1.4196 - val_f1_score: 0.6984
Epoch 393/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3884 - f1_score:
0.8844 - val_loss: 1.3354 - val_f1_score: 0.6801
Epoch 394/500
28/28 [==============================] - 2s 81ms/step - loss: 0.4018 - f1_score:
0.8717 - val_loss: 1.3978 - val_f1_score: 0.6817
Epoch 395/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3811 - f1_score:
0.8876 - val_loss: 1.2932 - val_f1_score: 0.6675
Epoch 396/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3800 - f1_score:
0.8914 - val_loss: 1.3056 - val_f1_score: 0.7075
Epoch 397/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3864 - f1_score:
0.8836 - val_loss: 1.3243 - val_f1_score: 0.6943
Epoch 398/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3607 - f1_score:
0.8922 - val_loss: 1.3432 - val_f1_score: 0.6746
Epoch 399/500
```

```
28/28 [==============================] - 2s 79ms/step - loss: 0.3842 - f1_score:
0.8812 - val_loss: 1.3475 - val_f1_score: 0.6938
Epoch 400/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3848 - f1_score:
0.8837 - val_loss: 1.2869 - val_f1_score: 0.6902
Epoch 401/500
28/28 [==============================] - 3s 92ms/step - loss: 0.4038 - f1_score:
0.8813 - val_loss: 1.3520 - val_f1_score: 0.6691
Epoch 402/500
28/28 [==============================] - 3s 92ms/step - loss: 0.3754 - f1_score:
0.8865 - val_loss: 1.2457 - val_f1_score: 0.6983
Epoch 403/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3507 - f1_score:
0.8968 - val_loss: 1.3460 - val_f1_score: 0.6923
Epoch 404/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3999 - f1_score:
0.8794 - val_loss: 1.2992 - val_f1_score: 0.7029
Epoch 405/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3880 - f1_score:
0.8764 - val_loss: 1.3425 - val_f1_score: 0.6802
Epoch 406/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3747 - f1_score:
0.8927 - val_loss: 1.3616 - val_f1_score: 0.6904
Epoch 407/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3698 - f1_score:
0.8891 - val_loss: 1.3888 - val_f1_score: 0.6827
Epoch 408/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3566 - f1_score:
0.8977 - val_loss: 1.3188 - val_f1_score: 0.6999
Epoch 409/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3793 - f1_score:
0.8893 - val_loss: 1.2709 - val_f1_score: 0.7063
Epoch 410/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3784 - f1_score:
0.8887 - val_loss: 1.3058 - val_f1_score: 0.7086
Epoch 411/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3609 - f1_score:
0.8936 - val_loss: 1.3884 - val_f1_score: 0.6950
Epoch 412/500
28/28 [==============================] - 3s 91ms/step - loss: 0.3672 - f1_score:
0.8865 - val_loss: 1.2961 - val_f1_score: 0.7036
Epoch 413/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3900 - f1_score:
0.8751 - val_loss: 1.4227 - val_f1_score: 0.6863
Epoch 414/500
28/28 [==============================] - 2s 88ms/step - loss: 0.3663 - f1_score:
0.8914 - val_loss: 1.2728 - val_f1_score: 0.6970
Epoch 415/500
```

```
28/28 [==============================] - 2s 85ms/step - loss: 0.3630 - f1_score:
0.8889 - val_loss: 1.3436 - val_f1_score: 0.6897
Epoch 416/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3761 - f1_score:
0.8808 - val_loss: 1.2462 - val_f1_score: 0.7036
Epoch 417/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3649 - f1_score:
0.8905 - val_loss: 1.4329 - val_f1_score: 0.6796
Epoch 418/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3819 - f1_score:
0.8909 - val_loss: 1.3749 - val_f1_score: 0.6949
Epoch 419/500
28/28 [==============================] - 3s 92ms/step - loss: 0.3547 - f1_score:
0.8946 - val_loss: 1.2924 - val_f1_score: 0.6838
Epoch 420/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3633 - f1_score:
0.8903 - val_loss: 1.3351 - val_f1_score: 0.7000
Epoch 421/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3693 - f1_score:
0.8904 - val_loss: 1.3779 - val_f1_score: 0.6911
Epoch 422/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3810 - f1_score:
0.8908 - val_loss: 1.2545 - val_f1_score: 0.6933
Epoch 423/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3462 - f1_score:
0.8943 - val_loss: 1.3804 - val_f1_score: 0.6763
Epoch 424/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3310 - f1_score:
0.9053 - val_loss: 1.3843 - val_f1_score: 0.6834
Epoch 425/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3717 - f1_score:
0.8880 - val_loss: 1.3076 - val_f1_score: 0.6789
Epoch 426/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3631 - f1_score:
0.8896 - val_loss: 1.2883 - val_f1_score: 0.6920
Epoch 427/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3548 - f1_score:
0.8983 - val_loss: 1.3721 - val_f1_score: 0.6885
Epoch 428/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3516 - f1_score:
0.8962 - val_loss: 1.3302 - val_f1_score: 0.6900
Epoch 429/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3749 - f1_score:
0.8869 - val_loss: 1.2507 - val_f1_score: 0.7059
Epoch 430/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3530 - f1_score:
0.8975 - val_loss: 1.2967 - val_f1_score: 0.6870
Epoch 431/500
```

```
28/28 [==============================] - 2s 85ms/step - loss: 0.3475 - f1_score:
0.8942 - val_loss: 1.3862 - val_f1_score: 0.6815
Epoch 432/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3359 - f1_score:
0.8942 - val_loss: 1.3141 - val_f1_score: 0.7018
Epoch 433/500
28/28 [==============================] - 3s 118ms/step - loss: 0.3310 -
f1_score: 0.9051 - val_loss: 1.4022 - val_f1_score: 0.6942
Epoch 434/500
28/28 [==============================] - 3s 99ms/step - loss: 0.3373 - f1_score:
0.9023 - val_loss: 1.3130 - val_f1_score: 0.7018
Epoch 435/500
28/28 [==============================] - 3s 106ms/step - loss: 0.3309 -
f1_score: 0.9061 - val_loss: 1.4690 - val_f1_score: 0.6640
Epoch 436/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3570 - f1_score:
0.8915 - val_loss: 1.4575 - val_f1_score: 0.6895
Epoch 437/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3957 - f1_score:
0.8846 - val_loss: 1.2806 - val_f1_score: 0.7027
Epoch 438/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3596 - f1_score:
0.8954 - val_loss: 1.3787 - val_f1_score: 0.6791
Epoch 439/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3293 - f1_score:
0.9105 - val_loss: 1.3576 - val_f1_score: 0.6848
Epoch 440/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3303 - f1_score:
0.9012 - val_loss: 1.3738 - val_f1_score: 0.6740
Epoch 441/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3352 - f1_score:
0.8933 - val_loss: 1.2693 - val_f1_score: 0.6938
Epoch 442/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3285 - f1_score:
0.9007 - val_loss: 1.4714 - val_f1_score: 0.6754
Epoch 443/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3194 - f1_score:
0.9117 - val_loss: 1.3890 - val_f1_score: 0.6970
Epoch 444/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3013 - f1_score:
0.9072 - val_loss: 1.3983 - val_f1_score: 0.6949
Epoch 445/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3053 - f1_score:
0.9163 - val_loss: 1.2851 - val_f1_score: 0.6890
Epoch 446/500
28/28 [==============================] - 3s 100ms/step - loss: 0.3470 -
f1_score: 0.9036 - val_loss: 1.3205 - val_f1_score: 0.6918
Epoch 447/500
```

```
28/28 [==============================] - 3s 93ms/step - loss: 0.3572 - f1_score:
0.8969 - val_loss: 1.3780 - val_f1_score: 0.6727
Epoch 448/500
28/28 [==============================] - 3s 96ms/step - loss: 0.3278 - f1_score:
0.9029 - val_loss: 1.3264 - val_f1_score: 0.7009
Epoch 449/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3291 - f1_score:
0.9050 - val_loss: 1.4834 - val_f1_score: 0.6741
Epoch 450/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3095 - f1_score:
0.9120 - val_loss: 1.3347 - val_f1_score: 0.6953
Epoch 451/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3437 - f1_score:
0.8951 - val_loss: 1.4411 - val_f1_score: 0.6721
Epoch 452/500
28/28 [==============================] - 2s 88ms/step - loss: 0.3783 - f1_score:
0.8846 - val_loss: 1.3278 - val_f1_score: 0.7070
Epoch 453/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3159 - f1_score:
0.9139 - val_loss: 1.3514 - val_f1_score: 0.6997
Epoch 454/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3228 - f1_score:
0.9111 - val_loss: 1.4644 - val_f1_score: 0.6701
Epoch 455/500
28/28 [==============================] - 3s 92ms/step - loss: 0.3451 - f1_score:
0.8986 - val_loss: 1.3302 - val_f1_score: 0.7105
Epoch 456/500
28/28 [==============================] - ETA: 0s - loss: 0.3154 - f1_score:
0.9069

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, lstm_cell_layer_call_fn,
lstm_cell_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 LSTM Trial 715/assets

28/28 [==============================] - 15s 555ms/step - loss: 0.3154 -
f1_score: 0.9069 - val_loss: 1.3636 - val_f1_score: 0.7306
Epoch 457/500
28/28 [==============================] - 2s 75ms/step - loss: 0.3101 - f1_score:
0.9128 - val_loss: 1.4169 - val_f1_score: 0.6897
Epoch 458/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3265 - f1_score:
0.9045 - val_loss: 1.4540 - val_f1_score: 0.6783
Epoch 459/500
28/28 [==============================] - 2s 76ms/step - loss: 0.3269 - f1_score:
0.9005 - val_loss: 1.3582 - val_f1_score: 0.6816
```

```
Epoch 460/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3191 - f1_score:
0.9042 - val_loss: 1.3540 - val_f1_score: 0.6965
Epoch 461/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3285 - f1_score:
0.9020 - val_loss: 1.4847 - val_f1_score: 0.6958
Epoch 462/500
28/28 [==============================] - 2s 83ms/step - loss: 0.3205 - f1_score:
0.9105 - val_loss: 1.3298 - val_f1_score: 0.7093
Epoch 463/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3613 - f1_score:
0.8901 - val_loss: 1.5186 - val_f1_score: 0.6922
Epoch 464/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3359 - f1_score:
0.8966 - val_loss: 1.3658 - val_f1_score: 0.6850
Epoch 465/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2924 - f1_score:
0.9125 - val_loss: 1.4372 - val_f1_score: 0.6754
Epoch 466/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3045 - f1_score:
0.9099 - val_loss: 1.5276 - val_f1_score: 0.6633
Epoch 467/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3193 - f1_score:
0.9130 - val_loss: 1.4604 - val_f1_score: 0.6680
Epoch 468/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3110 - f1_score:
0.9146 - val_loss: 1.3921 - val_f1_score: 0.7214
Epoch 469/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3156 - f1_score:
0.9063 - val_loss: 1.4179 - val_f1_score: 0.6840
Epoch 470/500
28/28 [==============================] - 2s 78ms/step - loss: 0.3219 - f1_score:
0.9068 - val_loss: 1.3757 - val_f1_score: 0.7152
Epoch 471/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3059 - f1_score:
0.9107 - val_loss: 1.4146 - val_f1_score: 0.6930
Epoch 472/500
28/28 [==============================] - 2s 80ms/step - loss: 0.3330 - f1_score:
0.9027 - val_loss: 1.4033 - val_f1_score: 0.6940
Epoch 473/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2865 - f1_score:
0.9186 - val_loss: 1.3253 - val_f1_score: 0.7101
Epoch 474/500
28/28 [==============================] - 2s 86ms/step - loss: 0.2931 - f1_score:
0.9131 - val_loss: 1.4595 - val_f1_score: 0.6651
Epoch 475/500
28/28 [==============================] - 2s 82ms/step - loss: 0.3003 - f1_score:
0.9201 - val_loss: 1.4052 - val_f1_score: 0.6974
```

```
Epoch 476/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3146 - f1_score:
0.9106 - val_loss: 1.3985 - val_f1_score: 0.6764
Epoch 477/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3212 - f1_score:
0.9066 - val_loss: 1.5078 - val_f1_score: 0.6842
Epoch 478/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3038 - f1_score:
0.9101 - val_loss: 1.3691 - val_f1_score: 0.7083
Epoch 479/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3094 - f1_score:
0.9095 - val_loss: 1.4212 - val_f1_score: 0.7073
Epoch 480/500
28/28 [==============================] - 3s 95ms/step - loss: 0.3129 - f1_score:
0.9080 - val_loss: 1.4840 - val_f1_score: 0.6729
Epoch 481/500
28/28 [==============================] - 3s 93ms/step - loss: 0.3176 - f1_score:
0.9128 - val_loss: 1.3904 - val_f1_score: 0.6846
Epoch 482/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3037 - f1_score:
0.9122 - val_loss: 1.4006 - val_f1_score: 0.6901
Epoch 483/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3058 - f1_score:
0.9154 - val_loss: 1.3425 - val_f1_score: 0.7012
Epoch 484/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3040 - f1_score:
0.9149 - val_loss: 1.3314 - val_f1_score: 0.7107
Epoch 485/500
28/28 [==============================] - 2s 89ms/step - loss: 0.3261 - f1_score:
0.9057 - val_loss: 1.5289 - val_f1_score: 0.6689
Epoch 486/500
28/28 [==============================] - 3s 108ms/step - loss: 0.3046 -
f1_score: 0.9178 - val_loss: 1.3875 - val_f1_score: 0.6894
Epoch 487/500
28/28 [==============================] - 2s 85ms/step - loss: 0.3174 - f1_score:
0.9041 - val_loss: 1.3922 - val_f1_score: 0.6929
Epoch 488/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2935 - f1_score:
0.9196 - val_loss: 1.3583 - val_f1_score: 0.7233
Epoch 489/500
28/28 [==============================] - 2s 85ms/step - loss: 0.2783 - f1_score:
0.9175 - val_loss: 1.3809 - val_f1_score: 0.7056
Epoch 490/500
28/28 [==============================] - 3s 94ms/step - loss: 0.2805 - f1_score:
0.9191 - val_loss: 1.4169 - val_f1_score: 0.7026
Epoch 491/500
28/28 [==============================] - 3s 90ms/step - loss: 0.3031 - f1_score:
0.9093 - val_loss: 1.3629 - val_f1_score: 0.7135
```

```
Epoch 492/500
28/28 [==============================] - 2s 84ms/step - loss: 0.2822 - f1_score:
0.9188 - val_loss: 1.4388 - val_f1_score: 0.6929
Epoch 493/500
28/28 [==============================] - 2s 86ms/step - loss: 0.3310 - f1_score:
0.9035 - val_loss: 1.4295 - val_f1_score: 0.6822
Epoch 494/500
28/28 [==============================] - 2s 87ms/step - loss: 0.3114 - f1_score:
0.9072 - val_loss: 1.4048 - val_f1_score: 0.6966
Epoch 495/500
28/28 [==============================] - 2s 84ms/step - loss: 0.3505 - f1_score:
0.9005 - val_loss: 1.4378 - val_f1_score: 0.6727
Epoch 496/500
28/28 [==============================] - 2s 83ms/step - loss: 0.2951 - f1_score:
0.9118 - val_loss: 1.4117 - val_f1_score: 0.7005
Epoch 497/500
28/28 [==============================] - 3s 90ms/step - loss: 0.2974 - f1_score:
0.9157 - val_loss: 1.3666 - val_f1_score: 0.6900
Epoch 498/500
28/28 [==============================] - 3s 91ms/step - loss: 0.2884 - f1_score:
0.9114 - val_loss: 1.3629 - val_f1_score: 0.6838
Epoch 499/500
28/28 [==============================] - 2s 89ms/step - loss: 0.2723 - f1_score:
0.9202 - val_loss: 1.3717 - val_f1_score: 0.7006
Epoch 500/500
28/28 [==============================] - 2s 89ms/step - loss: 0.2837 - f1_score:
0.9189 - val_loss: 1.5196 - val_f1_score: 0.6777
```

[125]:
```python
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 14ms/step
              precision    recall  f1-score   support

         AXE      0.889     1.000     0.941         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.833     1.000     0.909        10
         BEE      0.571     0.400     0.471        10
        BELT      1.000     1.000     1.000         4
        BITE      0.667     0.500     0.571         8
   BREAKFAST      0.273     0.500     0.353         6
      CANCER      0.750     0.750     0.750         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.600     1.000     0.750         6
        DARK      0.667     1.000     0.800         4
```

```
        DEAF      0.222     0.333     0.267         6
      DECIDE      1.000     0.667     0.800         6
      DEMAND      1.000     0.375     0.545         8
     DEVELOP      0.364     0.667     0.471         6
      DINNER      1.000     1.000     1.000         8
         DOG      0.800     0.667     0.727         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.571     1.000     0.727         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.714     0.833     0.769         6
    ELEVATOR      0.667     0.750     0.706         8
        FINE      0.667     0.500     0.571         4
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      0.625     0.833     0.714         6
       GUESS      0.800     1.000     0.889         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.667     0.800         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.667     0.500     0.571         4
        LOCK      1.000     0.750     0.857         8
       LUNCH      0.667     0.500     0.571         8
       MAPLE      0.571     1.000     0.727         4
        MEAT      0.714     0.833     0.769         6
    MECHANIC      0.800     1.000     0.889         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.545     0.750     0.632         8
        NOON      0.889     1.000     0.941         8
       PARTY      1.000     0.625     0.769         8
     PATIENT      0.000     0.000     0.000         6
       RAZOR      0.500     0.250     0.333         4
       RIVER      0.400     0.667     0.500         6
ROCKINGCHAIR      0.800     1.000     0.889         8
       SHAVE      0.667     0.600     0.632        10
        SINK      0.000     0.000     0.000         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      0.800     1.000     0.889         4
       TWINS      0.357     0.625     0.455         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.704       324
   macro avg      0.713     0.698     0.678       324
weighted avg      0.728     0.704     0.689       324

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
```

```
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

[126]:
```
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

# or save to csv:
hist_csv_file = '2 1DCNN + 1 LSTM Trial 715/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[127]:
```
hist_df = pd.read_csv('2 1DCNN + 1 LSTM Trial 715/history.csv', index_col=0)
hist_df.tail()
```

[127]:

	loss	f1_score	val_loss	val_f1_score
495	0.295059	0.911833	1.411746	0.700502
496	0.297430	0.915664	1.366644	0.689992
497	0.288362	0.911373	1.362883	0.683763
498	0.272276	0.920230	1.371670	0.700623
499	0.283748	0.918867	1.519600	0.677741

[128]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
```

```
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[129]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
```

```
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')

plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[130]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 LSTM Trial 715")
```

[131]:
```
reconstructed_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d (Conv1D)             (None, 125, 150)          359250

 max_pooling1d (MaxPooling1D  (None, 12, 150)          0
 )

 conv1d_1 (Conv1D)           (None, 10, 150)           67650

 max_pooling1d_1 (MaxPooling  (None, 10, 150)          0
 1D)

 dropout (Dropout)           (None, 10, 150)           0

 lstm (LSTM)                 (None, 75)                67800

 dropout_1 (Dropout)         (None, 75)                0

 dense (Dense)               (None, 110)               8360

 dense_1 (Dense)             (None, 50)                5550

=================================================================
Total params: 508,610
Trainable params: 508,610
Non-trainable params: 0
_________________________________________________________________
```

[132]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[132]:

InputLayer
input: [(None, 130, 399)]
output: [(None, 130, 399)]
Conv1D
input: (None, 130, 399)
output: (None, 125, 150)
MaxPooling1D
input: (None, 125, 150)
output: (None, 12, 150)
Conv1D
input: (None, 12, 150)
output: (None, 10, 150)
MaxPooling1D
input: (None, 10, 150)
output: (None, 10, 150)
Dropout
input: (None, 10, 150)
output: (None, 10, 150)
LSTM
input: (None, 10, 150)
output: (None, 75)
Dropout
input: (None, 75)
output: (None, 75)
Dense
input: (None, 75)
output: (None, 110)
Dense
input: (None, 110)
output: (None, 50)

[133]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[133]:

Conv1D
MaxPooling1D
Dropout
LSTM
Dense

[134]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 11ms/step - loss: 1.3636 - f1_score:
0.7306
```

[134]:
```
[1.363629698753357, 0.7305694818496704]
```

[135]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 13ms/step - loss: 0.0999 - f1_score:
0.9849
```

[135]:
```
[0.09994740784168243, 0.9849286675453186]
```

[136]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 9ms/step
              precision    recall  f1-score   support

         AXE      0.889     1.000     0.941         8
    BACKPACK      0.750     1.000     0.857         6
  BASKETBALL      0.714     1.000     0.833        10
         BEE      0.625     0.500     0.556        10
        BELT      0.800     1.000     0.889         4
        BITE      1.000     0.625     0.769         8
   BREAKFAST      0.500     0.500     0.500         6
      CANCER      1.000     0.750     0.857         8
   CHRISTMAS      1.000     1.000     1.000         6
    CONFUSED      0.667     1.000     0.800         6
        DARK      0.667     1.000     0.800         4
        DEAF      0.500     0.333     0.400         6
      DECIDE      0.800     0.667     0.727         6
      DEMAND      1.000     0.750     0.857         8
     DEVELOP      0.500     1.000     0.667         6
      DINNER      1.000     0.875     0.933         8
         DOG      0.667     0.667     0.667         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      0.600     0.750     0.667         4
         EAT      0.857     1.000     0.923         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      1.000     0.625     0.769         8
        FINE      1.000     0.500     0.667         4
```

```
       FLOAT      0.667     0.500     0.571         4
   FOREIGNER      0.714     0.833     0.769         6
       GUESS      0.800     1.000     0.889         8
   HALLOWEEN      1.000     1.000     1.000         8
    HOSPITAL      1.000     0.667     0.800         6
 HURDLE/TRIP      0.000     0.000     0.000         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      1.000     0.750     0.857         8
       LUNCH      0.667     0.750     0.706         8
       MAPLE      0.571     1.000     0.727         4
        MEAT      0.667     1.000     0.800         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.250     0.400         8
       MOVIE      0.545     0.750     0.632         8
        NOON      0.889     1.000     0.941         8
       PARTY      1.000     0.500     0.667         8
     PATIENT      0.400     0.333     0.364         6
       RAZOR      0.667     0.500     0.571         4
       RIVER      0.400     0.667     0.500         6
ROCKINGCHAIR      0.889     1.000     0.941         8
       SHAVE      0.727     0.800     0.762        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      1.000     0.500     0.667         4
        THEY      1.000     1.000     1.000         4
       TWINS      0.429     0.750     0.545         8
     WHATFOR      1.000     0.600     0.750        10

    accuracy                          0.750       324
   macro avg      0.778     0.740     0.731       324
weighted avg      0.793     0.750     0.743       324
```

[142]:
```
model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 LSTM Trial 715 Mish/',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

[143]:
```
act_function = mish
model = Sequential()
model.add(
    Conv1D(filters=150,
           kernel_size=5,
           activation=act_function,
           input_shape=(130, 126)))
model.add(MaxPooling1D(pool_size=3))
```

```
model.add(Conv1D(filters=100, kernel_size=4, activation=act_function))
model.add(MaxPooling1D(pool_size=3))
model.add(Dropout(.45))
model.add(
    GRU(units=150,
        return_sequences=False,
        kernel_regularizer=regularizers.l2(.00042286793942433336)))
model.add(Dropout(.8))
model.add(Dense(units=80, activation=act_function))
model.add(Dense(50, activation='softmax'))

model.compile(tf.optimizers.experimental.Nadam(.0019929796667454143),
              loss='categorical_crossentropy',
              metrics=[tfa.metrics.F1Score(num_classes=50, average='macro')])
model.summary()
History = model.fit(x=Xtrain,
                    y=Ytrain,
                    validation_data=(Xval, Yval),
                    batch_size=96,
                    epochs=500,
                    verbose=1,
                    callbacks=[model_checkpoint_callback])
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_4 (Conv1D)           (None, 126, 150)          94650

 max_pooling1d_4 (MaxPooling  (None, 42, 150)          0
 1D)

 conv1d_5 (Conv1D)           (None, 39, 100)           60100

 max_pooling1d_5 (MaxPooling  (None, 13, 100)          0
 1D)

 dropout_4 (Dropout)         (None, 13, 100)           0

 gru_2 (GRU)                 (None, 150)               113400

 dropout_5 (Dropout)         (None, 150)               0

 dense_4 (Dense)             (None, 80)                12080

 dense_5 (Dense)             (None, 50)                4050

=================================================================
```

```
Total params: 284,280
Trainable params: 284,280
Non-trainable params: 0
_________________________________________________________________
Epoch 1/500
27/28 [============================>..] - ETA: 0s - loss: 3.9685 - f1_score:
0.0173

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 16s 393ms/step - loss: 3.9667 -
f1_score: 0.0172 - val_loss: 3.8607 - val_f1_score: 0.0141
Epoch 2/500
27/28 [============================>..] - ETA: 0s - loss: 3.7361 - f1_score:
0.0426

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 302ms/step - loss: 3.7312 -
f1_score: 0.0433 - val_loss: 3.3516 - val_f1_score: 0.0401
Epoch 3/500
27/28 [============================>..] - ETA: 0s - loss: 3.3184 - f1_score:
0.0804

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 316ms/step - loss: 3.3134 -
f1_score: 0.0802 - val_loss: 2.9673 - val_f1_score: 0.1203
Epoch 4/500
27/28 [============================>..] - ETA: 0s - loss: 2.9599 - f1_score:
0.1299
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 287ms/step - loss: 2.9603 -
f1_score: 0.1299 - val_loss: 2.5864 - val_f1_score: 0.1928
Epoch 5/500
27/28 [===========================>..] - ETA: 0s - loss: 2.6673 - f1_score:
0.1869

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 10s 353ms/step - loss: 2.6639 -
f1_score: 0.1888 - val_loss: 2.4057 - val_f1_score: 0.2342
Epoch 6/500
28/28 [==============================] - 1s 38ms/step - loss: 2.4485 - f1_score:
0.2398 - val_loss: 2.4523 - val_f1_score: 0.2228
Epoch 7/500
27/28 [===========================>..] - ETA: 0s - loss: 2.2810 - f1_score:
0.2762

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 10s 365ms/step - loss: 2.2877 -
f1_score: 0.2757 - val_loss: 2.1469 - val_f1_score: 0.3372
Epoch 8/500
27/28 [===========================>..] - ETA: 0s - loss: 2.1416 - f1_score:
0.3087

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets
```

```
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 278ms/step - loss: 2.1425 -
f1_score: 0.3100 - val_loss: 2.0119 - val_f1_score: 0.3734
Epoch 9/500
27/28 [===========================>..] - ETA: 0s - loss: 2.0281 - f1_score:
0.3592

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 306ms/step - loss: 2.0177 -
f1_score: 0.3637 - val_loss: 1.8961 - val_f1_score: 0.4063
Epoch 10/500
27/28 [===========================>..] - ETA: 0s - loss: 1.9076 - f1_score:
0.3781

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 299ms/step - loss: 1.9047 -
f1_score: 0.3801 - val_loss: 1.8452 - val_f1_score: 0.4213
Epoch 11/500
27/28 [===========================>..] - ETA: 0s - loss: 1.7888 - f1_score:
0.4269

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 296ms/step - loss: 1.7919 -
f1_score: 0.4251 - val_loss: 1.7583 - val_f1_score: 0.4348
Epoch 12/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6956 - f1_score:
0.4384

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
```

```
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 306ms/step - loss: 1.6909 -
f1_score: 0.4396 - val_loss: 1.7644 - val_f1_score: 0.4443
Epoch 13/500
27/28 [===========================>..] - ETA: 0s - loss: 1.6276 - f1_score:
0.4761

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 330ms/step - loss: 1.6308 -
f1_score: 0.4757 - val_loss: 1.8618 - val_f1_score: 0.4454
Epoch 14/500
27/28 [===========================>..] - ETA: 0s - loss: 1.5693 - f1_score:
0.4970

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 305ms/step - loss: 1.5655 -
f1_score: 0.4973 - val_loss: 1.6262 - val_f1_score: 0.5272
Epoch 15/500
27/28 [===========================>..] - ETA: 0s - loss: 1.4783 - f1_score:
0.5471

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 292ms/step - loss: 1.4755 -
f1_score: 0.5462 - val_loss: 1.5496 - val_f1_score: 0.5610
Epoch 16/500
```

```
28/28 [==============================] - 1s 38ms/step - loss: 1.4444 - f1_score:
0.5465 - val_loss: 1.4769 - val_f1_score: 0.5580
Epoch 17/500
27/28 [===========================>..] - ETA: 0s - loss: 1.3217 - f1_score:
0.5702

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 304ms/step - loss: 1.3279 -
f1_score: 0.5694 - val_loss: 1.5161 - val_f1_score: 0.5745
Epoch 18/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2945 - f1_score:
0.5831

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 310ms/step - loss: 1.2985 -
f1_score: 0.5821 - val_loss: 1.5370 - val_f1_score: 0.6069
Epoch 19/500
28/28 [==============================] - 1s 38ms/step - loss: 1.2852 - f1_score:
0.5878 - val_loss: 1.4281 - val_f1_score: 0.6045
Epoch 20/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2173 - f1_score:
0.6180

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 283ms/step - loss: 1.2179 -
f1_score: 0.6184 - val_loss: 1.3851 - val_f1_score: 0.6276
Epoch 21/500
27/28 [===========================>..] - ETA: 0s - loss: 1.2130 - f1_score:
0.6124
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 282ms/step - loss: 1.2190 -
f1_score: 0.6137 - val_loss: 1.2672 - val_f1_score: 0.6686
Epoch 22/500
28/28 [==============================] - 1s 38ms/step - loss: 1.1470 - f1_score:
0.6439 - val_loss: 1.3689 - val_f1_score: 0.6425
Epoch 23/500
28/28 [==============================] - 1s 38ms/step - loss: 1.0645 - f1_score:
0.6726 - val_loss: 1.4077 - val_f1_score: 0.6420
Epoch 24/500
28/28 [==============================] - 1s 38ms/step - loss: 1.0290 - f1_score:
0.6716 - val_loss: 1.4038 - val_f1_score: 0.6378
Epoch 25/500
27/28 [===========================>..] - ETA: 0s - loss: 1.0354 - f1_score:
0.6777

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 330ms/step - loss: 1.0409 -
f1_score: 0.6763 - val_loss: 1.3490 - val_f1_score: 0.7047
Epoch 26/500
28/28 [==============================] - 1s 38ms/step - loss: 1.0103 - f1_score:
0.6855 - val_loss: 1.3758 - val_f1_score: 0.6790
Epoch 27/500
28/28 [==============================] - 1s 38ms/step - loss: 0.9848 - f1_score:
0.6917 - val_loss: 1.4690 - val_f1_score: 0.6577
Epoch 28/500
28/28 [==============================] - 1s 38ms/step - loss: 0.9359 - f1_score:
0.7218 - val_loss: 1.2835 - val_f1_score: 0.6766
Epoch 29/500
28/28 [==============================] - 1s 38ms/step - loss: 0.8999 - f1_score:
0.7260 - val_loss: 1.2871 - val_f1_score: 0.6809
Epoch 30/500
28/28 [==============================] - 1s 38ms/step - loss: 0.8965 - f1_score:
0.7249 - val_loss: 1.2039 - val_f1_score: 0.6934
Epoch 31/500
```

```
28/28 [==============================] - 1s 38ms/step - loss: 0.9033 - f1_score:
0.7138 - val_loss: 1.4615 - val_f1_score: 0.6660
Epoch 32/500
28/28 [==============================] - 1s 38ms/step - loss: 0.8628 - f1_score:
0.7397 - val_loss: 1.3793 - val_f1_score: 0.6746
Epoch 33/500
28/28 [==============================] - 1s 38ms/step - loss: 0.8719 - f1_score:
0.7307 - val_loss: 1.4074 - val_f1_score: 0.6479
Epoch 34/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8167 - f1_score:
0.7565

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 284ms/step - loss: 0.8174 -
f1_score: 0.7546 - val_loss: 1.2110 - val_f1_score: 0.7237
Epoch 35/500
28/28 [==============================] - 1s 38ms/step - loss: 0.8303 - f1_score:
0.7514 - val_loss: 1.2921 - val_f1_score: 0.7181
Epoch 36/500
28/28 [==============================] - 1s 40ms/step - loss: 0.8294 - f1_score:
0.7597 - val_loss: 1.2224 - val_f1_score: 0.7006
Epoch 37/500
27/28 [===========================>..] - ETA: 0s - loss: 0.8137 - f1_score:
0.7575

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 315ms/step - loss: 0.8050 -
f1_score: 0.7603 - val_loss: 1.2252 - val_f1_score: 0.7297
Epoch 38/500
28/28 [==============================] - 1s 38ms/step - loss: 0.7157 - f1_score:
0.7861 - val_loss: 1.3177 - val_f1_score: 0.6965
Epoch 39/500
28/28 [==============================] - 1s 38ms/step - loss: 0.7033 - f1_score:
0.7997 - val_loss: 1.2801 - val_f1_score: 0.6963
Epoch 40/500
28/28 [==============================] - 1s 38ms/step - loss: 0.7124 - f1_score:
```

```
0.7809 - val_loss: 1.2912 - val_f1_score: 0.7022
Epoch 41/500
27/28 [==========================>..] - ETA: 0s - loss: 0.7062 - f1_score:
0.7906

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 290ms/step - loss: 0.7047 -
f1_score: 0.7913 - val_loss: 1.2573 - val_f1_score: 0.7314
Epoch 42/500
28/28 [==============================] - 1s 38ms/step - loss: 0.6807 - f1_score:
0.7985 - val_loss: 1.3909 - val_f1_score: 0.6925
Epoch 43/500
27/28 [==========================>..] - ETA: 0s - loss: 0.6624 - f1_score:
0.8067

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 314ms/step - loss: 0.6617 -
f1_score: 0.8074 - val_loss: 1.3076 - val_f1_score: 0.7417
Epoch 44/500
28/28 [==============================] - 1s 38ms/step - loss: 0.6426 - f1_score:
0.8186 - val_loss: 1.2638 - val_f1_score: 0.7152
Epoch 45/500
27/28 [==========================>..] - ETA: 0s - loss: 0.6595 - f1_score:
0.8067

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 320ms/step - loss: 0.6617 -
f1_score: 0.8073 - val_loss: 1.1966 - val_f1_score: 0.7534
Epoch 46/500
28/28 [==============================] - 1s 38ms/step - loss: 0.6622 - f1_score:
```

```
0.8199 - val_loss: 1.3031 - val_f1_score: 0.7242
Epoch 47/500
27/28 [==========================>..] - ETA: 0s - loss: 0.6536 - f1_score:
0.8083

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 303ms/step - loss: 0.6538 -
f1_score: 0.8080 - val_loss: 1.2127 - val_f1_score: 0.7642
Epoch 48/500
27/28 [==========================>..] - ETA: 0s - loss: 0.6251 - f1_score:
0.8191

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 340ms/step - loss: 0.6254 -
f1_score: 0.8205 - val_loss: 1.1647 - val_f1_score: 0.7687
Epoch 49/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5900 - f1_score:
0.8253 - val_loss: 1.1282 - val_f1_score: 0.7619
Epoch 50/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5942 - f1_score:
0.8320 - val_loss: 1.3222 - val_f1_score: 0.7546
Epoch 51/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5728 - f1_score:
0.8395 - val_loss: 1.2784 - val_f1_score: 0.7537
Epoch 52/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5521 - f1_score:
0.8477 - val_loss: 1.2723 - val_f1_score: 0.7475
Epoch 53/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5369 - f1_score:
0.8532 - val_loss: 1.4468 - val_f1_score: 0.7328
Epoch 54/500
28/28 [==============================] - 1s 40ms/step - loss: 0.5949 - f1_score:
0.8333 - val_loss: 1.5265 - val_f1_score: 0.7164
Epoch 55/500
28/28 [==============================] - 1s 38ms/step - loss: 0.6279 - f1_score:
0.8287 - val_loss: 1.3086 - val_f1_score: 0.7446
```

```
Epoch 56/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5962 - f1_score:
0.8414 - val_loss: 1.3426 - val_f1_score: 0.7595
Epoch 57/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5255 - f1_score:
0.8526 - val_loss: 1.3306 - val_f1_score: 0.7628
Epoch 58/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5383 - f1_score:
0.8593 - val_loss: 1.3607 - val_f1_score: 0.7598
Epoch 59/500
28/28 [==============================] - 1s 39ms/step - loss: 0.5606 - f1_score:
0.8519 - val_loss: 1.3873 - val_f1_score: 0.7580
Epoch 60/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5243 - f1_score:
0.8641 - val_loss: 1.4478 - val_f1_score: 0.7535
Epoch 61/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4953 - f1_score:
0.8661 - val_loss: 1.4229 - val_f1_score: 0.7430
Epoch 62/500
27/28 [===========================>..] - ETA: 0s - loss: 0.5093 - f1_score:
0.8683

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 307ms/step - loss: 0.5069 -
f1_score: 0.8696 - val_loss: 1.2423 - val_f1_score: 0.7856
Epoch 63/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4884 - f1_score:
0.8732 - val_loss: 1.3165 - val_f1_score: 0.7761
Epoch 64/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4702 - f1_score:
0.8757 - val_loss: 1.4028 - val_f1_score: 0.7699
Epoch 65/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5113 - f1_score:
0.8732 - val_loss: 1.2855 - val_f1_score: 0.7503
Epoch 66/500
28/28 [==============================] - 1s 38ms/step - loss: 0.5086 - f1_score:
0.8696 - val_loss: 1.3848 - val_f1_score: 0.7590
Epoch 67/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4775 - f1_score:
0.8754 - val_loss: 1.3450 - val_f1_score: 0.7756
Epoch 68/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4754 - f1_score:
```

```
0.8743 - val_loss: 1.3393 - val_f1_score: 0.7716
Epoch 69/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4991 - f1_score:
0.8746 - val_loss: 1.4702 - val_f1_score: 0.7568
Epoch 70/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4823 - f1_score:
0.8735

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 277ms/step - loss: 0.4828 -
f1_score: 0.8730 - val_loss: 1.2616 - val_f1_score: 0.7975
Epoch 71/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4476 - f1_score:
0.8826 - val_loss: 1.3496 - val_f1_score: 0.7769
Epoch 72/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4624 - f1_score:
0.8811 - val_loss: 1.4625 - val_f1_score: 0.7400
Epoch 73/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4539 - f1_score:
0.8810 - val_loss: 1.4245 - val_f1_score: 0.7796
Epoch 74/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3916 - f1_score:
0.8947 - val_loss: 1.4351 - val_f1_score: 0.7735
Epoch 75/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4319 - f1_score:
0.8911

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 10s 354ms/step - loss: 0.4295 -
f1_score: 0.8918 - val_loss: 1.2109 - val_f1_score: 0.8030
Epoch 76/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4448 - f1_score:
0.8869 - val_loss: 1.3074 - val_f1_score: 0.7850
Epoch 77/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4289 - f1_score:
0.8902 - val_loss: 1.2743 - val_f1_score: 0.7701
```

```
Epoch 78/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4196 - f1_score:
0.8935 - val_loss: 1.4083 - val_f1_score: 0.7783
Epoch 79/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4741 - f1_score:
0.8807 - val_loss: 1.3937 - val_f1_score: 0.7936
Epoch 80/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4693 - f1_score:
0.8827 - val_loss: 1.3758 - val_f1_score: 0.7986
Epoch 81/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4861 - f1_score:
0.8691 - val_loss: 1.3154 - val_f1_score: 0.7725
Epoch 82/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4228 - f1_score:
0.8913 - val_loss: 1.1841 - val_f1_score: 0.7864
Epoch 83/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4018 - f1_score:
0.9048 - val_loss: 1.2760 - val_f1_score: 0.7904
Epoch 84/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4047 - f1_score:
0.9019

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 292ms/step - loss: 0.4051 -
f1_score: 0.9021 - val_loss: 1.2125 - val_f1_score: 0.8054
Epoch 85/500
27/28 [===========================>..] - ETA: 0s - loss: 0.4367 - f1_score:
0.8896

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 308ms/step - loss: 0.4366 -
f1_score: 0.8888 - val_loss: 1.2861 - val_f1_score: 0.8080
Epoch 86/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4541 - f1_score:
0.8931 - val_loss: 1.4048 - val_f1_score: 0.7896
Epoch 87/500
```

```
28/28 [==============================] - 1s 38ms/step - loss: 0.4424 - f1_score:
0.8865 - val_loss: 1.2911 - val_f1_score: 0.7939
Epoch 88/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4577 - f1_score:
0.8921 - val_loss: 1.4341 - val_f1_score: 0.7795
Epoch 89/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4323 - f1_score:
0.8912 - val_loss: 1.4458 - val_f1_score: 0.7512
Epoch 90/500
28/28 [==============================] - 1s 38ms/step - loss: 0.3862 - f1_score:
0.9046 - val_loss: 1.4521 - val_f1_score: 0.7835
Epoch 91/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4301 - f1_score:
0.8951 - val_loss: 1.3661 - val_f1_score: 0.7832
Epoch 92/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4053 - f1_score:
0.9007 - val_loss: 1.1693 - val_f1_score: 0.8036
Epoch 93/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4418 - f1_score:
0.9021 - val_loss: 1.4699 - val_f1_score: 0.7525
Epoch 94/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4225 - f1_score:
0.8985 - val_loss: 1.2938 - val_f1_score: 0.7879
Epoch 95/500
28/28 [==============================] - 1s 38ms/step - loss: 0.4205 - f1_score:
0.8990 - val_loss: 1.5778 - val_f1_score: 0.7493
Epoch 96/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4716 - f1_score:
0.8791 - val_loss: 1.3936 - val_f1_score: 0.7806
Epoch 97/500
28/28 [==============================] - 1s 38ms/step - loss: 0.3760 - f1_score:
0.9076 - val_loss: 1.4170 - val_f1_score: 0.7885
Epoch 98/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3525 - f1_score:
0.9114 - val_loss: 1.5979 - val_f1_score: 0.7643
Epoch 99/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3793 - f1_score:
0.9126 - val_loss: 1.3130 - val_f1_score: 0.7906
Epoch 100/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3549 - f1_score:
0.9176 - val_loss: 1.4948 - val_f1_score: 0.7844
Epoch 101/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4045 - f1_score:
0.8988 - val_loss: 1.6399 - val_f1_score: 0.7600
Epoch 102/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3880 - f1_score:
0.9077 - val_loss: 1.3830 - val_f1_score: 0.7956
Epoch 103/500
```

```
28/28 [==============================] - 1s 39ms/step - loss: 0.3617 - f1_score:
0.9192 - val_loss: 1.4584 - val_f1_score: 0.7920
Epoch 104/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3078 - f1_score:
0.9320 - val_loss: 1.4737 - val_f1_score: 0.7874
Epoch 105/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3345 - f1_score:
0.9205 - val_loss: 1.4000 - val_f1_score: 0.7910
Epoch 106/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3677 - f1_score:
0.9214 - val_loss: 1.5511 - val_f1_score: 0.7784
Epoch 107/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4094 - f1_score:
0.9045 - val_loss: 1.7381 - val_f1_score: 0.7675
Epoch 108/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3649 - f1_score:
0.9122 - val_loss: 1.6739 - val_f1_score: 0.7721
Epoch 109/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3619 - f1_score:
0.9137 - val_loss: 1.5227 - val_f1_score: 0.7690
Epoch 110/500
27/28 [============================>..] - ETA: 0s - loss: 0.4092 - f1_score:
0.9059

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 10s 355ms/step - loss: 0.4018 -
f1_score: 0.9080 - val_loss: 1.4065 - val_f1_score: 0.8127
Epoch 111/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3813 - f1_score:
0.9143 - val_loss: 1.4458 - val_f1_score: 0.7976
Epoch 112/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3979 - f1_score:
0.9090 - val_loss: 1.5291 - val_f1_score: 0.7805
Epoch 113/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3954 - f1_score:
0.9087 - val_loss: 1.4778 - val_f1_score: 0.7706
Epoch 114/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3852 - f1_score:
0.9093 - val_loss: 1.5232 - val_f1_score: 0.7886
Epoch 115/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4268 - f1_score:
0.8951 - val_loss: 1.3973 - val_f1_score: 0.8067
```

```
Epoch 116/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3486 - f1_score:
0.9218 - val_loss: 1.2990 - val_f1_score: 0.8106
Epoch 117/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3470 - f1_score:
0.9164 - val_loss: 1.3904 - val_f1_score: 0.8046
Epoch 118/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3169 - f1_score:
0.9316 - val_loss: 1.4484 - val_f1_score: 0.7895
Epoch 119/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3192 - f1_score:
0.9321 - val_loss: 1.3120 - val_f1_score: 0.7883
Epoch 120/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3388 - f1_score:
0.9267 - val_loss: 1.4721 - val_f1_score: 0.7815
Epoch 121/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3502 - f1_score:
0.9211 - val_loss: 1.4492 - val_f1_score: 0.7896
Epoch 122/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3612 - f1_score:
0.9159 - val_loss: 1.4128 - val_f1_score: 0.7939
Epoch 123/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3245 - f1_score:
0.9272 - val_loss: 1.4874 - val_f1_score: 0.7988
Epoch 124/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3406 - f1_score:
0.9219 - val_loss: 1.5364 - val_f1_score: 0.8116
Epoch 125/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4042 - f1_score:
0.9111 - val_loss: 1.5409 - val_f1_score: 0.7783
Epoch 126/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4001 - f1_score:
0.9096 - val_loss: 1.4403 - val_f1_score: 0.7881
Epoch 127/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3984 - f1_score:
0.9132 - val_loss: 1.5370 - val_f1_score: 0.7862
Epoch 128/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3234 - f1_score:
0.9309 - val_loss: 1.5378 - val_f1_score: 0.7849
Epoch 129/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3023 - f1_score:
0.9304 - val_loss: 1.5184 - val_f1_score: 0.7869
Epoch 130/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3774 - f1_score:
0.9156 - val_loss: 1.6773 - val_f1_score: 0.7761
Epoch 131/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4095 - f1_score:
0.9035 - val_loss: 1.5540 - val_f1_score: 0.7805
```

```
Epoch 132/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3643 - f1_score:
0.9189 - val_loss: 1.5917 - val_f1_score: 0.7840
Epoch 133/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3757 - f1_score:
0.9195 - val_loss: 1.6305 - val_f1_score: 0.7584
Epoch 134/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3789 - f1_score:
0.9167 - val_loss: 1.3986 - val_f1_score: 0.7999
Epoch 135/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3636 - f1_score:
0.9174 - val_loss: 1.5652 - val_f1_score: 0.7678
Epoch 136/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3653 - f1_score:
0.9198 - val_loss: 1.5317 - val_f1_score: 0.7852
Epoch 137/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3866 - f1_score:
0.9144 - val_loss: 1.6338 - val_f1_score: 0.7763
Epoch 138/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3908 - f1_score:
0.9072 - val_loss: 1.5041 - val_f1_score: 0.7800
Epoch 139/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3862 - f1_score:
0.9162 - val_loss: 1.4848 - val_f1_score: 0.7866
Epoch 140/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3434 - f1_score:
0.9313 - val_loss: 1.2454 - val_f1_score: 0.8010
Epoch 141/500
28/28 [==============================] - 1s 44ms/step - loss: 0.3379 - f1_score:
0.9185 - val_loss: 1.3273 - val_f1_score: 0.7921
Epoch 142/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3278 - f1_score:
0.9335 - val_loss: 1.4422 - val_f1_score: 0.7787
Epoch 143/500
27/28 [============================>..] - ETA: 0s - loss: 0.3208 - f1_score:
0.9386

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
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INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 8s 308ms/step - loss: 0.3205 -
f1_score: 0.9379 - val_loss: 1.2689 - val_f1_score: 0.8406
Epoch 144/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3410 - f1_score:
```

```
0.9286 - val_loss: 1.4219 - val_f1_score: 0.7808
Epoch 145/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3155 - f1_score:
0.9325 - val_loss: 1.3326 - val_f1_score: 0.7909
Epoch 146/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2974 - f1_score:
0.9390 - val_loss: 1.3369 - val_f1_score: 0.8048
Epoch 147/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3200 - f1_score:
0.9370 - val_loss: 1.3570 - val_f1_score: 0.8323
Epoch 148/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3099 - f1_score:
0.9325 - val_loss: 1.3147 - val_f1_score: 0.7869
Epoch 149/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3270 - f1_score:
0.9264 - val_loss: 1.2507 - val_f1_score: 0.8189
Epoch 150/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3028 - f1_score:
0.9309 - val_loss: 1.3471 - val_f1_score: 0.8038
Epoch 151/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3613 - f1_score:
0.9206 - val_loss: 1.5151 - val_f1_score: 0.7913
Epoch 152/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3288 - f1_score:
0.9276 - val_loss: 1.5527 - val_f1_score: 0.7901
Epoch 153/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3848 - f1_score:
0.9155 - val_loss: 1.5866 - val_f1_score: 0.7688
Epoch 154/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3870 - f1_score:
0.9169 - val_loss: 1.4476 - val_f1_score: 0.7822
Epoch 155/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3249 - f1_score:
0.9297 - val_loss: 1.5265 - val_f1_score: 0.7781
Epoch 156/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3338 - f1_score:
0.9348 - val_loss: 1.5625 - val_f1_score: 0.7866
Epoch 157/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4379 - f1_score:
0.9024 - val_loss: 1.5488 - val_f1_score: 0.7833
Epoch 158/500
28/28 [==============================] - 1s 39ms/step - loss: 0.4481 - f1_score:
0.8996 - val_loss: 1.4300 - val_f1_score: 0.7959
Epoch 159/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3593 - f1_score:
0.9273 - val_loss: 1.3723 - val_f1_score: 0.7984
Epoch 160/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2807 - f1_score:
```

```
0.9412 - val_loss: 1.3767 - val_f1_score: 0.7995
Epoch 161/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2884 - f1_score:
0.9404 - val_loss: 1.5211 - val_f1_score: 0.7848
Epoch 162/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3145 - f1_score:
0.9365 - val_loss: 1.3375 - val_f1_score: 0.7950
Epoch 163/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2883 - f1_score:
0.9398 - val_loss: 1.4732 - val_f1_score: 0.7873
Epoch 164/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3131 - f1_score:
0.9358 - val_loss: 1.4415 - val_f1_score: 0.8013
Epoch 165/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3333 - f1_score:
0.9364 - val_loss: 1.3185 - val_f1_score: 0.8239
Epoch 166/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3135 - f1_score:
0.9353 - val_loss: 1.4350 - val_f1_score: 0.8011
Epoch 167/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2974 - f1_score:
0.9362 - val_loss: 1.4768 - val_f1_score: 0.7864
Epoch 168/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2836 - f1_score:
0.9397 - val_loss: 1.3590 - val_f1_score: 0.7985
Epoch 169/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3025 - f1_score:
0.9367 - val_loss: 1.4035 - val_f1_score: 0.8088
Epoch 170/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3079 - f1_score:
0.9333 - val_loss: 1.5433 - val_f1_score: 0.7998
Epoch 171/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3403 - f1_score:
0.9273 - val_loss: 1.6458 - val_f1_score: 0.7727
Epoch 172/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3817 - f1_score:
0.9183 - val_loss: 1.4547 - val_f1_score: 0.8070
Epoch 173/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3294 - f1_score:
0.9318 - val_loss: 1.3368 - val_f1_score: 0.8284
Epoch 174/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3219 - f1_score:
0.9321 - val_loss: 1.5559 - val_f1_score: 0.7855
Epoch 175/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2994 - f1_score:
0.9363 - val_loss: 1.4902 - val_f1_score: 0.7881
Epoch 176/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3479 - f1_score:
```

```
0.9302 - val_loss: 1.4557 - val_f1_score: 0.8170
Epoch 177/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3350 - f1_score:
0.9251 - val_loss: 1.6073 - val_f1_score: 0.7927
Epoch 178/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3320 - f1_score:
0.9354 - val_loss: 1.4503 - val_f1_score: 0.8056
Epoch 179/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3528 - f1_score:
0.9278 - val_loss: 1.4963 - val_f1_score: 0.8054
Epoch 180/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3297 - f1_score:
0.9272 - val_loss: 1.3572 - val_f1_score: 0.8117
Epoch 181/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3105 - f1_score:
0.9336 - val_loss: 1.4847 - val_f1_score: 0.7946
Epoch 182/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3305 - f1_score:
0.9362 - val_loss: 1.6190 - val_f1_score: 0.7828
Epoch 183/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3675 - f1_score:
0.9193 - val_loss: 1.5845 - val_f1_score: 0.8223
Epoch 184/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3463 - f1_score:
0.9274 - val_loss: 1.6209 - val_f1_score: 0.7779
Epoch 185/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3129 - f1_score:
0.9340 - val_loss: 1.5144 - val_f1_score: 0.8153
Epoch 186/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3247 - f1_score:
0.9300 - val_loss: 1.5091 - val_f1_score: 0.8247
Epoch 187/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3345 - f1_score:
0.9306 - val_loss: 1.7830 - val_f1_score: 0.7758
Epoch 188/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3446 - f1_score:
0.9307 - val_loss: 1.5960 - val_f1_score: 0.7817
Epoch 189/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3535 - f1_score:
0.9256 - val_loss: 1.6865 - val_f1_score: 0.7837
Epoch 190/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3428 - f1_score:
0.9270 - val_loss: 1.4729 - val_f1_score: 0.7997
Epoch 191/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3103 - f1_score:
0.9361 - val_loss: 1.6077 - val_f1_score: 0.8139
Epoch 192/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3086 - f1_score:
```

```
0.9365 - val_loss: 1.5082 - val_f1_score: 0.8058
Epoch 193/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3378 - f1_score:
0.9300 - val_loss: 1.6144 - val_f1_score: 0.7849
Epoch 194/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3835 - f1_score:
0.9220 - val_loss: 1.4839 - val_f1_score: 0.7888
Epoch 195/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3642 - f1_score:
0.9204 - val_loss: 1.6407 - val_f1_score: 0.7857
Epoch 196/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3555 - f1_score:
0.9204 - val_loss: 1.5185 - val_f1_score: 0.7949
Epoch 197/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3121 - f1_score:
0.9410 - val_loss: 1.4290 - val_f1_score: 0.7995
Epoch 198/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2760 - f1_score:
0.9416 - val_loss: 1.5504 - val_f1_score: 0.8060
Epoch 199/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3110 - f1_score:
0.9347 - val_loss: 1.5475 - val_f1_score: 0.8057
Epoch 200/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3563 - f1_score:
0.9280 - val_loss: 1.3826 - val_f1_score: 0.8211
Epoch 201/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3084 - f1_score:
0.9374 - val_loss: 1.4495 - val_f1_score: 0.8218
Epoch 202/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3116 - f1_score:
0.9363 - val_loss: 1.4158 - val_f1_score: 0.8383
Epoch 203/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2682 - f1_score:
0.9444 - val_loss: 1.3949 - val_f1_score: 0.8230
Epoch 204/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2683 - f1_score:
0.9547 - val_loss: 1.4956 - val_f1_score: 0.8132
Epoch 205/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2790 - f1_score:
0.9456 - val_loss: 1.5248 - val_f1_score: 0.8048
Epoch 206/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3191 - f1_score:
0.9363 - val_loss: 1.5763 - val_f1_score: 0.8010
Epoch 207/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3537 - f1_score:
0.9295 - val_loss: 1.4661 - val_f1_score: 0.8239
Epoch 208/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3597 - f1_score:
```

```
0.9293 - val_loss: 1.3836 - val_f1_score: 0.8325
Epoch 209/500
27/28 [==========================>..] - ETA: 0s - loss: 0.2891 - f1_score:
0.9448

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

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28/28 [==============================] - 10s 376ms/step - loss: 0.2881 -
f1_score: 0.9446 - val_loss: 1.3258 - val_f1_score: 0.8420
Epoch 210/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3227 - f1_score:
0.9377 - val_loss: 1.2618 - val_f1_score: 0.8348
Epoch 211/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2755 - f1_score:
0.9459 - val_loss: 1.3257 - val_f1_score: 0.8113
Epoch 212/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3465 - f1_score:
0.9330 - val_loss: 1.3949 - val_f1_score: 0.8084
Epoch 213/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2943 - f1_score:
0.9399 - val_loss: 1.3821 - val_f1_score: 0.8172
Epoch 214/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2737 - f1_score:
0.9496 - val_loss: 1.5960 - val_f1_score: 0.7923
Epoch 215/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2224 - f1_score:
0.9596 - val_loss: 1.4672 - val_f1_score: 0.8193
Epoch 216/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2515 - f1_score:
0.9538 - val_loss: 1.4415 - val_f1_score: 0.8114
Epoch 217/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2739 - f1_score:
0.9492 - val_loss: 1.3721 - val_f1_score: 0.8329
Epoch 218/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2712 - f1_score:
0.9484 - val_loss: 1.2790 - val_f1_score: 0.8378
Epoch 219/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3126 - f1_score:
0.9375 - val_loss: 1.3815 - val_f1_score: 0.8175
Epoch 220/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2915 - f1_score:
0.9456 - val_loss: 1.3661 - val_f1_score: 0.8297
Epoch 221/500
```

```
28/28 [==============================] - 1s 43ms/step - loss: 0.2748 - f1_score:
0.9488 - val_loss: 1.6960 - val_f1_score: 0.7958
Epoch 222/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3035 - f1_score:
0.9395 - val_loss: 1.5529 - val_f1_score: 0.8215
Epoch 223/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3270 - f1_score:
0.9364 - val_loss: 1.5136 - val_f1_score: 0.7824
Epoch 224/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3943 - f1_score:
0.9161 - val_loss: 1.5926 - val_f1_score: 0.7826
Epoch 225/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2993 - f1_score:
0.9374 - val_loss: 1.6507 - val_f1_score: 0.7822
Epoch 226/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3150 - f1_score:
0.9358 - val_loss: 1.5499 - val_f1_score: 0.8029
Epoch 227/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3006 - f1_score:
0.9420 - val_loss: 1.4920 - val_f1_score: 0.8254
Epoch 228/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2747 - f1_score:
0.9474 - val_loss: 1.5086 - val_f1_score: 0.8296
Epoch 229/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2978 - f1_score:
0.9395 - val_loss: 1.4707 - val_f1_score: 0.8095
Epoch 230/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2931 - f1_score:
0.9458 - val_loss: 1.4530 - val_f1_score: 0.8177
Epoch 231/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2900 - f1_score:
0.9438 - val_loss: 1.5240 - val_f1_score: 0.8165
Epoch 232/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2890 - f1_score:
0.9449 - val_loss: 1.5154 - val_f1_score: 0.8061
Epoch 233/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2953 - f1_score:
0.9424 - val_loss: 1.4327 - val_f1_score: 0.8070
Epoch 234/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2473 - f1_score:
0.9492 - val_loss: 1.6314 - val_f1_score: 0.8138
Epoch 235/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3086 - f1_score:
0.9362 - val_loss: 1.4565 - val_f1_score: 0.8221
Epoch 236/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3286 - f1_score:
0.9369 - val_loss: 1.6591 - val_f1_score: 0.7919
Epoch 237/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.3292 - f1_score:
0.9355 - val_loss: 1.6282 - val_f1_score: 0.7842
Epoch 238/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3110 - f1_score:
0.9316 - val_loss: 1.5273 - val_f1_score: 0.8217
Epoch 239/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3407 - f1_score:
0.9282 - val_loss: 1.7486 - val_f1_score: 0.7917
Epoch 240/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3203 - f1_score:
0.9331 - val_loss: 1.5243 - val_f1_score: 0.8018
Epoch 241/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3168 - f1_score:
0.9321 - val_loss: 1.5027 - val_f1_score: 0.8089
Epoch 242/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4043 - f1_score:
0.9200 - val_loss: 1.3569 - val_f1_score: 0.8140
Epoch 243/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3423 - f1_score:
0.9353 - val_loss: 1.4531 - val_f1_score: 0.8261
Epoch 244/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3251 - f1_score:
0.9309 - val_loss: 1.3990 - val_f1_score: 0.8250
Epoch 245/500
27/28 [===========================>..] - ETA: 0s - loss: 0.2946 - f1_score:
0.9430

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

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28/28 [==============================] - 10s 355ms/step - loss: 0.2923 -
f1_score: 0.9437 - val_loss: 1.2688 - val_f1_score: 0.8473
Epoch 246/500
27/28 [===========================>..] - ETA: 0s - loss: 0.2543 - f1_score:
0.9548

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets
```

```
28/28 [==============================] - 8s 308ms/step - loss: 0.2536 -
f1_score: 0.9558 - val_loss: 1.4264 - val_f1_score: 0.8482
Epoch 247/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2807 - f1_score:
0.9457 - val_loss: 1.3389 - val_f1_score: 0.8365
Epoch 248/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2305 - f1_score:
0.9575 - val_loss: 1.5210 - val_f1_score: 0.8251
Epoch 249/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2848 - f1_score:
0.9559 - val_loss: 1.5312 - val_f1_score: 0.8237
Epoch 250/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2660 - f1_score:
0.9522 - val_loss: 1.4814 - val_f1_score: 0.8185
Epoch 251/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2575 - f1_score:
0.9507 - val_loss: 1.3259 - val_f1_score: 0.8290
Epoch 252/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2840 - f1_score:
0.9470 - val_loss: 1.4630 - val_f1_score: 0.8256
Epoch 253/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3131 - f1_score:
0.9379 - val_loss: 1.4611 - val_f1_score: 0.8152
Epoch 254/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3550 - f1_score:
0.9278 - val_loss: 1.7530 - val_f1_score: 0.7972
Epoch 255/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3734 - f1_score:
0.9312 - val_loss: 1.6548 - val_f1_score: 0.7957
Epoch 256/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3383 - f1_score:
0.9269 - val_loss: 1.5924 - val_f1_score: 0.8144
Epoch 257/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3505 - f1_score:
0.9304 - val_loss: 1.6122 - val_f1_score: 0.8054
Epoch 258/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3048 - f1_score:
0.9388 - val_loss: 1.4817 - val_f1_score: 0.7947
Epoch 259/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2662 - f1_score:
0.9485 - val_loss: 1.4687 - val_f1_score: 0.8244
Epoch 260/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2410 - f1_score:
0.9560 - val_loss: 1.5328 - val_f1_score: 0.8090
Epoch 261/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2855 - f1_score:
0.9412 - val_loss: 1.5042 - val_f1_score: 0.8154
Epoch 262/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.2755 - f1_score:
0.9439 - val_loss: 1.4955 - val_f1_score: 0.8206
Epoch 263/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2604 - f1_score:
0.9522 - val_loss: 1.3978 - val_f1_score: 0.8117
Epoch 264/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2692 - f1_score:
0.9525 - val_loss: 1.3727 - val_f1_score: 0.8210
Epoch 265/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2843 - f1_score:
0.9418 - val_loss: 1.3937 - val_f1_score: 0.8244
Epoch 266/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3269 - f1_score:
0.9362 - val_loss: 1.6779 - val_f1_score: 0.8070
Epoch 267/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2985 - f1_score:
0.9446 - val_loss: 1.4032 - val_f1_score: 0.8286
Epoch 268/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2780 - f1_score:
0.9491 - val_loss: 1.4698 - val_f1_score: 0.8109
Epoch 269/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3036 - f1_score:
0.9418 - val_loss: 1.6378 - val_f1_score: 0.8060
Epoch 270/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2908 - f1_score:
0.9466 - val_loss: 1.4393 - val_f1_score: 0.8252
Epoch 271/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2969 - f1_score:
0.9442 - val_loss: 1.5309 - val_f1_score: 0.7977
Epoch 272/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3136 - f1_score:
0.9414 - val_loss: 1.3733 - val_f1_score: 0.8218
Epoch 273/500
28/28 [==============================] - 1s 44ms/step - loss: 0.3117 - f1_score:
0.9367 - val_loss: 1.3624 - val_f1_score: 0.8228
Epoch 274/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3715 - f1_score:
0.9244 - val_loss: 1.4718 - val_f1_score: 0.8035
Epoch 275/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3279 - f1_score:
0.9355 - val_loss: 1.5737 - val_f1_score: 0.7950
Epoch 276/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3157 - f1_score:
0.9360 - val_loss: 1.3941 - val_f1_score: 0.8149
Epoch 277/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3493 - f1_score:
0.9355 - val_loss: 1.4273 - val_f1_score: 0.7932
Epoch 278/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.3226 - f1_score:
0.9412 - val_loss: 1.5116 - val_f1_score: 0.8201
Epoch 279/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3941 - f1_score:
0.9220 - val_loss: 1.5679 - val_f1_score: 0.8118
Epoch 280/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4313 - f1_score:
0.9116 - val_loss: 1.5070 - val_f1_score: 0.8106
Epoch 281/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3938 - f1_score:
0.9188 - val_loss: 1.5860 - val_f1_score: 0.7927
Epoch 282/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3376 - f1_score:
0.9367 - val_loss: 1.5597 - val_f1_score: 0.8163
Epoch 283/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3491 - f1_score:
0.9301 - val_loss: 1.5851 - val_f1_score: 0.7976
Epoch 284/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3242 - f1_score:
0.9370 - val_loss: 1.6350 - val_f1_score: 0.7994
Epoch 285/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3869 - f1_score:
0.9266 - val_loss: 1.4558 - val_f1_score: 0.7954
Epoch 286/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3982 - f1_score:
0.9211 - val_loss: 1.3374 - val_f1_score: 0.8068
Epoch 287/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3049 - f1_score:
0.9400 - val_loss: 1.3803 - val_f1_score: 0.8293
Epoch 288/500
28/28 [==============================] - 1s 43ms/step - loss: 0.2931 - f1_score:
0.9428 - val_loss: 1.5628 - val_f1_score: 0.8070
Epoch 289/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3107 - f1_score:
0.9351 - val_loss: 1.4711 - val_f1_score: 0.7820
Epoch 290/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2434 - f1_score:
0.9569 - val_loss: 1.5295 - val_f1_score: 0.8022
Epoch 291/500
28/28 [==============================] - 1s 45ms/step - loss: 0.2664 - f1_score:
0.9509 - val_loss: 1.3786 - val_f1_score: 0.8322
Epoch 292/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3438 - f1_score:
0.9361 - val_loss: 1.6261 - val_f1_score: 0.7851
Epoch 293/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3379 - f1_score:
0.9385 - val_loss: 1.4663 - val_f1_score: 0.8214
Epoch 294/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2747 - f1_score:
0.9537 - val_loss: 1.4823 - val_f1_score: 0.8141
Epoch 295/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2730 - f1_score:
0.9499 - val_loss: 1.4005 - val_f1_score: 0.8136
Epoch 296/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2303 - f1_score:
0.9631 - val_loss: 1.3575 - val_f1_score: 0.8303
Epoch 297/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3408 - f1_score:
0.9401 - val_loss: 1.7659 - val_f1_score: 0.7738
Epoch 298/500
28/28 [==============================] - 1s 42ms/step - loss: 0.4086 - f1_score:
0.9187 - val_loss: 1.5151 - val_f1_score: 0.8190
Epoch 299/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3219 - f1_score:
0.9358 - val_loss: 1.4389 - val_f1_score: 0.8265
Epoch 300/500
27/28 [===========================>..] - ETA: 0s - loss: 0.3085 - f1_score:
0.9427

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 335ms/step - loss: 0.3059 -
f1_score: 0.9431 - val_loss: 1.2551 - val_f1_score: 0.8492
Epoch 301/500
28/28 [==============================] - ETA: 0s - loss: 0.3349 - f1_score:
0.9390

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 9s 335ms/step - loss: 0.3349 -
f1_score: 0.9390 - val_loss: 1.2706 - val_f1_score: 0.8586
Epoch 302/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3181 - f1_score:
0.9368 - val_loss: 1.4708 - val_f1_score: 0.8246
Epoch 303/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2969 - f1_score:
```

```
0.9450 - val_loss: 1.4686 - val_f1_score: 0.7998
Epoch 304/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3777 - f1_score:
0.9248 - val_loss: 1.6342 - val_f1_score: 0.7976
Epoch 305/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3869 - f1_score:
0.9293 - val_loss: 1.6567 - val_f1_score: 0.8005
Epoch 306/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3615 - f1_score:
0.9263 - val_loss: 1.3916 - val_f1_score: 0.8201
Epoch 307/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3177 - f1_score:
0.9431 - val_loss: 1.4371 - val_f1_score: 0.8344
Epoch 308/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3187 - f1_score:
0.9439 - val_loss: 1.3915 - val_f1_score: 0.8326
Epoch 309/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2738 - f1_score:
0.9533 - val_loss: 1.2904 - val_f1_score: 0.8325
Epoch 310/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2603 - f1_score:
0.9487 - val_loss: 1.2859 - val_f1_score: 0.8356
Epoch 311/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2527 - f1_score:
0.9558 - val_loss: 1.6028 - val_f1_score: 0.8007
Epoch 312/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3271 - f1_score:
0.9437 - val_loss: 1.4049 - val_f1_score: 0.8233
Epoch 313/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2895 - f1_score:
0.9436 - val_loss: 1.3768 - val_f1_score: 0.8215
Epoch 314/500
27/28 [============================>..] - ETA: 0s - loss: 0.2658 - f1_score:
0.9563

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_3_layer_call_fn,
gru_cell_3_layer_call_and_return_conditional_losses while saving (showing 4 of
4). These functions will not be directly callable after loading.

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Trial 721 Mish/assets

28/28 [==============================] - 10s 357ms/step - loss: 0.2622 -
f1_score: 0.9570 - val_loss: 1.2373 - val_f1_score: 0.8632
Epoch 315/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2744 - f1_score:
0.9498 - val_loss: 1.4353 - val_f1_score: 0.8167
Epoch 316/500
```

```
28/28 [==============================] - 1s 39ms/step - loss: 0.2780 - f1_score:
0.9528 - val_loss: 1.4913 - val_f1_score: 0.8220
Epoch 317/500
28/28 [==============================] - 1s 39ms/step - loss: 0.3100 - f1_score:
0.9426 - val_loss: 1.4050 - val_f1_score: 0.8283
Epoch 318/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2650 - f1_score:
0.9532 - val_loss: 1.3959 - val_f1_score: 0.8295
Epoch 319/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2948 - f1_score:
0.9471 - val_loss: 1.4728 - val_f1_score: 0.8279
Epoch 320/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3391 - f1_score:
0.9381 - val_loss: 1.5978 - val_f1_score: 0.8159
Epoch 321/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2998 - f1_score:
0.9420 - val_loss: 1.3740 - val_f1_score: 0.8343
Epoch 322/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2675 - f1_score:
0.9515 - val_loss: 1.4160 - val_f1_score: 0.8145
Epoch 323/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2858 - f1_score:
0.9558 - val_loss: 1.3645 - val_f1_score: 0.8240
Epoch 324/500
28/28 [==============================] - 1s 39ms/step - loss: 0.2640 - f1_score:
0.9537 - val_loss: 1.5690 - val_f1_score: 0.7995
Epoch 325/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3001 - f1_score:
0.9449 - val_loss: 1.4281 - val_f1_score: 0.8220
Epoch 326/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2515 - f1_score:
0.9516 - val_loss: 1.3503 - val_f1_score: 0.8285
Epoch 327/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2585 - f1_score:
0.9529 - val_loss: 1.3918 - val_f1_score: 0.8471
Epoch 328/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2632 - f1_score:
0.9568 - val_loss: 1.4014 - val_f1_score: 0.8356
Epoch 329/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2383 - f1_score:
0.9638 - val_loss: 1.4322 - val_f1_score: 0.8233
Epoch 330/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2783 - f1_score:
0.9462 - val_loss: 1.4693 - val_f1_score: 0.8034
Epoch 331/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2180 - f1_score:
0.9646 - val_loss: 1.3711 - val_f1_score: 0.8366
Epoch 332/500
```

```
28/28 [==============================] - 1s 40ms/step - loss: 0.2875 - f1_score:
0.9442 - val_loss: 1.4472 - val_f1_score: 0.8138
Epoch 333/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3386 - f1_score:
0.9418 - val_loss: 1.5110 - val_f1_score: 0.8046
Epoch 334/500
28/28 [==============================] - 1s 44ms/step - loss: 0.2827 - f1_score:
0.9508 - val_loss: 1.4989 - val_f1_score: 0.8252
Epoch 335/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2842 - f1_score:
0.9470 - val_loss: 1.5709 - val_f1_score: 0.8262
Epoch 336/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2567 - f1_score:
0.9519 - val_loss: 1.4794 - val_f1_score: 0.8157
Epoch 337/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2888 - f1_score:
0.9497 - val_loss: 1.5646 - val_f1_score: 0.8011
Epoch 338/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2491 - f1_score:
0.9517 - val_loss: 1.5783 - val_f1_score: 0.8052
Epoch 339/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3141 - f1_score:
0.9423 - val_loss: 1.5249 - val_f1_score: 0.8242
Epoch 340/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2394 - f1_score:
0.9580 - val_loss: 1.5483 - val_f1_score: 0.8273
Epoch 341/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2976 - f1_score:
0.9501 - val_loss: 1.6011 - val_f1_score: 0.7974
Epoch 342/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3887 - f1_score:
0.9216 - val_loss: 1.6374 - val_f1_score: 0.8076
Epoch 343/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3383 - f1_score:
0.9325 - val_loss: 1.4655 - val_f1_score: 0.8204
Epoch 344/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2448 - f1_score:
0.9507 - val_loss: 1.3560 - val_f1_score: 0.8257
Epoch 345/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2845 - f1_score:
0.9516 - val_loss: 1.3838 - val_f1_score: 0.8127
Epoch 346/500
28/28 [==============================] - 1s 40ms/step - loss: 0.2565 - f1_score:
0.9509 - val_loss: 1.4921 - val_f1_score: 0.8109
Epoch 347/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2700 - f1_score:
0.9522 - val_loss: 1.2881 - val_f1_score: 0.8261
Epoch 348/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2817 - f1_score:
0.9510 - val_loss: 1.6146 - val_f1_score: 0.8240
Epoch 349/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2894 - f1_score:
0.9452 - val_loss: 1.4974 - val_f1_score: 0.7990
Epoch 350/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3029 - f1_score:
0.9510 - val_loss: 1.5922 - val_f1_score: 0.8078
Epoch 351/500
28/28 [==============================] - 1s 40ms/step - loss: 0.4153 - f1_score:
0.9196 - val_loss: 1.3920 - val_f1_score: 0.8231
Epoch 352/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3730 - f1_score:
0.9318 - val_loss: 1.3357 - val_f1_score: 0.8185
Epoch 353/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3267 - f1_score:
0.9350 - val_loss: 1.5014 - val_f1_score: 0.8122
Epoch 354/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3769 - f1_score:
0.9285 - val_loss: 1.6948 - val_f1_score: 0.7781
Epoch 355/500
28/28 [==============================] - 1s 44ms/step - loss: 0.4416 - f1_score:
0.9183 - val_loss: 1.3641 - val_f1_score: 0.8189
Epoch 356/500
28/28 [==============================] - 1s 45ms/step - loss: 0.3583 - f1_score:
0.9278 - val_loss: 1.5462 - val_f1_score: 0.7972
Epoch 357/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3124 - f1_score:
0.9404 - val_loss: 1.4296 - val_f1_score: 0.8042
Epoch 358/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3006 - f1_score:
0.9464 - val_loss: 1.6004 - val_f1_score: 0.8167
Epoch 359/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2865 - f1_score:
0.9518 - val_loss: 1.5165 - val_f1_score: 0.8143
Epoch 360/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2752 - f1_score:
0.9487 - val_loss: 1.4438 - val_f1_score: 0.8204
Epoch 361/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2686 - f1_score:
0.9572 - val_loss: 1.5670 - val_f1_score: 0.8084
Epoch 362/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3476 - f1_score:
0.9379 - val_loss: 1.4790 - val_f1_score: 0.8275
Epoch 363/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3581 - f1_score:
0.9283 - val_loss: 1.6435 - val_f1_score: 0.7951
Epoch 364/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.3312 - f1_score:
0.9369 - val_loss: 1.6113 - val_f1_score: 0.7893
Epoch 365/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3236 - f1_score:
0.9405 - val_loss: 1.4398 - val_f1_score: 0.8220
Epoch 366/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2836 - f1_score:
0.9454 - val_loss: 1.5008 - val_f1_score: 0.8044
Epoch 367/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2970 - f1_score:
0.9466 - val_loss: 1.5501 - val_f1_score: 0.7998
Epoch 368/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2823 - f1_score:
0.9537 - val_loss: 1.3880 - val_f1_score: 0.8089
Epoch 369/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3038 - f1_score:
0.9455 - val_loss: 1.4853 - val_f1_score: 0.8159
Epoch 370/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3164 - f1_score:
0.9402 - val_loss: 1.5863 - val_f1_score: 0.8015
Epoch 371/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2947 - f1_score:
0.9486 - val_loss: 1.3573 - val_f1_score: 0.8327
Epoch 372/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2631 - f1_score:
0.9550 - val_loss: 1.3874 - val_f1_score: 0.8241
Epoch 373/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2653 - f1_score:
0.9546 - val_loss: 1.4747 - val_f1_score: 0.8049
Epoch 374/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2998 - f1_score:
0.9445 - val_loss: 1.4636 - val_f1_score: 0.8000
Epoch 375/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3190 - f1_score:
0.9401 - val_loss: 1.5476 - val_f1_score: 0.7866
Epoch 376/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3405 - f1_score:
0.9382 - val_loss: 1.7437 - val_f1_score: 0.7589
Epoch 377/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3574 - f1_score:
0.9263 - val_loss: 1.4167 - val_f1_score: 0.8131
Epoch 378/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3118 - f1_score:
0.9413 - val_loss: 1.4649 - val_f1_score: 0.7859
Epoch 379/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3194 - f1_score:
0.9497 - val_loss: 1.4602 - val_f1_score: 0.8272
Epoch 380/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2529 - f1_score:
0.9529 - val_loss: 1.3638 - val_f1_score: 0.8145
Epoch 381/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2868 - f1_score:
0.9511 - val_loss: 1.3739 - val_f1_score: 0.8233
Epoch 382/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3239 - f1_score:
0.9369 - val_loss: 1.5720 - val_f1_score: 0.7979
Epoch 383/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3092 - f1_score:
0.9501 - val_loss: 1.6083 - val_f1_score: 0.8171
Epoch 384/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3133 - f1_score:
0.9445 - val_loss: 1.6125 - val_f1_score: 0.8003
Epoch 385/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3329 - f1_score:
0.9440 - val_loss: 1.6152 - val_f1_score: 0.8030
Epoch 386/500
28/28 [==============================] - 1s 40ms/step - loss: 0.3414 - f1_score:
0.9398 - val_loss: 1.5038 - val_f1_score: 0.8197
Epoch 387/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3152 - f1_score:
0.9420 - val_loss: 1.4609 - val_f1_score: 0.8263
Epoch 388/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3506 - f1_score:
0.9330 - val_loss: 1.4416 - val_f1_score: 0.7990
Epoch 389/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3137 - f1_score:
0.9444 - val_loss: 1.4386 - val_f1_score: 0.8070
Epoch 390/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3210 - f1_score:
0.9413 - val_loss: 1.4719 - val_f1_score: 0.8055
Epoch 391/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3052 - f1_score:
0.9440 - val_loss: 1.5104 - val_f1_score: 0.8065
Epoch 392/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3605 - f1_score:
0.9341 - val_loss: 1.3865 - val_f1_score: 0.8232
Epoch 393/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3208 - f1_score:
0.9393 - val_loss: 1.4089 - val_f1_score: 0.8202
Epoch 394/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3100 - f1_score:
0.9407 - val_loss: 1.4332 - val_f1_score: 0.8340
Epoch 395/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2814 - f1_score:
0.9565 - val_loss: 1.5296 - val_f1_score: 0.7945
Epoch 396/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2995 - f1_score:
0.9509 - val_loss: 1.7063 - val_f1_score: 0.8101
Epoch 397/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2921 - f1_score:
0.9481 - val_loss: 1.4551 - val_f1_score: 0.8149
Epoch 398/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2625 - f1_score:
0.9568 - val_loss: 1.4314 - val_f1_score: 0.8138
Epoch 399/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3152 - f1_score:
0.9413 - val_loss: 1.3768 - val_f1_score: 0.8041
Epoch 400/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3207 - f1_score:
0.9400 - val_loss: 1.5198 - val_f1_score: 0.7982
Epoch 401/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3429 - f1_score:
0.9382 - val_loss: 1.4780 - val_f1_score: 0.8139
Epoch 402/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2588 - f1_score:
0.9634 - val_loss: 1.4458 - val_f1_score: 0.8047
Epoch 403/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2593 - f1_score:
0.9584 - val_loss: 1.3533 - val_f1_score: 0.8030
Epoch 404/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2501 - f1_score:
0.9581 - val_loss: 1.3236 - val_f1_score: 0.8080
Epoch 405/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2550 - f1_score:
0.9591 - val_loss: 1.6356 - val_f1_score: 0.7989
Epoch 406/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2754 - f1_score:
0.9558 - val_loss: 1.3092 - val_f1_score: 0.8456
Epoch 407/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2359 - f1_score:
0.9634 - val_loss: 1.4260 - val_f1_score: 0.8243
Epoch 408/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3169 - f1_score:
0.9480 - val_loss: 1.4717 - val_f1_score: 0.8093
Epoch 409/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3154 - f1_score:
0.9404 - val_loss: 1.6456 - val_f1_score: 0.8042
Epoch 410/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2915 - f1_score:
0.9480 - val_loss: 1.4799 - val_f1_score: 0.7901
Epoch 411/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2671 - f1_score:
0.9519 - val_loss: 1.3626 - val_f1_score: 0.8317
Epoch 412/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2469 - f1_score:
0.9616 - val_loss: 1.3463 - val_f1_score: 0.8233
Epoch 413/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2605 - f1_score:
0.9609 - val_loss: 1.3828 - val_f1_score: 0.8292
Epoch 414/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2339 - f1_score:
0.9608 - val_loss: 1.3531 - val_f1_score: 0.8381
Epoch 415/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2664 - f1_score:
0.9517 - val_loss: 1.4587 - val_f1_score: 0.7966
Epoch 416/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3219 - f1_score:
0.9435 - val_loss: 1.3729 - val_f1_score: 0.8230
Epoch 417/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2686 - f1_score:
0.9536 - val_loss: 1.3514 - val_f1_score: 0.8212
Epoch 418/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2437 - f1_score:
0.9619 - val_loss: 1.3255 - val_f1_score: 0.8167
Epoch 419/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3355 - f1_score:
0.9425 - val_loss: 1.4343 - val_f1_score: 0.7871
Epoch 420/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3125 - f1_score:
0.9449 - val_loss: 1.4298 - val_f1_score: 0.7909
Epoch 421/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3089 - f1_score:
0.9461 - val_loss: 1.3638 - val_f1_score: 0.8272
Epoch 422/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2920 - f1_score:
0.9483 - val_loss: 1.3589 - val_f1_score: 0.8146
Epoch 423/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2916 - f1_score:
0.9492 - val_loss: 1.3621 - val_f1_score: 0.8373
Epoch 424/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2974 - f1_score:
0.9438 - val_loss: 1.4326 - val_f1_score: 0.8325
Epoch 425/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2632 - f1_score:
0.9596 - val_loss: 1.4594 - val_f1_score: 0.8161
Epoch 426/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2374 - f1_score:
0.9605 - val_loss: 1.4560 - val_f1_score: 0.8272
Epoch 427/500
28/28 [==============================] - 1s 50ms/step - loss: 0.2447 - f1_score:
0.9619 - val_loss: 1.4826 - val_f1_score: 0.8234
Epoch 428/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2774 - f1_score:
0.9540 - val_loss: 1.2858 - val_f1_score: 0.8339
Epoch 429/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2484 - f1_score:
0.9658 - val_loss: 1.3933 - val_f1_score: 0.8291
Epoch 430/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3124 - f1_score:
0.9406 - val_loss: 1.5266 - val_f1_score: 0.8076
Epoch 431/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3084 - f1_score:
0.9451 - val_loss: 1.5568 - val_f1_score: 0.8254
Epoch 432/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4646 - f1_score:
0.9133 - val_loss: 1.6142 - val_f1_score: 0.7936
Epoch 433/500
28/28 [==============================] - 1s 41ms/step - loss: 0.4199 - f1_score:
0.9187 - val_loss: 1.3645 - val_f1_score: 0.8327
Epoch 434/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3242 - f1_score:
0.9336 - val_loss: 1.4465 - val_f1_score: 0.8078
Epoch 435/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3289 - f1_score:
0.9352 - val_loss: 1.3469 - val_f1_score: 0.8259
Epoch 436/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3130 - f1_score:
0.9446 - val_loss: 1.3307 - val_f1_score: 0.8451
Epoch 437/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3924 - f1_score:
0.9236 - val_loss: 1.4699 - val_f1_score: 0.7914
Epoch 438/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3487 - f1_score:
0.9328 - val_loss: 1.6025 - val_f1_score: 0.7921
Epoch 439/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3020 - f1_score:
0.9440 - val_loss: 1.3661 - val_f1_score: 0.7987
Epoch 440/500
28/28 [==============================] - 1s 46ms/step - loss: 0.3336 - f1_score:
0.9408 - val_loss: 1.4209 - val_f1_score: 0.7992
Epoch 441/500
28/28 [==============================] - 1s 44ms/step - loss: 0.3120 - f1_score:
0.9471 - val_loss: 1.3605 - val_f1_score: 0.8254
Epoch 442/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3168 - f1_score:
0.9467 - val_loss: 1.3068 - val_f1_score: 0.8124
Epoch 443/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3043 - f1_score:
0.9490 - val_loss: 1.4539 - val_f1_score: 0.8173
Epoch 444/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.2495 - f1_score:
0.9597 - val_loss: 1.5134 - val_f1_score: 0.8123
Epoch 445/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2602 - f1_score:
0.9599 - val_loss: 1.6448 - val_f1_score: 0.8091
Epoch 446/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2895 - f1_score:
0.9471 - val_loss: 1.4938 - val_f1_score: 0.8159
Epoch 447/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2375 - f1_score:
0.9599 - val_loss: 1.5536 - val_f1_score: 0.8162
Epoch 448/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2515 - f1_score:
0.9601 - val_loss: 1.3970 - val_f1_score: 0.8045
Epoch 449/500
28/28 [==============================] - 1s 46ms/step - loss: 0.2747 - f1_score:
0.9555 - val_loss: 1.5640 - val_f1_score: 0.8198
Epoch 450/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3039 - f1_score:
0.9446 - val_loss: 1.5311 - val_f1_score: 0.8147
Epoch 451/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3072 - f1_score:
0.9429 - val_loss: 1.4925 - val_f1_score: 0.8050
Epoch 452/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2984 - f1_score:
0.9428 - val_loss: 1.5509 - val_f1_score: 0.7991
Epoch 453/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2708 - f1_score:
0.9514 - val_loss: 1.4439 - val_f1_score: 0.8192
Epoch 454/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2414 - f1_score:
0.9625 - val_loss: 1.5890 - val_f1_score: 0.7985
Epoch 455/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2655 - f1_score:
0.9570 - val_loss: 1.5596 - val_f1_score: 0.7940
Epoch 456/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3281 - f1_score:
0.9424 - val_loss: 1.7089 - val_f1_score: 0.8006
Epoch 457/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3201 - f1_score:
0.9422 - val_loss: 1.3757 - val_f1_score: 0.8188
Epoch 458/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2928 - f1_score:
0.9533 - val_loss: 1.4827 - val_f1_score: 0.7931
Epoch 459/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2771 - f1_score:
0.9520 - val_loss: 1.4953 - val_f1_score: 0.8227
Epoch 460/500
```

```
28/28 [==============================] - 1s 41ms/step - loss: 0.2829 - f1_score:
0.9521 - val_loss: 1.3544 - val_f1_score: 0.8266
Epoch 461/500
28/28 [==============================] - 1s 47ms/step - loss: 0.3900 - f1_score:
0.9260 - val_loss: 1.3733 - val_f1_score: 0.8102
Epoch 462/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3159 - f1_score:
0.9395 - val_loss: 1.4325 - val_f1_score: 0.8164
Epoch 463/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2881 - f1_score:
0.9557 - val_loss: 1.3585 - val_f1_score: 0.8356
Epoch 464/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2818 - f1_score:
0.9508 - val_loss: 1.3744 - val_f1_score: 0.8345
Epoch 465/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3044 - f1_score:
0.9437 - val_loss: 1.4418 - val_f1_score: 0.7963
Epoch 466/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3559 - f1_score:
0.9380 - val_loss: 1.3186 - val_f1_score: 0.8317
Epoch 467/500
28/28 [==============================] - 1s 44ms/step - loss: 0.2682 - f1_score:
0.9591 - val_loss: 1.3963 - val_f1_score: 0.8291
Epoch 468/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2719 - f1_score:
0.9529 - val_loss: 1.4746 - val_f1_score: 0.8285
Epoch 469/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2921 - f1_score:
0.9524 - val_loss: 1.3347 - val_f1_score: 0.8111
Epoch 470/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2882 - f1_score:
0.9504 - val_loss: 1.3515 - val_f1_score: 0.8168
Epoch 471/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2726 - f1_score:
0.9533 - val_loss: 1.4725 - val_f1_score: 0.8196
Epoch 472/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3268 - f1_score:
0.9389 - val_loss: 1.4524 - val_f1_score: 0.8017
Epoch 473/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3815 - f1_score:
0.9340 - val_loss: 1.3011 - val_f1_score: 0.8343
Epoch 474/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3119 - f1_score:
0.9405 - val_loss: 1.4986 - val_f1_score: 0.8143
Epoch 475/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2616 - f1_score:
0.9508 - val_loss: 1.3669 - val_f1_score: 0.8330
Epoch 476/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.2683 - f1_score:
0.9537 - val_loss: 1.3377 - val_f1_score: 0.8337
Epoch 477/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2563 - f1_score:
0.9592 - val_loss: 1.3573 - val_f1_score: 0.8275
Epoch 478/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2793 - f1_score:
0.9525 - val_loss: 1.3989 - val_f1_score: 0.8222
Epoch 479/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3500 - f1_score:
0.9334 - val_loss: 1.5081 - val_f1_score: 0.8077
Epoch 480/500
28/28 [==============================] - 1s 42ms/step - loss: 0.3111 - f1_score:
0.9468 - val_loss: 1.3798 - val_f1_score: 0.8162
Epoch 481/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3026 - f1_score:
0.9495 - val_loss: 1.3525 - val_f1_score: 0.8353
Epoch 482/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2809 - f1_score:
0.9489 - val_loss: 1.5959 - val_f1_score: 0.8307
Epoch 483/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2678 - f1_score:
0.9556 - val_loss: 1.4039 - val_f1_score: 0.8358
Epoch 484/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2563 - f1_score:
0.9571 - val_loss: 1.2858 - val_f1_score: 0.8472
Epoch 485/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2809 - f1_score:
0.9546 - val_loss: 1.4180 - val_f1_score: 0.8297
Epoch 486/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2660 - f1_score:
0.9578 - val_loss: 1.3024 - val_f1_score: 0.8478
Epoch 487/500
28/28 [==============================] - 1s 42ms/step - loss: 0.2623 - f1_score:
0.9616 - val_loss: 1.4289 - val_f1_score: 0.8112
Epoch 488/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2784 - f1_score:
0.9506 - val_loss: 1.3807 - val_f1_score: 0.8359
Epoch 489/500
28/28 [==============================] - 1s 43ms/step - loss: 0.2505 - f1_score:
0.9616 - val_loss: 1.3522 - val_f1_score: 0.8230
Epoch 490/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2932 - f1_score:
0.9511 - val_loss: 1.4428 - val_f1_score: 0.8001
Epoch 491/500
28/28 [==============================] - 1s 41ms/step - loss: 0.3413 - f1_score:
0.9392 - val_loss: 1.4841 - val_f1_score: 0.7953
Epoch 492/500
```

```
28/28 [==============================] - 1s 42ms/step - loss: 0.3191 - f1_score:
0.9401 - val_loss: 1.4856 - val_f1_score: 0.8230
Epoch 493/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2935 - f1_score:
0.9516 - val_loss: 1.4632 - val_f1_score: 0.8163
Epoch 494/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2956 - f1_score:
0.9488 - val_loss: 1.2660 - val_f1_score: 0.8317
Epoch 495/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2986 - f1_score:
0.9505 - val_loss: 1.3989 - val_f1_score: 0.8231
Epoch 496/500
28/28 [==============================] - 1s 44ms/step - loss: 0.2923 - f1_score:
0.9509 - val_loss: 1.3804 - val_f1_score: 0.8427
Epoch 497/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2553 - f1_score:
0.9592 - val_loss: 1.3801 - val_f1_score: 0.8292
Epoch 498/500
28/28 [==============================] - 1s 41ms/step - loss: 0.2825 - f1_score:
0.9534 - val_loss: 1.3417 - val_f1_score: 0.8291
Epoch 499/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3257 - f1_score:
0.9470 - val_loss: 1.4801 - val_f1_score: 0.8137
Epoch 500/500
28/28 [==============================] - 1s 43ms/step - loss: 0.3436 - f1_score:
0.9372 - val_loss: 1.4551 - val_f1_score: 0.8171
```

[144]:
```python
# convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

# or save to csv:
hist_csv_file = '2 1DCNN + 1 LSTM Trial 715 Mish/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

[189]:
```python
hist_df = pd.read_csv('2 1DCNN + 1 LSTM Trial 715 Mish/history.csv',
                      index_col=0)
hist_df.tail()
```

[189]:

	loss	f1_score	val_loss	val_f1_score
495	0.292308	0.950895	1.380354	0.842725
496	0.255275	0.959189	1.380063	0.829194
497	0.282479	0.953392	1.341682	0.829057
498	0.325660	0.946974	1.480074	0.813747
499	0.343594	0.937179	1.455086	0.817053

[190]:
```
# Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (Epoch {min_loss_epoch})')
plt.scatter(
    min_val_loss_epoch,
    min_val_loss,
    c='green',
    marker='p',
    label=f'Min Val Loss: {min_val_loss:.4f} (Epoch {min_val_loss_epoch})')

plt.title('Training Loss vs. Validation Loss')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[191]:
```
# Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.f1_score, label='F1 Score')
plt.plot(epochs, hist_df.val_f1_score, label='Validation F1 Score')
plt.scatter(max_f1_epoch,
            max_f1,
            c='red',
            marker='p',
            label=f'Max F1 Score: {max_f1:.4f} (Epoch {max_f1_epoch})')
plt.scatter(
    max_val_f1_epoch,
    max_val_f1,
    c='green',
    marker='p',
    label=f'Max Val F1 Score: {max_val_f1:.4f} (Epoch {max_val_f1_epoch})')
```

```
plt.title('Training F1 Score vs. Validation F1 Score')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
plt.show()
```

[147]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 6ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.750     0.857         8
    BACKPACK      0.714     0.833     0.769         6
  BASKETBALL      0.909     1.000     0.952        10
         BEE      1.000     0.700     0.824        10
        BELT      1.000     1.000     1.000         4
        BITE      0.800     1.000     0.889         8
   BREAKFAST      0.462     1.000     0.632         6
      CANCER      0.727     1.000     0.842         8
```

CHRISTMAS	1.000	0.833	0.909	6
CONFUSED	0.857	1.000	0.923	6
DARK	1.000	1.000	1.000	4
DEAF	0.857	1.000	0.923	6
DECIDE	1.000	1.000	1.000	6
DEMAND	0.857	0.750	0.800	8
DEVELOP	0.571	0.667	0.615	6
DINNER	1.000	0.875	0.933	8
DOG	0.667	1.000	0.800	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	0.750	0.750	0.750	4
EAT	1.000	1.000	1.000	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	1.000	1.000	1.000	8
FINE	1.000	1.000	1.000	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	1.000	0.667	0.800	6
GUESS	1.000	0.875	0.933	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	1.000	0.667	0.800	6
HURDLE/TRIP	1.000	0.500	0.667	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.667	0.250	0.364	8
LUNCH	1.000	0.500	0.667	8
MAPLE	0.800	1.000	0.889	4
MEAT	0.857	1.000	0.923	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	0.875	0.875	0.875	8
MOVIE	0.600	0.750	0.667	8
NOON	0.889	1.000	0.941	8
PARTY	0.800	1.000	0.889	8
PATIENT	0.857	1.000	0.923	6
RAZOR	0.750	0.750	0.750	4
RIVER	0.600	1.000	0.750	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	1.000	0.600	0.750	10
SINK	0.375	0.500	0.429	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.750	0.750	0.750	4
TWINS	0.889	1.000	0.941	8
WHATFOR	1.000	1.000	1.000	10
accuracy			0.836	324
macro avg	0.847	0.824	0.817	324
weighted avg	0.858	0.836	0.829	324

[155]:
```
reconstructed_model = tf.keras.models.load_model(
    "2 1DCNN + 1 LSTM Trial 715 Mish")
```

[149]:
```
reconstructed_model.summary()
```

```
Model: "sequential_2"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv1d_4 (Conv1D)           (None, 126, 150)          94650

 max_pooling1d_4 (MaxPooling  (None, 42, 150)          0
 1D)

 conv1d_5 (Conv1D)           (None, 39, 100)           60100

 max_pooling1d_5 (MaxPooling  (None, 13, 100)          0
 1D)

 dropout_4 (Dropout)         (None, 13, 100)           0

 gru_2 (GRU)                 (None, 150)               113400

 dropout_5 (Dropout)         (None, 150)               0

 dense_4 (Dense)             (None, 80)                12080

 dense_5 (Dense)             (None, 50)                4050

=================================================================
Total params: 284,280
Trainable params: 284,280
Non-trainable params: 0
_________________________________________________________________
```

[150]:
```
plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

[150]:

InputLayer
input: [(None, 130, 126)]
output: [(None, 130, 126)]
Conv1D
input: (None, 130, 126)
output: (None, 126, 150)
MaxPooling1D
input: (None, 126, 150)
output: (None, 42, 150)
Conv1D
input: (None, 42, 150)
output: (None, 39, 100)
MaxPooling1D
input: (None, 39, 100)
output: (None, 13, 100)
Dropout
input: (None, 13, 100)
output: (None, 13, 100)
GRU
input: (None, 13, 100)
output: (None, 150)
Dropout
input: (None, 150)
output: (None, 150)
Dense
input: (None, 150)
output: (None, 80)
Dense
input: (None, 80)
output: (None, 50)

[156]:
```
font = ImageFont.truetype("arial.ttf", 12)
visualkeras.layered_view(reconstructed_model, legend=True, font=font)
```

[156]:

Conv1D
MaxPooling1D
Conv1D
Dropout
GRU
Dense
Dense

[151]:
```
reconstructed_model.evaluate(Xval, Yval)
```

```
11/11 [==============================] - 1s 7ms/step - loss: 1.2373 - f1_score:
0.8632
```

[151]:
```
[1.2372610569000244, 0.8632017374038696]
```

[153]:
```
reconstructed_model.evaluate(Xtrain, Ytrain)
```

```
84/84 [==============================] - 1s 8ms/step - loss: 0.1030 - f1_score:
1.0000
```

[153]:
```
[0.10299792885780334, 1.0]
```

[154]:
```
print(
    classification_report(np.argmax(Yval, axis=1),
                          np.argmax(reconstructed_model.predict(Xval), axis=1),
                          digits=3,
                          target_names=label_map))
```

```
11/11 [==============================] - 1s 6ms/step
              precision    recall  f1-score   support

         AXE      1.000     0.750     0.857         8
    BACKPACK      0.800     0.667     0.727         6
  BASKETBALL      1.000     1.000     1.000        10
         BEE      1.000     1.000     1.000        10
        BELT      1.000     1.000     1.000         4
        BITE      0.800     1.000     0.889         8
   BREAKFAST      0.667     1.000     0.800         6
      CANCER      0.889     1.000     0.941         8
   CHRISTMAS      0.857     1.000     0.923         6
    CONFUSED      1.000     1.000     1.000         6
        DARK      1.000     1.000     1.000         4
        DEAF      1.000     0.833     0.909         6
      DECIDE      1.000     1.000     1.000         6
      DEMAND      0.714     0.625     0.667         8
     DEVELOP      0.600     1.000     0.750         6
      DINNER      1.000     0.750     0.857         8
         DOG      1.000     1.000     1.000         6
    DOWNSIZE      1.000     1.000     1.000         8
        DRAG      1.000     0.750     0.857         4
         EAT      1.000     1.000     1.000         6
        EDIT      0.857     1.000     0.923         6
    ELEVATOR      0.889     1.000     0.941         8
        FINE      1.000     1.000     1.000         4
```

```
       FLOAT      1.000     0.500     0.667         4
   FOREIGNER      1.000     0.667     0.800         6
       GUESS      1.000     1.000     1.000         8
   HALLOWEEN      0.800     1.000     0.889         8
    HOSPITAL      1.000     0.833     0.909         6
 HURDLE/TRIP      1.000     0.500     0.667         4
     JEWELRY      1.000     0.500     0.667         4
      KNIGHT      0.500     0.500     0.500         4
        LOCK      0.857     0.750     0.800         8
       LUNCH      0.833     0.625     0.714         8
       MAPLE      1.000     1.000     1.000         4
        MEAT      0.750     1.000     0.857         6
    MECHANIC      1.000     1.000     1.000         4
  MICROSCOPE      1.000     0.625     0.769         8
       MOVIE      0.667     1.000     0.800         8
        NOON      0.889     1.000     0.941         8
       PARTY      0.778     0.875     0.824         8
     PATIENT      0.857     1.000     0.923         6
       RAZOR      0.750     0.750     0.750         4
       RIVER      0.600     1.000     0.750         6
ROCKINGCHAIR      1.000     1.000     1.000         8
       SHAVE      1.000     0.800     0.889        10
        SINK      1.000     0.333     0.500         6
     SQUEEZE      0.600     0.750     0.667         4
        THEY      0.800     1.000     0.889         4
       TWINS      1.000     1.000     1.000         8
     WHATFOR      1.000     0.900     0.947        10

    accuracy                          0.877       324
   macro avg      0.895     0.866     0.863       324
weighted avg      0.900     0.877     0.873       324
```

[249]:
```python
# Plotting
import matplotlib.pyplot as plt

epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, marker='o', label='Loss')
plt.plot(epochs, hist_df.f1_score, marker='o', label='F1 Score')
plt.plot(epochs, hist_df.val_loss, marker='o', label='Validation Loss')
plt.plot(epochs, hist_df.val_f1_score, marker='o', label='Validation F1 Score')
plt.title('Training Metrics')
plt.xlabel('Epochs')
plt.ylabel('Value')
plt.legend()
plt.grid()
```

```
plt.show()
```

[ ]:

```

```

4 Test in Custom Dataset

[150]:

```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout, GRU
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten
import tensorflow as tf
from tensorflow.keras import layers, models, regularizers
from tensorflow.keras.optimizers import Adam, Adagrad, Adadelta, SGD, Nadam
import os
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa
from sklearn.metrics import classification_report


from mmpose.apis import Pose2DInferencer, init_model
import cv2

import pandas as pd
import torch
```

```python
import matplotlib.pyplot as plt
import numpy as np
```

[151]:
```python
def extract_keypoints_from_file(filepath):
    # Open the video file
    cap = cv2.VideoCapture(filepath)

    # Initialize an empty list to store the keypoints for each frame
    keypoints = []

    # Loop through the frames of the video
    while cap.isOpened():
        # Read a frame from the video
        ret, frame = cap.read()
        if not ret:
            break
        frame = cv2.resize(frame, (640, 480))
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=False,
                                      return_datasample=False)
        result = next(result_generator)
        # Extract the keypoints from the results object
        if np.array(result['predictions'][0][0]['keypoints']).shape == (133,
                                                                        2):
            keypoint = np.array(
                result['predictions'][0][0]['keypoints']).flatten()
            keypoint = np.append(
                np.array(result['predictions'][0][0]['keypoint_scores']),
                keypoint)
        else:
            keypoint = np.zeros(399)

        # Append the keypoints to the list
        keypoints.append(keypoint)
        gc.collect()
        torch.cuda.empty_cache()
    # Release the video capture object and the YOLO model
    cap.release()

    # Convert the keypoints list to a NumPy array
    return np.array(keypoints)
```

[152]:
```python
def extract_keypoints_from_file_flip(filepath):
    # Open the video file
    cap = cv2.VideoCapture(filepath)
```

```
    # Initialize an empty list to store the keypoints for each frame
    keypoints = []

    # Loop through the frames of the video
    while cap.isOpened():
        # Read a frame from the video
        ret, frame = cap.read()
        if not ret:
            break
        frame = cv2.flip(frame, 1)
        frame = cv2.resize(frame, (640, 480))
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=False,
                                      return_datasample=False)
        result = next(result_generator)
        # Extract the keypoints from the results object
        if np.array(result['predictions'][0][0]['keypoints']).shape == (133,
                                                                        2):
            keypoint = np.array(
                result['predictions'][0][0]['keypoints']).flatten()
            keypoint = np.append(
                np.array(result['predictions'][0][0]['keypoint_scores']),
                keypoint)
        else:
            keypoint = np.zeros(399)

        # Append the keypoints to the list
        keypoints.append(keypoint)
        gc.collect()
        torch.cuda.empty_cache()
    # Release the video capture object and the YOLO model
    cap.release()

    # Convert the keypoints list to a NumPy array
    return np.array(keypoints)
```

[153]:
```
inferencer = Pose2DInferencer(
    device='cuda',
    model='rtmpose-l_8xb64-270e_coco-wholebody-256x192',
    det_model='yolox_tiny_8x8_300e_coco',
    det_cat_ids=[0],  # the category id of 'human' class
)
```

```
Loads checkpoint by http backend from path:
https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/rtmpose-l_simcc-
coco-wholebody_pt-aic-coco_270e-256x192-6f206314_20230124.pth
```

```
Loads checkpoint by http backend from path: https://download.openmmlab.com/mmdet
ection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171
234-b4047906.pth
```

[124]:
```
words = [
    'AXE', 'BACKPACK', 'BASKETBALL', 'BEE', 'BELT', 'BITE', 'BREAKFAST',
    'CANCER', 'CHRISTMAS', 'CONFUSED', 'DARK', 'DEAF', 'DECIDE', 'DEMAND',
    'DEVELOP', 'DINNER', 'DOG', 'DOWNSIZE', 'DRAG', 'EAT', 'EDIT', 'ELEVATOR',
    'FINE', 'FLOAT', 'FOREIGNER', 'GUESS', 'HALLOWEEN', 'HOSPITAL',
    'HURDLE/TRIP', 'JEWELRY', 'KNIGHT', 'LOCK', 'LUNCH', 'MAPLE', 'MEAT',
    'MECHANIC', 'MICROSCOPE', 'MOVIE', 'NOON', 'PARTY', 'PATIENT', 'RAZOR',
    'RIVER', 'ROCKINGCHAIR', 'SHAVE', 'SINK', 'SQUEEZE', 'THEY', 'TWINS',
    'WHATFOR'
]
```

[125]:
```
label_map = {label: num for num, label in enumerate(words)}
```

[126]:
```
inv_label_map = {v: k for k, v in label_map.items()}
```

[67]:
```
label_map
```

[67]:
```
{'AXE': 0,
 'BACKPACK': 1,
 'BASKETBALL': 2,
 'BEE': 3,
 'BELT': 4,
 'BITE': 5,
 'BREAKFAST': 6,
 'CANCER': 7,
 'CHRISTMAS': 8,
 'CONFUSED': 9,
 'DARK': 10,
 'DEAF': 11,
 'DECIDE': 12,
 'DEMAND': 13,
 'DEVELOP': 14,
 'DINNER': 15,
 'DOG': 16,
 'DOWNSIZE': 17,
 'DRAG': 18,
 'EAT': 19,
 'EDIT': 20,
 'ELEVATOR': 21,
 'FINE': 22,
 'FLOAT': 23,
 'FOREIGNER': 24,
 'GUESS': 25,
 'HALLOWEEN': 26,
```

```
 'HOSPITAL': 27,
 'HURDLE/TRIP': 28,
 'JEWELRY': 29,
 'KNIGHT': 30,
 'LOCK': 31,
 'LUNCH': 32,
 'MAPLE': 33,
 'MEAT': 34,
 'MECHANIC': 35,
 'MICROSCOPE': 36,
 'MOVIE': 37,
 'NOON': 38,
 'PARTY': 39,
 'PATIENT': 40,
 'RAZOR': 41,
 'RIVER': 42,
 'ROCKINGCHAIR': 43,
 'SHAVE': 44,
 'SINK': 45,
 'SQUEEZE': 46,
 'THEY': 47,
 'TWINS': 48,
 'WHATFOR': 49}
```

[66]:
```
signs_df = pd.read_csv('/home/kristian/cct_gdrive/DAP/Signs_DF.csv')
```

[67]:
```
signs_df.head()
```

[67]:
```
                                                 path Gloss             file  \
0  file:/home/kristian/Capstone/Sign_Videos_DF/AX…   AXE  AXE_video_1.mp4
1  file:/home/kristian/Capstone/Sign_Videos_DF/AX…   AXE  AXE_video_2.mp4
2  file:/home/kristian/Capstone/Sign_Videos_DF/AX…   AXE  AXE_video_3.mp4
3  file:/home/kristian/Capstone/Sign_Videos_DF/AX…   AXE  AXE_video_4.mp4
4  file:/home/kristian/Capstone/Sign_Videos_DF/AX…   AXE  AXE_video_5.mp4

   Frequency  Frames  FPS  Length  Width  Height
0          5     130   24       5    640     480
1          5     130   24       5    640     480
2          5     130   24       5    640     480
3          5     130   24       5    640     480
4          5     130   24       5    640     480
```

[68]:
```
signs_df.tail()
```

[68]:
```
                                                   path    Gloss  \
245  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
246  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
```

```
247  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
248  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
249  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR

                    file  Frequency  Frames  FPS  Length  Width  Height
245  WHATFOR_video_4.mp4          5     130   24       5    640     480
246  WHATFOR_video_1.mp4          5     130   24       5    640     480
247  WHATFOR_video_2.mp4          5     130   24       5    640     480
248  WHATFOR_video_3.mp4          5     130   24       5    640     480
249  WHATFOR_video_5.mp4          5     130   24       5    640     480
```

[69]:
```
signs_df.describe()
```

[69]:
```
       Frequency  Frames    FPS  Length  Width  Height
count      250.0   250.0  250.0   250.0  250.0   250.0
mean         5.0   130.0   24.0     5.0  640.0   480.0
std          0.0     0.0    0.0     0.0    0.0     0.0
min          5.0   130.0   24.0     5.0  640.0   480.0
25%          5.0   130.0   24.0     5.0  640.0   480.0
50%          5.0   130.0   24.0     5.0  640.0   480.0
75%          5.0   130.0   24.0     5.0  640.0   480.0
max          5.0   130.0   24.0     5.0  640.0   480.0
```

[70]:
```
cap = cv2.VideoCapture(signs_df.path[249])
#cap = cv2.VideoCapture(0)

# Loop through the video frames
while cap.isOpened():
    # Read a frame from the video
    success, frame = cap.read()

    if success:
        # Display the annotated frame
        cv2.imshow("Custom ASL", frame)

        # Break the loop if 'q' is pressed
        if cv2.waitKey(1) & 0xFF == ord("q"):
            break
    else:
        # Break the loop if the end of the video is reached
        break

# Release the video capture object and close the display window
cap.release()
cv2.destroyAllWindows()
```

[71]:
```
signs_df.path[1]
```

[71]: 'file:/home/kristian/Capstone/Sign_Videos_DF/AXE/AXE_video_2.mp4'

[ ]:
```
extract_keypoints_from_file(signs_df.path[1]).shape
```

[20]:
```
#tqdm.pandas()
#keypoints_series = signs_df['path'].progress_apply(extract_keypoints_from_file)
#np.save("/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_keypoints.npy", keypoints_series)
```

```
100%|
   | 250/250 [43:13<00:00, 10.37s/it]
```

[21]:
```
#tqdm.pandas()
#keypoints_series = signs_df['path'].
 ↪progress_apply(extract_keypoints_from_file_flip)
#np.save("/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_keypoints_flip.npy", keypoints_series)
```

```
100%|
   | 250/250 [42:16<00:00, 10.15s/it]
```

[68]:
```
import numpy as np

sign_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_keypoints.npy",
    allow_pickle=True)
sign_keypoints_flip = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_keypoints_flip.npy",
    allow_pickle=True)

print('Sign Keypoints Shape:', sign_keypoints.shape)
print('Sign_FLIP Kepoints Shape:', sign_keypoints_flip.shape)
```

```
Sign Keypoints Shape: (250,)
Sign_FLIP Kepoints Shape: (250,)
```

[69]:
```
max_len = 130
```

[70]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(sign_keypoints), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(sign_keypoints):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]
```

```
sign_keypoints = keypoints_np
print('Sign Keypoints Shape:', sign_keypoints.shape)
```

```
Sign Keypoints Shape: (250, 130, 399)
```

[71]:
```
# Create a padded array to store keypoints
keypoints_np = np.zeros((len(sign_keypoints_flip), max_len, 399))

# Iterate through keypoints_series and fill keypoints_np with pre-padding
for i, keypoints in enumerate(sign_keypoints_flip):
    keypoints_len = min(keypoints.shape[0], max_len)
    padding_len = max_len - keypoints_len
    keypoints_np[i, padding_len:, :] = keypoints[:keypoints_len, :]

sign_keypoints_flip = keypoints_np
print('Sign_flip Keypoints Shape:', sign_keypoints_flip.shape)
```

```
Sign_flip Keypoints Shape: (250, 130, 399)
```

[72]:
```
from sklearn.preprocessing import OrdinalEncoder
from keras.utils import to_categorical
import numpy as np
```

[82]:
```
signs_df['Cat_label'] = signs_df['Gloss'].map(label_map)
```

[83]:
```
signs_df.tail(20)
```

[83]:
```
                                                  path    Gloss  \
230  file:/home/kristian/Capstone/Sign_Videos_DF/SQ…  SQUEEZE
231  file:/home/kristian/Capstone/Sign_Videos_DF/SQ…  SQUEEZE
232  file:/home/kristian/Capstone/Sign_Videos_DF/SQ…  SQUEEZE
233  file:/home/kristian/Capstone/Sign_Videos_DF/SQ…  SQUEEZE
234  file:/home/kristian/Capstone/Sign_Videos_DF/SQ…  SQUEEZE
235  file:/home/kristian/Capstone/Sign_Videos_DF/TH…     THEY
236  file:/home/kristian/Capstone/Sign_Videos_DF/TH…     THEY
237  file:/home/kristian/Capstone/Sign_Videos_DF/TH…     THEY
238  file:/home/kristian/Capstone/Sign_Videos_DF/TH…     THEY
239  file:/home/kristian/Capstone/Sign_Videos_DF/TH…     THEY
240  file:/home/kristian/Capstone/Sign_Videos_DF/TW…    TWINS
241  file:/home/kristian/Capstone/Sign_Videos_DF/TW…    TWINS
242  file:/home/kristian/Capstone/Sign_Videos_DF/TW…    TWINS
243  file:/home/kristian/Capstone/Sign_Videos_DF/TW…    TWINS
244  file:/home/kristian/Capstone/Sign_Videos_DF/TW…    TWINS
245  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
246  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
247  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
248  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
249  file:/home/kristian/Capstone/Sign_Videos_DF/WH…  WHATFOR
```

```
                    file  Frequency  Frames  FPS  Length  Width  Height  \
230  SQUEEZE_video_5.mp4          5     130   24       5    640     480
231  SQUEEZE_video_3.mp4          5     130   24       5    640     480
232  SQUEEZE_video_4.mp4          5     130   24       5    640     480
233  SQUEEZE_video_1.mp4          5     130   24       5    640     480
234  SQUEEZE_video_2.mp4          5     130   24       5    640     480
235     THEY_video_1.mp4          5     130   24       5    640     480
236     THEY_video_2.mp4          5     130   24       5    640     480
237     THEY_video_3.mp4          5     130   24       5    640     480
238     THEY_video_4.mp4          5     130   24       5    640     480
239     THEY_video_5.mp4          5     130   24       5    640     480
240    TWINS_video_5.mp4          5     130   24       5    640     480
241    TWINS_video_4.mp4          5     130   24       5    640     480
242    TWINS_video_2.mp4          5     130   24       5    640     480
243    TWINS_video_1.mp4          5     130   24       5    640     480
244    TWINS_video_3.mp4          5     130   24       5    640     480
245  WHATFOR_video_4.mp4          5     130   24       5    640     480
246  WHATFOR_video_1.mp4          5     130   24       5    640     480
247  WHATFOR_video_2.mp4          5     130   24       5    640     480
248  WHATFOR_video_3.mp4          5     130   24       5    640     480
249  WHATFOR_video_5.mp4          5     130   24       5    640     480

     Cat_label
230         46
231         46
232         46
233         46
234         46
235         47
236         47
237         47
238         47
239         47
240         48
241         48
242         48
243         48
244         48
245         49
246         49
247         49
248         49
249         49
```

[84]:
```
sign_labels = signs_df['Cat_label'].to_numpy()
```

[85]:
```
sign_labels
```

[85]:
```
array([ 0,  0,  0,  0,  0,  1,  1,  1,  1,  1,  2,  2,  2,  2,  2,  3,  3,
        3,  3,  3,  4,  4,  4,  4,  4,  5,  5,  5,  5,  5,  6,  6,  6,  6,
        6,  7,  7,  7,  7,  7,  8,  8,  8,  8,  8,  9,  9,  9,  9,  9, 10,
       10, 10, 10, 10, 11, 11, 11, 11, 11, 12, 12, 12, 12, 12, 13, 13, 13,
       13, 13, 14, 14, 14, 14, 14, 15, 15, 15, 15, 15, 16, 16, 16, 16, 16,
       17, 17, 17, 17, 17, 18, 18, 18, 18, 18, 19, 19, 19, 19, 19, 20, 20,
       20, 20, 20, 21, 21, 21, 21, 21, 22, 22, 22, 22, 22, 23, 23, 23, 23,
       23, 24, 24, 24, 24, 24, 25, 25, 25, 25, 25, 26, 26, 26, 26, 26, 27,
       27, 27, 27, 27, 28, 28, 28, 28, 28, 29, 29, 29, 29, 29, 30, 30, 30,
       30, 30, 31, 31, 31, 31, 31, 32, 32, 32, 32, 32, 33, 33, 33, 33, 33,
       34, 34, 34, 34, 34, 35, 35, 35, 35, 35, 36, 36, 36, 36, 36, 37, 37,
       37, 37, 37, 38, 38, 38, 38, 38, 39, 39, 39, 39, 39, 40, 40, 40, 40,
       40, 41, 41, 41, 41, 41, 42, 42, 42, 42, 42, 43, 43, 43, 43, 43, 44,
       44, 44, 44, 44, 45, 45, 45, 45, 45, 46, 46, 46, 46, 46, 47, 47, 47,
       47, 47, 48, 48, 48, 48, 48, 49, 49, 49, 49, 49])
```

[86]:
```
#np.save("/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_labels.npy", sign_labels)
```

[73]:
```
sign_labels = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_labels.npy"
)
sign_labels_flip = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/RTMPose/
 ↪sign_videos_labels.npy"
)
```

[74]:
```
from pickle import load

scaler = load(open('scaler.pkl', 'rb'))

num_samples, num_frames, num_keypoints = sign_keypoints.shape
sign_keypoints = sign_keypoints.reshape(num_samples, -1)

# Transform the data
sign_keypoints = scaler.transform(sign_keypoints)

# Reshape the scaled data back to the original shape
sign_keypoints = sign_keypoints.reshape(num_samples, num_frames, num_keypoints)
```

[75]:
```
from pickle import load

scaler = load(open('scaler.pkl', 'rb'))
```

```
num_samples, num_frames, num_keypoints = sign_keypoints_flip.shape
sign_keypoints_flip = sign_keypoints_flip.reshape(num_samples, -1)

# Transform the data
sign_keypoints_flip = scaler.transform(sign_keypoints_flip)

# Reshape the scaled data back to the original shape
sign_keypoints_flip = sign_keypoints_flip.reshape(num_samples, num_frames,
                                                  num_keypoints)
```

[78]:
```
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU")
```

[79]:
```
print(
    classification_report(sign_labels,
                          np.argmax(
                              reconstructed_model.predict(sign_keypoints),
                              axis=1),
                          digits=3,
                          target_names=label_map))
```

```
8/8 [==============================] - 0s 16ms/step
              precision    recall  f1-score   support

         AXE      0.286     0.400     0.333         5
    BACKPACK      0.000     0.000     0.000         5
  BASKETBALL      0.833     1.000     0.909         5
         BEE      0.429     0.600     0.500         5
        BELT      1.000     1.000     1.000         5
        BITE      0.000     0.000     0.000         5
   BREAKFAST      0.000     0.000     0.000         5
      CANCER      0.000     0.000     0.000         5
   CHRISTMAS      1.000     1.000     1.000         5
    CONFUSED      0.556     1.000     0.714         5
        DARK      1.000     1.000     1.000         5
        DEAF      1.000     0.400     0.571         5
      DECIDE      1.000     1.000     1.000         5
      DEMAND      0.000     0.000     0.000         5
     DEVELOP      0.000     0.000     0.000         5
      DINNER      0.625     1.000     0.769         5
         DOG      1.000     0.400     0.571         5
    DOWNSIZE      1.000     0.600     0.750         5
        DRAG      0.000     0.000     0.000         5
         EAT      1.000     0.400     0.571         5
        EDIT      1.000     0.600     0.750         5
    ELEVATOR      0.625     1.000     0.769         5
        FINE      1.000     0.400     0.571         5
       FLOAT      0.333     0.400     0.364         5
   FOREIGNER      1.000     1.000     1.000         5
```

```
       GUESS      1.000     1.000     1.000         5
   HALLOWEEN      0.000     0.000     0.000         5
    HOSPITAL      0.294     1.000     0.455         5
 HURDLE/TRIP      0.000     0.000     0.000         5
     JEWELRY      1.000     0.400     0.571         5
      KNIGHT      0.300     0.600     0.400         5
        LOCK      0.000     0.000     0.000         5
       LUNCH      0.800     0.800     0.800         5
       MAPLE      0.000     0.000     0.000         5
        MEAT      1.000     0.800     0.889         5
    MECHANIC      0.833     1.000     0.909         5
  MICROSCOPE      0.312     1.000     0.476         5
       MOVIE      0.000     0.000     0.000         5
        NOON      0.250     0.800     0.381         5
       PARTY      0.500     1.000     0.667         5
     PATIENT      0.444     0.800     0.571         5
       RAZOR      0.000     0.000     0.000         5
       RIVER      1.000     0.400     0.571         5
ROCKINGCHAIR      1.000     0.800     0.889         5
       SHAVE      0.000     0.000     0.000         5
        SINK      1.000     0.600     0.750         5
     SQUEEZE      0.000     0.000     0.000         5
        THEY      0.667     0.800     0.727         5
       TWINS      0.667     0.400     0.500         5
     WHATFOR      0.308     0.800     0.444         5

    accuracy                          0.524       250
   macro avg      0.521     0.524     0.483       250
weighted avg      0.521     0.524     0.483       250

/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

5 Realtime Implementation

[154]:
```
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import LSTM, Dense, Dropout, GRU
from tensorflow.keras.layers import Conv1D, MaxPooling1D, Flatten
import tensorflow as tf
from tensorflow.keras import layers, models, regularizers
from tensorflow.keras.optimizers import Adam, Adagrad, Adadelta, SGD, Nadam
import os
from tensorflow.keras.callbacks import EarlyStopping
import tensorflow_addons as tfa
from sklearn.metrics import classification_report


from mmpose.apis import Pose2DInferencer, init_model
import cv2
import pandas as pd
import torch
import matplotlib.pyplot as plt
import numpy as np
import random
import time
```

[155]:
```
inferencer = Pose2DInferencer(
    device='cuda',
    model='rtmpose-l_8xb64-270e_coco-wholebody-256x192',
    det_model='yolox_tiny_8x8_300e_coco',
    det_cat_ids=[0],  # the category id of 'human' class
)
```

```
Loads checkpoint by http backend from path:
https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/rtmpose-l_simcc-
coco-wholebody_pt-aic-coco_270e-256x192-6f206314_20230124.pth
Loads checkpoint by http backend from path: https://download.openmmlab.com/mmdet
ection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171
234-b4047906.pth
```

[156]:
```
from pickle import load


scaler = load(open('scaler.pkl', 'rb'))
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU")
```

[157]:
```
words = [
    'AXE', 'BACKPACK', 'BASKETBALL', 'BEE', 'BELT', 'BITE', 'BREAKFAST',
    'CANCER', 'CHRISTMAS', 'CONFUSED', 'DARK', 'DEAF', 'DECIDE', 'DEMAND',
    'DEVELOP', 'DINNER', 'DOG', 'DOWNSIZE', 'DRAG', 'EAT', 'EDIT', 'ELEVATOR',
    'FINE', 'FLOAT', 'FOREIGNER', 'GUESS', 'HALLOWEEN', 'HOSPITAL',
```

```
    'HURDLE/TRIP', 'JEWELRY', 'KNIGHT', 'LOCK', 'LUNCH', 'MAPLE', 'MEAT',
    'MECHANIC', 'MICROSCOPE', 'MOVIE', 'NOON', 'PARTY', 'PATIENT', 'RAZOR',
    'RIVER', 'ROCKINGCHAIR', 'SHAVE', 'SINK', 'SQUEEZE', 'THEY', 'TWINS',
    'WHATFOR'
]
```

[158]:
```
label_map = {label: num for num, label in enumerate(words)}
```

[159]:
```
inv_label_map = {v: k for k, v in label_map.items()}
```

[176]:
```
tf.random.set_seed(5)
tf.keras.utils.set_random_seed(5)
```

[177]:
```
signs_df = pd.read_csv('/home/kristian/cct_gdrive/DAP/Signs_DF.csv')

signs_df = signs_df.sample(frac=1).reset_index(drop=True)

num_clips_to_concatenate = 10

video_clips = []

# Loop through the shuffled DataFrame and add video clips
for index, row in signs_df.iterrows():
    if len(video_clips) >= num_clips_to_concatenate:
        break

    path = row['path']  # Get the video path from the DataFrame
    gloss_label = row['Gloss']  # Get the gloss label from the DataFrame
    cap = cv2.VideoCapture(path)

    frames = []
    while True:
        ret, frame = cap.read()
        if not ret:
            break

        # Add gloss label
        text_position = (10, frame.shape[0] - 50)
        cv2.putText(frame, f'Gloss: {gloss_label}', text_position,
                    cv2.FONT_HERSHEY_SIMPLEX, 1.0, (0, 255, 0), 2)
        frames.append(frame)

    cap.release()

    if len(frames) > 0:
        video_clips.append(frames)
```

```
# Concatenate the video clips
if len(video_clips) > 0:
    concatenated_clip = cv2.VideoWriter(
        'concatenated_video5.mp4', cv2.VideoWriter_fourcc(*'mp4v'), 24,
        (frames[0].shape[1], frames[0].shape[0]))
    for clip_frames in video_clips:
        for frame in clip_frames:
            concatenated_clip.write(frame)
    concatenated_clip.release()

    # Play the concatenated video
    cap_concatenated = cv2.VideoCapture('concatenated_video5.mp4')
    while True:
        ret, frame = cap_concatenated.read()
        if not ret:
            break
        cv2.imshow("Concatenated Video", frame)
        if cv2.waitKey(1) & 0xFF == 27:
            break
    cap_concatenated.release()
    cv2.destroyAllWindows()
else:
    print("No video clips to concatenate.")
```

[178]:
```
#path = valdf.Path[40]
#print(path)
#path = '/home/kristian/ASL_Citizen/videos/7246944741037324-CONFUSED.mp4'

#path = 0
#path = '/home/kristian/Capstone/Sign_Videos_DF/BASKETBALL/BASKETBALL_video_1.
 ↪mp4'
path = 'concatenated_video5.mp4'
cap = cv2.VideoCapture(path)
#cap = cv2.VideoCapture(0)
#print(frames_from_file(path))
print(path)
sequence = [np.zeros(399)] * 130
inference_times = []
predictions = ['None']
threshold = 0.8
i = 0
width = int(cap.get(cv2.CAP_PROP_FRAME_WIDTH))
height = int(cap.get(cv2.CAP_PROP_FRAME_HEIGHT))
frame_count = 0
total_inference_time = 0
writer= cv2.VideoWriter('test5.avi', cv2.VideoWriter_fourcc(*'XVID'), 24,␣
 ↪(width,height))
```

```
cap = cv2.VideoCapture(path)
#cap = cv2.VideoCapture(0)
fps = cap.get(cv2.CAP_PROP_FPS)
print(fps)
# Loop through the video frames
while cap.isOpened():
    # Read a frame from the video
    success, frame = cap.read()

    if success:
        fps = cap.get(cv2.CAP_PROP_FPS)
        start_time = time.time()

        frame_rgb = cv2.cvtColor(frame, cv2.COLOR_BGR2RGB)
        result_generator = inferencer(frame,
                                      show=False,
                                      return_vis=True,
                                      return_datasample=False)
        result = next(result_generator)

        # Extract the keypoints from the results object
        if np.array(result['predictions'][0][0]['keypoints']).shape == (133,
                                                                        2):
            keypoint = np.array(
                result['predictions'][0][0]['keypoints']).flatten()
            keypoint = np.append(
                np.array(result['predictions'][0][0]['keypoint_scores']),
                keypoint)
        else:
            keypoint = np.zeros(399)

        # Initialize an empty list to store the keypoints for each frame
        sequence = np.array(sequence)
        sequence = sequence.reshape(1, -1)
        sequence = scaler.inverse_transform(sequence).reshape(130, 399)
        sequence = sequence.tolist()
        sequence.append(keypoint)
        sequence.pop(0)  # Remove the oldest element
        sequence = np.array(sequence)
        sequence = sequence.reshape(1, -1)
        sequence = scaler.transform(sequence).reshape(130, 399)
        sequence = sequence.tolist()

        i = i + 1
        if i == fps / 2:
            i = 0
```

```
            res = reconstructed_model.predict(np.expand_dims(sequence,
                                                              axis=0))[0]
            if res[np.argmax(res)] > threshold:
                print(inv_label_map[np.argmax(res)])
                predictions.append(inv_label_map[np.argmax(res)])

        # Calculate inference time for this frame
        end_time = time.time()
        inference_time = end_time - start_time
        inference_times.append(inference_time)

        image_array = cv2.cvtColor(result['visualization'][0],
                                   cv2.COLOR_RGB2BGR)

        #Write prediction and time
        image_array = cv2.putText(image_array,
                                  f'Inference Time: {inference_time:.2f} sec',
                                  (10, image_array.shape[0] - 10),
                                  cv2.FONT_HERSHEY_SIMPLEX, 1.0, (0, 255, 0),
                                  2)

        image_array = cv2.putText(image_array,
                                  'Last Prediction:' + predictions[-1],
                                  (10, 30), cv2.FONT_HERSHEY_SIMPLEX, 1.0,
                                  (0, 255, 0), 2)

        writer.write(image_array)
        cv2.imshow("RTMPose Inference", image_array)

        # Break the loop if 'q' is pressed
        if cv2.waitKey(1) & 0xFF == ord("q"):
            break
    else:
        # Break the loop if the end of the video is reached
        break

# Release the video capture object and close the display window
cap.release()
cv2.destroyAllWindows()

# Calculate average inference time
average_inference_time = np.mean(inference_times)
print(f'Average Inference Time: {average_inference_time:.2f} seconds')
```

Inference

```
Average Inference Time: 0.14 seconds
```

[179]:
```
cap.release()
cv2.destroyAllWindows()
```

[19]:
```
time_intervals = [i / fps for i in range(len(inference_times))]

mean_inference_time = np.mean(inference_times)

plt.figure(figsize=(10, 6))
plt.plot(time_intervals, inference_times, label='Inference Time (seconds)')
plt.axhline(mean_inference_time,
            color='red',
            linestyle='--',
            label=f'Mean: {mean_inference_time:.2f} sec')

plt.xlabel('Time (seconds)')
plt.ylabel('Inference Time (seconds)')
plt.legend()

plt.title('Inference Time vs. Time Predicting Every Frame (in seconds)')
plt.grid()
plt.show()
```

[17]:
```
import matplotlib.pyplot as plt
import numpy as np

time_intervals = [i / fps for i in range(len(inference_times))]

mean_inference_time = np.mean(inference_times)

plt.figure(figsize=(10, 6))
plt.plot(time_intervals, inference_times, label='Inference Time (seconds)')
plt.axhline(mean_inference_time,
            color='red',
            linestyle='--',
            label=f'Mean: {mean_inference_time:.2f} sec')

plt.xlabel('Time (seconds)')
plt.ylabel('Inference Time (seconds)')
plt.legend()

plt.title('Inference Time vs. Time Predicting Every Half Second (in seconds)')
plt.grid()
plt.show()
```

[ ]:

```

```