

# Cspnext ASL Citizen

September 23, 2023

## 1 EDA

```
[148]: 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 numpy as np

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

```
[127]: cv2.__version__
```

```
[127]: '4.8.0'
```

```
[126]: inferencer = Pose2DInferencer(
    device='cuda',
    model='cspnext-m_udp_8xb64-210e_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/cspnext-m\\_udp-coco-wholebody\\_pt-in1k\\_210e-256x192-320fa258\\_20230123.pth](https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/cspnext-m_udp-coco-wholebody_pt-in1k_210e-256x192-320fa258_20230123.pth)

09/23 16:24:36 - mmengine - **WARNING** - Failed to search registry with scope "mmpose" in the "function" registry tree. As a workaround, the current "function" registry in "mmengine" is used to build instance. This may cause unexpected failure when running the built modules. Please check whether "mmpose" is a correct scope, or whether the registry is initialized.

09/23 16:24:37 - mmengine - **WARNING** - `Visualizer` backend is not initialized because save\_dir is None.

Loads checkpoint by http backend from path: [https://download.openmmlab.com/mmdetection/v2.0/yolox/yolox\\_tiny\\_8x8\\_300e\\_coco/yolox\\_tiny\\_8x8\\_300e\\_coco\\_20211124\\_171](https://download.openmmlab.com/mmdetection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171)

```
234-b4047906.pth
09/23 16:24:37 - mmengine - WARNING - Failed to search registry
with scope "mmdet" in the "function" registry tree. As a workaround, the current
"function" registry in "mmengine" is used to build instance. This may cause
unexpected failure when running the built modules. Please check whether "mmdet"
is a correct scope, or whether the registry is initialized.
```

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

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

```
[129]: result_generator = inferencer('demo.jpg',
                                  show=True,
                                  return_vis=True,
                                  return_datasample=False,
                                  wait_time=5)
result = next(result_generator)
cv2.destroyAllWindows()
```

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Output()
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```
[130]: result['visualization'][0]
```

```
[130]: array([[[ 0,  34,  59],
   [ 0,  34,  59],
   [ 1,  35,  60],
   ...,
   [ 0,  33,  58],
   [ 0,  33,  58],
   [ 0,  33,  58]],

   [[ 1,  35,  60],
   [ 1,  35,  60],
   [ 2,  36,  61],
   ...,
   [ 0,  33,  58],
   [ 0,  33,  58],
   [ 0,  33,  58]],
```

```

[[ 3, 37, 62],
 [ 3, 37, 62],
 [ 3, 37, 62],
 ...,
 [ 0, 33, 58],
 [ 0, 33, 58],
 [ 0, 33, 58]],

...,

[[ 95, 74, 69],
 [ 94, 74, 67],
 [ 92, 71, 66],
 ...,
 [ 2, 2, 2],
 [ 1, 1, 1],
 [ 0, 0, 0]],

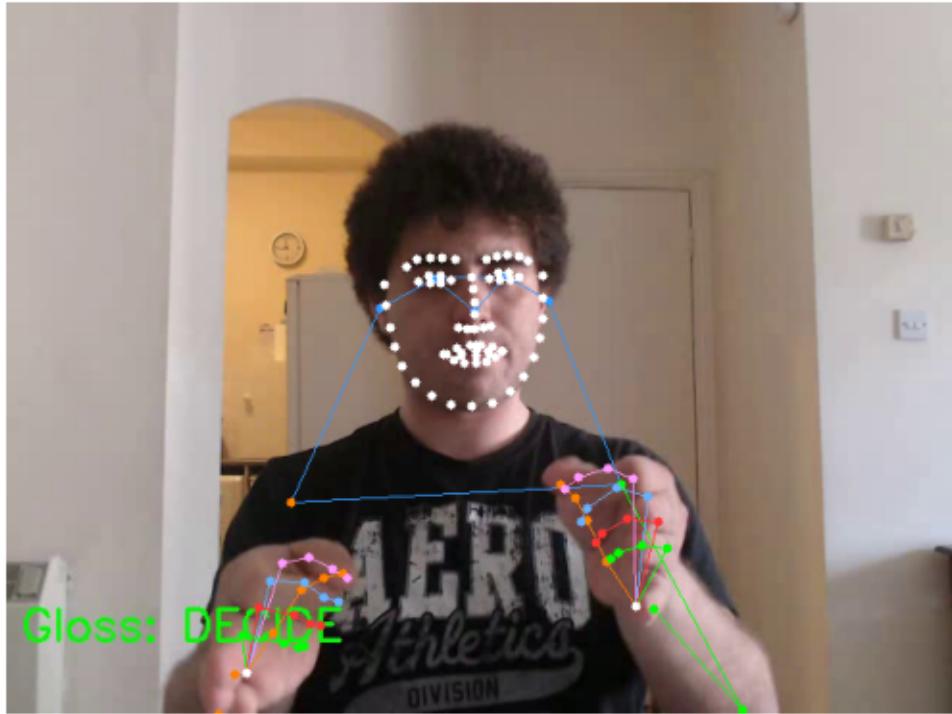
[[103, 84, 80],
 [ 99, 80, 74],
 [ 95, 76, 72],
 ...,
 [ 2, 2, 2],
 [ 1, 1, 1],
 [ 0, 0, 0]],

[[102, 84, 80],
 [ 98, 80, 76],
 [ 95, 76, 72],
 ...,
 [ 2, 2, 2],
 [ 1, 1, 1],
 [ 0, 0, 0]], dtype=uint8)

```

```
[158]: # Assuming the given data is stored in the variable 'data'
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()
```



```
[160]: # Assuming the given data is stored in the variable 'data'  
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()
```

```
[161]: # 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("CspNet Next 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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```
[162]: result['predictions'][0][0]['keypoints']
```

```
[162]: [[340.38791996268355, 222.4053898186179],  
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```

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[354.2214197073531, 186.67399653993607],  
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[635.0754463959713, 600.7667090876937],  
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[197.38599096613433, 342.70675987984237],  
[199.11514072574334, 334.47019284426256],  
[205.0409923280754, 322.31320954503735],  
[206.5652241806473, 314.5994073548022],

```
[195.01585244262583, 321.63472751171753],  
[188.2764329572479, 316.9117195752102],  
[190.4686176470181, 311.9199674579145],  
[193.5654035055229, 309.54107933802277],  
[184.3642893200988, 325.03229891090837],  
[179.3055818016465, 320.66533600415164],  
[184.8353636970631, 317.20298913545116],  
[190.36082671517897, 314.4560131097603],  
[181.34222154723523, 328.20121570339893],  
[180.04872533736875, 324.34861563544143],  
[183.20954521368702, 323.9502805060788],  
[186.31715591832506, 323.00897570610755],  
[180.3806705261315, 330.7715895534161],  
[180.974061139384, 327.616356028728],  
[182.35677057256095, 328.5432973984622],  
[183.5566341258837, 329.7647491023906]]
```

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

```
[163]: (133, 2)
```

```
[66]: 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()
```

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

```
Output()
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`Output()`

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```
[168]: test_flip = extract_keypoints_from_file_flip(  
        'file://media/kristian/HDD/ASL_Citizen/ASL_Citizen/videos/  
        ↴0023159093449660606-CAFETERIA.mp4'  
)
```

Output()

`Output()`

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Output()
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Output()
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```
[169]: test[0]
```

```
[169]: array([8.82143259e-01, 9.41623032e-01, 9.40438986e-01, 8.79736423e-01,
 9.21689272e-01, 8.11476707e-01, 7.92172372e-01, 6.15188539e-01,
 3.82438302e-01, 2.66277045e-02, 1.88575797e-02, 5.30553572e-02,
 2.40469128e-02, 6.66843876e-02, 2.75597367e-02, 5.61714321e-02,
 2.21673474e-02, 1.94816533e-02, 9.87884682e-03, 6.82943687e-03,
 1.56321421e-01, 9.98151973e-02, 7.35376263e-03, 9.33728397e-01,
 9.36857581e-01, 8.94915521e-01, 9.23893869e-01, 9.41972435e-01,
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 7.85277709e-02, 4.38759811e-02, 5.10901213e-02, 7.62097836e-02,
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5.32173552e-02, 3.60253528e-02, 4.28743809e-02, 4.62896116e-02,  
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 2.13714654e+02, 3.18616064e+02, 2.10007439e+02, 4.02086621e+02,  
 2.32248244e+02, 2.83765725e+02, 2.23662786e+02, 4.75781970e+02,  
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 2.39163901e+02, 2.90626270e+02, 2.54492053e+02, 2.94869374e+02,  
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 2.92989415e+02, 3.24389292e+02, 3.01118957e+02, 3.38501085e+02,  
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```
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2.81767804e+02, 4.20930390e+02, 2.21161046e+02, 4.21632666e+02,  
2.16097019e+02, 4.52753197e+02, 2.81708520e+02, 4.52334005e+02,  
2.81900270e+02, 4.49532999e+02, 2.82770965e+02, 4.34911824e+02,  
2.15733135e+02, 4.53230092e+02, 2.81611495e+02, 4.53942011e+02,  
2.81619242e+02, 6.26855267e+02, 6.09684806e+02, 6.26882172e+02,  
6.09930102e+02, 4.55337068e+02, 2.81829138e+02, 4.54926268e+02,  
2.82099871e+02, 6.26836192e+02, 6.10148552e+02, 6.26873176e+02,  
6.09903588e+02, 1.01902039e+02, 4.43424642e+02, 1.02249185e+02,  
4.32452945e+02, 1.02405320e+02, 4.27920171e+02, 1.02286355e+02,  
4.25323872e+02, 2.64666183e+02, 2.60800415e+02, 1.02125637e+02,  
4.30600777e+02, 2.58769301e+02, 2.55489021e+02, 2.62964801e+02,  
2.47623086e+02, 2.64203739e+02, 2.43809939e+02, 1.02213322e+02,  
4.37099522e+02, 2.51648130e+02, 2.56425089e+02, 2.57451689e+02,  
2.51376991e+02, 2.59263949e+02, 2.48364297e+02, 1.02135723e+02,  
4.46341844e+02, 2.49789609e+02, 2.57930110e+02, 2.51346564e+02,  
2.57074309e+02, 1.22685615e+02, 4.40745196e+02, 1.19209419e+02,  
4.59100293e+02, 1.20393968e+02, 4.54166785e+02, 2.48728166e+02,  
2.59568716e+02, 2.48612050e+02, 2.59690950e+02])
```

```
[170]: test_flip[0]
```

```
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6.62090108e-02, 5.59023693e-02, 2.70892307e-02, 5.89044765e-03,  
2.83485893e-02, 6.65203575e-03, 9.55008063e-03, 6.03237795e-03,  
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9.55755949e-01, 9.33971584e-01, 9.35433447e-01, 9.18531477e-01,
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2.70622403e+02, 2.90527089e+02, 2.71412467e+02, 3.95068902e+02,
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3.17603369e+02, 1.92284870e+02, 3.08920794e+02, 2.14473062e+02,
3.95195302e+02, 2.11615803e+02, 4.05999129e+02, 1.86446180e+02,
3.15398839e+02, 2.12717761e+02, 3.95664163e+02, 2.11649083e+02,
4.10545320e+02, 2.10851609e+02, 4.18943514e+02])

```

[171]: test.shape

[171]: (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()

	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

[132]: traindf.tail()

	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'

[134]: # Open the video file
#video_path = 0
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("CspNet Next 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()
```

[ERROR:0@188.779] global cap.cpp:164 open VIDEOIO(CV\_IMAGES): raised OpenCV exception:

OpenCV(4.8.0) /io/opencv/modules/videoio/src/cap\_images.cpp:267: error:  
(-215:Assertion failed) number < max\_number in function 'icvExtractPattern'

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

	Participant ID	Video file	Gloss \	
[135]:	21755	P52	39017907015121867-seedMESS.mp4	MESS

37395	P31	4148502782625585-UNIVERSE.mp4	UNIVERSE
22536	P4	0909056403412476-MOVE.mp4	MOVE
22149	P50	24781695300999185-MIX 3.mp4	MIX2
23756	P37	5180931702231095-OFFEND.mp4	OFFEND
15977	P33	9526781160149522-HAMBURGER.mp4	HAMBURGER
30551	P45	5529327143293021-SHARPEN 1.mp4	SHARPEN1
9483	P40	9553318754297411-DIP 3.mp4	DIP3
26161	P32	1596543216308992-PLANT.mp4	PLANT
33442	P23	4059043146141006-STETHOSCOPE 4.mp4	STETHOSCOPE3
4024	P38	12301657845922032-BRAIDS.mp4	BRAIDS
5046	P16	629918688259232-CANCEL.mp4	CANCEL1
32359	P29	2404786212034853-SOMERSAULT 2.mp4	SOMERSAULT1
7971	P36	7835139700219875-CRACKER 2.mp4	CRACKER2
274	P40	8384344275744424-ACTION.mp4	ACTION
35139	P40	3274515703834051-TEAR RIP_2.mp4	TEARRIP2
22398	P52	019021288975465955-seedMOSQUITO.mp4	MOSQUITO
7681	P34	8153384297148962-COPY.mp4	COPY
20698	P20	7764622739129698-LONG WORD.mp4	LONGWORD
10857	P7	06467313990217516-EARS UP.mp4	EARSUP

#### ASL-LEX Code

#### Path \

21755	J_03_008	file:///home/kristian/ASL_Citizen/videos/3901...
37395	K_01_127	file:///home/kristian/ASL_Citizen/videos/41485...
22536	D_03_090	file:///home/kristian/ASL_Citizen/videos/09090...
22149	K_03_118	file:///home/kristian/ASL_Citizen/videos/24781...
23756	D_03_039	file:///home/kristian/ASL_Citizen/videos/51809...
15977	A_01_004	file:///home/kristian/ASL_Citizen/videos/95267...
30551	H_03_060	file:///home/kristian/ASL_Citizen/videos/55293...
9483	K_02_052	file:///home/kristian/ASL_Citizen/videos/95533...
26161	E_01_029	file:///home/kristian/ASL_Citizen/videos/15965...
33442	K_02_031	file:///home/kristian/ASL_Citizen/videos/40590...
4024	K_03_125	file:///home/kristian/ASL_Citizen/videos/12301...
5046	F_03_083	file:///home/kristian/ASL_Citizen/videos/62991...
32359	K_02_118	file:///home/kristian/ASL_Citizen/videos/24047...
7971	K_03_093	file:///home/kristian/ASL_Citizen/videos/78351...
274	C_01_026	file:///home/kristian/ASL_Citizen/videos/83843...
35139	K_03_050	file:///home/kristian/ASL_Citizen/videos/32745...
22398	H_03_053	file:///home/kristian/ASL_Citizen/videos/01902...
7681	D_01_064	file:///home/kristian/ASL_Citizen/videos/81533...
20698	H_02_047	file:///home/kristian/ASL_Citizen/videos/77646...
10857	E_02_099	file:///home/kristian/ASL_Citizen/videos/06467...

#### Frequency

21755	16
37395	13
22536	15
22149	15

```

23756      17
15977      13
30551      16
9483       15
26161      16
33442      13
4024       16
5046       15
32359      16
7971       16
274        14
35139      15
22398      16
7681       17
20698      14
10857      14

```

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

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

	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

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

	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

```

[139]: traindf.describe()

```

[139]:      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()

	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

```

[144]: valdf.tail()

	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')

```

[146]: testdf.head()

	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

[147]: testdf.tail()

	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)
```

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

	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

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

	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
```

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

```
[152]:      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
```

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

```
[153]:   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)
```

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

```
[155]: 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

[ ]: testdf.tail()

[157]: testdf.describe()

[157]:

	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
```

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

```
Output()
```

```
Output()
```

```
Output()
```

```
Output()
```

`Output()`

[172]: (100, 399)

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

Output()

Output()

Output()

Output()

Output()

Output()

Output()

Output()

`Output()`

```
Output()
```

[173]: `numpy.ndarray`

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

100

```
[175]: 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
```

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

```
[176]: 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
```

```
[ ]:
```

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

```
[167]: (83, 29, 3, 640, 480)
```

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

```
100%| 950/950 [00:45<00:00, 20.96it/s]
```

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

```
[169]:   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

```

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

[170]: 540

[171]: `traindf.describe()`

	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

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

	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

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

	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

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

	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
```

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

```
50
```

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

```
100%| 191/191 [00:07<00:00, 25.30it/s]
```

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

```
[177]: 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
```

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

```
[178]: 207
```

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

```
[179]:   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

```

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

```
[180]:    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
```

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

```
[181]:    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
```

```
[182]: valdf.tail(60)
```

	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

[183]: valdf.head(10)

	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

[184]: `valdf.describe()`

	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

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

50

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

100% | 729/729 [00:31<00:00, 23.20it/s]

[187]: `testdf.head()`

```
[187]: 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
```

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

```
[188]: 234
```

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

```
[189]:    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
```

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

```
[190]:    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

```

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

```
[191]:      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
```

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

```
[192]:   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

[193]: testdf.head(10)

	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

```

[194]: testdf.describe()

	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

[195]: print(testdf['Gloss'].nunique())

50

## 2 Keypoint Collection

```

[ ]: keypoints_series = traindf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/train_keypoints.npy",
    keypoints_series)
keypoints_series = traindf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/train_keypoints_flip.
    npy",
    keypoints_series)
keypoints_series = testdf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/test_keypoints.npy",
    keypoints_series)
keypoints_series = testdf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/test_keypoints_flip.
    npy",
    keypoints_series)

```

```

keypoints_series = valdf['Path'].progress_apply(extract_keypoints_from_file)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/val_keypoints.npy",
    keypoints_series)
keypoints_series = valdf['Path'].progress_apply(
    extract_keypoints_from_file_flip)
np.save(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/val_keypoints_flip.
    npy",
    keypoints_series)

```

### 3 Preprocessing

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

```
[89]: train_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/train_keypoints.npy",
    allow_pickle=True)
val_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/val_keypoints.npy",
    allow_pickle=True)
test_keypoints = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/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/CSPnext/train_keypoints_flip.
    npy",
    allow_pickle=True)
val_keypoints_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/val_keypoints_flip.
    npy",
    allow_pickle=True)
test_keypoints_flip = np.load(
    "/home/kristian/Capstone/keypoints/ASL_Citizen/CSPnext/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)

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

```
[206]: 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
```

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

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

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

```
[209]: 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
```

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

```
[210]:   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
```

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

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

```
[212]:   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

```

[213]: valdf.tail()

```

[213]:   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    032677896012150764-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

```

[214]: testdf['Cat\_label'] = encoder.fit\_transform(testdf[['Gloss']]).astype(int)  
testdf = testdf.sort\_values(by='Gloss', )

[215]: testdf.head()

```

[215]:   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

```

[216]: `testdf.tail()`

```

[216]:   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()}
```

```
[220]: inv_label_map
```

```
[220]: {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'}
```

```
[221]: inv_label_map[0]
```

```
[221]: 'AXE'
```

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

```
[222]: Participant ID          Video file      Gloss ASL-LEX Code \
738        P31      8181455878756794-SINK.mp4      SINK      E_02_042
668        P27      4255829936145523-RAZOR 2.mp4      RAZOR      K_03_103
690        P40      3476425948425619-RIVER.mp4      RIVER      A_03_035
142        P16      14386294518453524-CHRISTMAS.mp4    CHRISTMAS  F_03_029
416        P29      2586710992257413-GUESS.mp4      GUESS      D_02_013
45         P4       9779859866933089-BASKETBALL.mp4    BASKETBALL A_03_045
303        P31      7744888594683579-DRAG.mp4      DRAG      J_02_039
622        P50      8214132465485497-NOON.mp4      NOON      G_02_014
358        P20      36752310622942996-ELEVATOR.mp4    ELEVATOR  G_03_036
211        P27      9451130688097962-DECIDE.mp4      DECIDE    B_02_074
```

```
Path   Frequency  Frames \
738  file:///home/kristian/ASL_Citizen/videos/81814...      14      94
668  file:///home/kristian/ASL_Citizen/videos/42558...      13      83
690  file:///home/kristian/ASL_Citizen/videos/34764...      15     103
142  file:///home/kristian/ASL_Citizen/videos/14386...      17      56
416  file:///home/kristian/ASL_Citizen/videos/25867...      15      48
45   file:///home/kristian/ASL_Citizen/videos/97798...      17     120
303  file:///home/kristian/ASL_Citizen/videos/77448...      16     111
622  file:///home/kristian/ASL_Citizen/videos/82141...      17      75
358  file:///home/kristian/ASL_Citizen/videos/36752...      17      72
211  file:///home/kristian/ASL_Citizen/videos/94511...      17      54
```

	FPS	Length	Width	Height	Cat_label
738	30	3	640	480	45
668	29	3	640	480	41
690	30	3	640	480	42
142	30	2	640	480	8
416	30	2	640	480	25
45	30	4	640	480	2
303	30	4	640	480	18
622	30	2	640	480	38
358	30	2	640	480	21
211	29	2	640	480	12

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

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

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

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

```
[227]: Ytrain
```

```
[227]: array([[ 0.],
   [ 0.],
   [ 0.],
   [ 0.],
   [ 0.],
   [ 0.]])
```





















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```
[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)
```

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

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

```
[237]: (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]: 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)
```

```
[159]: 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.          ],
  ...,
  [0.92521965, 0.96203432, 0.94232939, ..., 0.62990154,
   0.30816935, 0.39157613],
  [0.93134978, 0.96042015, 0.94408182, ..., 0.82756123,
   0.04570193, 0.19082419],
  [0.93541483, 0.95992051, 0.94518072, ..., 0.76602721,
   0.08255193, 0.05653119]],

  [[[0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  ...,
  [0.94342242, 0.91127282, 0.94222529, ..., 0.55980526,
   0.22405324, 0.29297146],
  [0.93140801, 0.92215728, 0.94053198, ..., 0.58351268,
   0.0323885 , 0.13975692],
  [0.93215593, 0.942232 , 0.9387416 , ..., 0.56146342,
   0.04766226, 0.0577154 ]],

  [[[0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  ...,
  [0.96441616, 0.96031935, 0.97893411, ..., 0.67657878,
   0.06438163, 0.35334064],
  [0.96778606, 0.96000502, 0.97796118, ..., 0.72501748,
   0.00846105, 0.17037499],
  [0.96712051, 0.95895687, 0.97753643, ..., 0.66242493,
   0.01493493, 0.04899012]],

  ...,
  [[[0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  [0.          , 0.          , 0.          , ..., 0.          ,
   0.          , 0.          ],
  ...,
  [0.96441616, 0.96031935, 0.97893411, ..., 0.67657878,
   0.06438163, 0.35334064],
  [0.96778606, 0.96000502, 0.97796118, ..., 0.72501748,
   0.00846105, 0.17037499],
  [0.96712051, 0.95895687, 0.97753643, ..., 0.66242493,
   0.01493493, 0.04899012]]]
```

```

0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
..., [0.94823539, 0.98182878, 0.95895482, ..., 0.47942304,
0.00554882, 0.25021535],
[0.93889049, 0.98050154, 0.96381785, ..., 0.54053235,
0.0072413 , 0.12710562],
[0.93663503, 0.97441783, 0.96610103, ..., 0.47736444,
0.01242928, 0.03555301]],

[[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
..., [0.94690078, 0.94252239, 0.96160128, ..., 0.65363488,
0.21933207, 0.33942024],
[0.93924798, 0.96814759, 0.95298204, ..., 0.72188129,
0.02953083, 0.16924235],
[0.93349577, 0.96389743, 0.95745327, ..., 0.65926345,
0.05285527, 0.0486798 ]],

[[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
[0.        , 0.        , 0.        , ..., 0.        ,
0.        , 0.        ],
..., [0.99027064, 0.94314502, 0.97771284, ..., 0.72005445,
0.03503745, 0.37021053],
[0.99011802, 0.94290185, 0.97696868, ..., 0.78796738,
0.00307658, 0.18432917],
[0.98845691, 0.93931175, 0.97913474, ..., 0.71153023,
0.01151423, 0.0517321 ]])

```

[246]: Ytrain

```

[246]: 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)
```

```
[247]: Yval.shape
```

```
[247]: (324, 50)
```

```
[248]: Xval.shape
```

```
[248]: (324, 130, 399)
```

## 4 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})
```

## 4.1 Hyperparameter Tuning 1 LSTM Layer

```
[125]: 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)
```

```
[126]: 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/CSPNext/hyperband/',
    project_name='1_LSTM',
    overwrite=False)
```

The history saving thread hit an unexpected error (OperationalError('database is locked')).History will not be written to the database.

INFO:tensorflow:Reloading Tuner from  
/media/kristian/HDD/ASL\_Citizen/CSPNext/hyperband/1\_LSTM/tuner0.json

```
[127]: 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'}
```

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

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

```
Trial 725 Complete [00h 02m 38s]
val_f1_score: 0.0019229152239859104
```

```
Best val_f1_score So Far: 0.6036034822463989
Total elapsed time: 11h 10m 04s
INFO:tensorflow:Oracle triggered exit
```

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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/1_LSTM
Showing 10 best trials
```

```
Objective(name="val_f1_score", direction="max")

Trial 0671 summary
Hyperparameters:
dense_activation: gelu
units_1: 150
regularizer_1: 0.000334067220168496
dropout_1: 0.4
units_2: 100
dropout_2: 0.2
learning_rate: 0.0003401691826873532
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0665
Score: 0.6036034822463989

Trial 0426 summary
Hyperparameters:
dense_activation: elu
units_1: 150
regularizer_1: 0.00011974213314597185
dropout_1: 0.2
units_2: 100
dropout_2: 0.25
learning_rate: 0.0003033525380540957
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0422
Score: 0.5896454453468323

Trial 0598 summary
Hyperparameters:
dense_activation: selu
units_1: 100
regularizer_1: 0.00031379448250526605
dropout_1: 0.1
units_2: 70
dropout_2: 0.1
learning_rate: 0.0002832574472375902
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0593
```

Score: 0.5736761093139648

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: 0.5580940544605255

Trial 0422 summary  
Hyperparameters:  
dense\_activation: elu  
units\_1: 150  
regularizer\_1: 0.00011974213314597185  
dropout\_1: 0.2  
units\_2: 100  
dropout\_2: 0.25  
learning\_rate: 0.0003033525380540957  
tuner/epochs: 100  
tuner/initial\_epoch: 34  
tuner/bracket: 5  
tuner/round: 4  
tuner/trial\_id: 0411  
Score: 0.5492494702339172

Trial 0593 summary  
Hyperparameters:  
dense\_activation: selu  
units\_1: 100  
regularizer\_1: 0.00031379448250526605  
dropout\_1: 0.1  
units\_2: 70  
dropout\_2: 0.1  
learning\_rate: 0.0002832574472375902  
tuner/epochs: 100  
tuner/initial\_epoch: 34  
tuner/bracket: 4  
tuner/round: 3  
tuner/trial\_id: 0587

Score: 0.5490592420101166

Trial 0599 summary

Hyperparameters:

dense\_activation: selu  
units\_1: 150  
regularizer\_1: 0.0015359876270177853  
dropout\_1: 0.05  
units\_2: 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: 0594  
Score: 0.540589451789856

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: 0.536371111869812

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: 0.5176999866962433
```

```
Trial 0594 summary
Hyperparameters:
dense_activation: selu
units_1: 150
regularizer_1: 0.0015359876270177853
dropout_1: 0.05
units_2: 120
dropout_2: 0.35000000000000003
learning_rate: 0.0001792680161103088
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0590
Score: 0.5036843717098236
```

```
[132]: 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
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:Detecting that an object or model or tf.train.Checkpoint is
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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
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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
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.8
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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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object: (root).optimizer._variables.13
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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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```

```
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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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
```

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

```
11/11 [=====] - 1s 19ms/step - loss: 1.9230 - f1_score: 0.6088
```

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

```
84/84 [=====] - 1s 17ms/step - loss: 0.2982 - f1_score: 0.9203
```

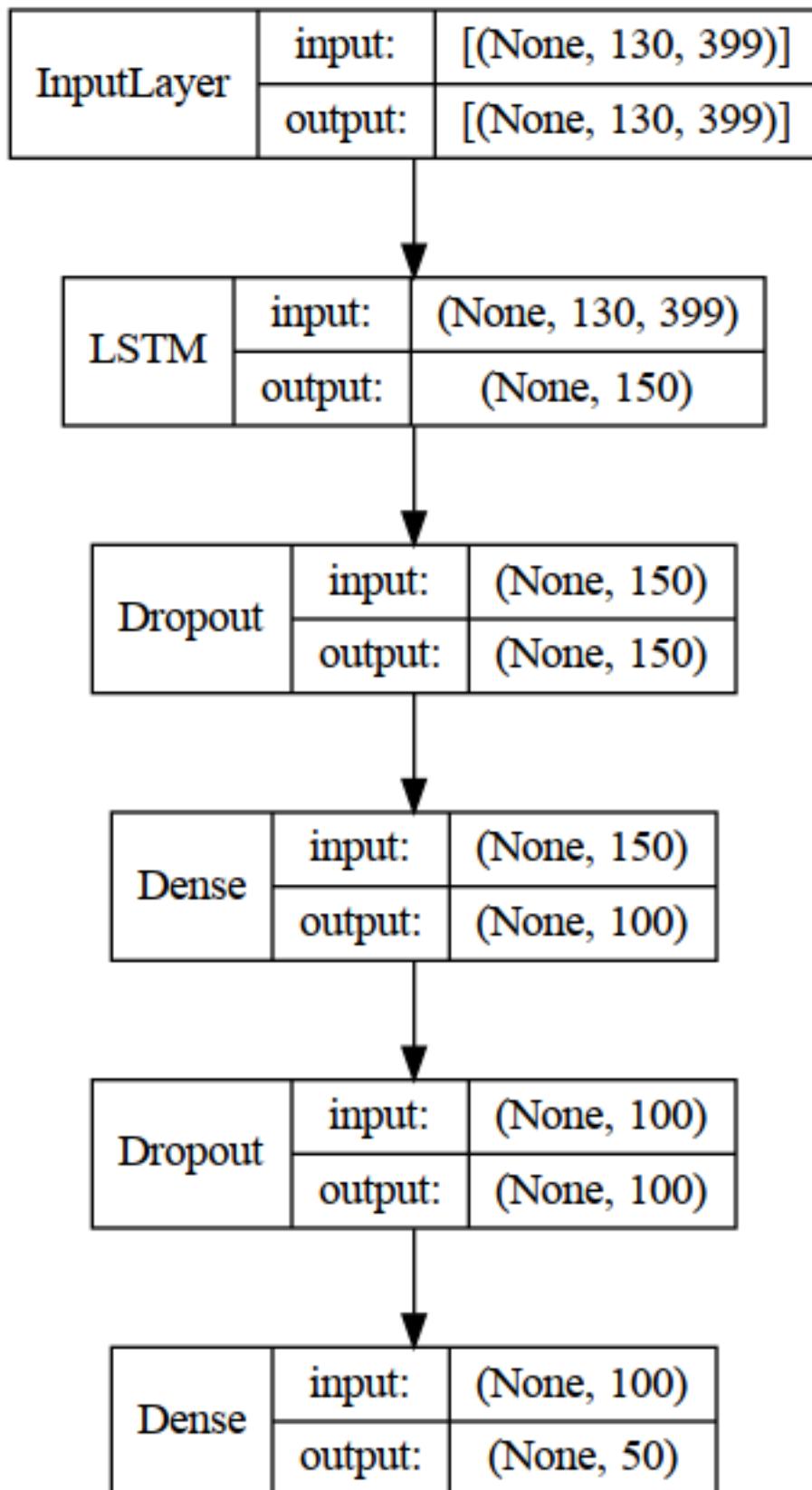
```
[135]: best_model.summary()
```

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
<hr/>		
lstm (LSTM)	(None, 150)	330000
dropout (Dropout)	(None, 150)	0
dense (Dense)	(None, 100)	15100
dropout_1 (Dropout)	(None, 100)	0
dense_1 (Dense)	(None, 50)	5050
<hr/>		
Total params: 350,150		
Trainable params: 350,150		
Non-trainable params: 0		

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

```
[136]:
```



```
[137]: 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 14ms/step

	precision	recall	f1-score	support
AXE	0.778	0.875	0.824	8
BACKPACK	0.500	0.667	0.571	6
BASKETBALL	0.889	0.800	0.842	10
BEE	0.375	0.300	0.333	10
BELT	0.800	1.000	0.889	4
BITE	1.000	0.375	0.545	8
BREAKFAST	0.571	0.667	0.615	6
CANCER	0.500	0.500	0.500	8
CHRISTMAS	0.800	0.667	0.727	6
CONFUSED	0.600	0.500	0.545	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	0.625	0.625	0.625	8
DEVELOP	0.500	0.500	0.500	6
DINNER	1.000	0.375	0.545	8
DOG	0.375	0.500	0.429	6
DOWNSIZE	1.000	0.750	0.857	8
DRAG	0.500	0.500	0.500	4
EAT	0.200	0.167	0.182	6
EDIT	1.000	0.833	0.909	6
ELEVATOR	0.312	0.625	0.417	8
FINE	0.000	0.000	0.000	4
FLOAT	0.333	0.250	0.286	4
FOREIGNER	0.571	0.667	0.615	6
GUESS	0.800	1.000	0.889	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	0.750	0.857	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.417	0.625	0.500	8
LUNCH	1.000	0.375	0.545	8
MAPLE	0.667	0.500	0.571	4
MEAT	1.000	1.000	1.000	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.875	0.933	8

MOVIE	0.545	0.750	0.632	8
NOON	1.000	0.750	0.857	8
PARTY	1.000	0.750	0.857	8
PATIENT	0.250	0.500	0.333	6
RAZOR	0.286	0.500	0.364	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.727	1.000	0.842	8
SHAVE	0.286	0.200	0.235	10
SINK	0.667	0.333	0.444	6
SQUEEZE	0.500	0.250	0.333	4
THEY	1.000	0.500	0.667	4
TWINS	0.556	0.625	0.588	8
WHATFOR	0.500	0.500	0.500	10
accuracy			0.614	324
macro avg	0.652	0.605	0.609	324
weighted avg	0.662	0.614	0.617	324

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

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

```
[140]: 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: 4.1027 - f1\_score: 0.0127

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 [=====] - 37s 1s/step - loss: 4.1027 - f1_score: 0.0127 - val_loss: 4.0776 - val_f1_score: 0.0011
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 4.0808 - f1_score: 0.0107

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 [=====] - 23s 834ms/step - loss: 4.0808 - f1_score: 0.0107 - val_loss: 4.0682 - val_f1_score: 0.0033
Epoch 3/500
28/28 [=====] - 2s 80ms/step - loss: 4.0631 - f1_score: 0.0089 - val_loss: 4.0602 - val_f1_score: 0.0033
Epoch 4/500
28/28 [=====] - 2s 80ms/step - loss: 4.0558 - f1_score: 0.0145 - val_loss: 4.0526 - val_f1_score: 0.0021
Epoch 5/500
28/28 [=====] - 2s 80ms/step - loss: 4.0480 - f1_score: 0.0125 - val_loss: 4.0422 - val_f1_score: 7.3260e-04
Epoch 6/500
28/28 [=====] - 2s 80ms/step - loss: 4.0395 - f1_score: 0.0126 - val_loss: 4.0385 - val_f1_score: 9.7561e-04
Epoch 7/500
28/28 [=====] - 2s 80ms/step - loss: 4.0329 - f1_score: 0.0105 - val_loss: 4.0331 - val_f1_score: 1.0000e-03
Epoch 8/500
28/28 [=====] - 2s 83ms/step - loss: 4.0277 - f1_score: 0.0140 - val_loss: 4.0275 - val_f1_score: 9.1603e-04
Epoch 9/500
28/28 [=====] - 2s 81ms/step - loss: 4.0219 - f1_score: 0.0100 - val_loss: 4.0224 - val_f1_score: 0.0019
Epoch 10/500
28/28 [=====] - 2s 80ms/step - loss: 4.0164 - f1_score: 0.0121 - val_loss: 4.0198 - val_f1_score: 0.0022
Epoch 11/500
28/28 [=====] - 2s 84ms/step - loss: 4.0119 - f1_score: 0.0152 - val_loss: 4.0137 - val_f1_score: 0.0013
Epoch 12/500
28/28 [=====] - 2s 81ms/step - loss: 4.0058 - f1_score: 0.0156 - val_loss: 4.0128 - val_f1_score: 0.0010
Epoch 13/500
28/28 [=====] - 2s 81ms/step - loss: 3.9997 - f1_score: 0.0110 - val_loss: 4.0084 - val_f1_score: 0.0027
Epoch 14/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.9982 - f1_score: 0.0144
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 456ms/step - loss: 3.9982 - f1_score: 0.0144 - val_loss: 4.0011 - val_f1_score: 0.0036
Epoch 15/500
28/28 [=====] - 2s 80ms/step - loss: 3.9933 - f1_score: 0.0139 - val_loss: 4.0001 - val_f1_score: 0.0030
Epoch 16/500
28/28 [=====] - 2s 81ms/step - loss: 3.9787 - f1_score: 0.0193 - val_loss: 3.9835 - val_f1_score: 0.0013
Epoch 17/500
28/28 [=====] - 2s 81ms/step - loss: 3.9589 - f1_score: 0.0217 - val_loss: 3.9520 - val_f1_score: 0.0035
Epoch 18/500
28/28 [=====] - ETA: 0s - loss: 3.9365 - f1_score: 0.0182
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 379ms/step - loss: 3.9365 - f1_score: 0.0182 - val_loss: 3.9219 - val_f1_score: 0.0164
Epoch 19/500
28/28 [=====] - 2s 80ms/step - loss: 3.8553 - f1_score: 0.0240 - val_loss: 3.7473 - val_f1_score: 0.0043
Epoch 20/500
28/28 [=====] - 2s 79ms/step - loss: 3.7895 - f1_score: 0.0220 - val_loss: 3.6663 - val_f1_score: 0.0065
Epoch 21/500
28/28 [=====] - 2s 80ms/step - loss: 3.7209 - f1_score: 0.0292 - val_loss: 3.6156 - val_f1_score: 0.0144
Epoch 22/500
28/28 [=====] - 2s 83ms/step - loss: 3.6806 - f1_score: 0.0284 - val_loss: 3.5969 - val_f1_score: 0.0061
Epoch 23/500
28/28 [=====] - 2s 82ms/step - loss: 3.6648 - f1_score: 0.0335 - val_loss: 3.5792 - val_f1_score: 0.0038
Epoch 24/500
```

```
28/28 [=====] - 2s 81ms/step - loss: 3.6251 - f1_score: 0.0345 - val_loss: 3.5577 - val_f1_score: 0.0149
Epoch 25/500
28/28 [=====] - 2s 84ms/step - loss: 3.5870 - f1_score: 0.0463 - val_loss: 3.5227 - val_f1_score: 0.0139
Epoch 26/500
28/28 [=====] - 2s 81ms/step - loss: 3.5485 - f1_score: 0.0440 - val_loss: 3.4466 - val_f1_score: 0.0164
Epoch 27/500
28/28 [=====] - 2s 84ms/step - loss: 3.5553 - f1_score: 0.0427 - val_loss: 3.4644 - val_f1_score: 0.0114
Epoch 28/500
28/28 [=====] - ETA: 0s - loss: 3.4865 - f1_score: 0.0523

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 437ms/step - loss: 3.4865 - f1_score: 0.0523 - val_loss: 3.3967 - val_f1_score: 0.0199
Epoch 29/500
28/28 [=====] - 2s 81ms/step - loss: 3.4295 - f1_score: 0.0514 - val_loss: 3.3375 - val_f1_score: 0.0160
Epoch 30/500
28/28 [=====] - ETA: 0s - loss: 3.4121 - f1_score: 0.0445

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 379ms/step - loss: 3.4121 - f1_score: 0.0445 - val_loss: 3.2807 - val_f1_score: 0.0249
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 3.3789 - f1_score: 0.0584

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 401ms/step - loss: 3.3789 -  
f1_score: 0.0584 - val_loss: 3.2798 - val_f1_score: 0.0351  
Epoch 32/500  
28/28 [=====] - 2s 80ms/step - loss: 3.3346 - f1_score:  
0.0610 - val_loss: 3.1988 - val_f1_score: 0.0348  
Epoch 33/500  
28/28 [=====] - ETA: 0s - loss: 3.3080 - f1_score:  
0.0616  
  
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 381ms/step - loss: 3.3080 -  
f1_score: 0.0616 - val_loss: 3.2014 - val_f1_score: 0.0445  
Epoch 34/500  
28/28 [=====] - 2s 83ms/step - loss: 3.2351 - f1_score:  
0.0742 - val_loss: 3.1792 - val_f1_score: 0.0419  
Epoch 35/500  
28/28 [=====] - 2s 81ms/step - loss: 3.2159 - f1_score:  
0.0688 - val_loss: 3.1687 - val_f1_score: 0.0322  
Epoch 36/500  
28/28 [=====] - ETA: 0s - loss: 3.1775 - f1_score:  
0.0815  
  
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 420ms/step - loss: 3.1775 -  
f1_score: 0.0815 - val_loss: 3.1150 - val_f1_score: 0.0454  
Epoch 37/500  
28/28 [=====] - 2s 80ms/step - loss: 3.1710 - f1_score:  
0.0776 - val_loss: 3.2788 - val_f1_score: 0.0268  
Epoch 38/500  
28/28 [=====] - 2s 81ms/step - loss: 3.1463 - f1_score:  
0.0711 - val_loss: 3.1285 - val_f1_score: 0.0413  
Epoch 39/500  
28/28 [=====] - ETA: 0s - loss: 3.1282 - f1_score:  
0.0814  
  
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 402ms/step - loss: 3.1282 - f1_score: 0.0814 - val_loss: 3.0358 - val_f1_score: 0.0567
Epoch 40/500
28/28 [=====] - 2s 80ms/step - loss: 3.1006 - f1_score: 0.0858 - val_loss: 3.1031 - val_f1_score: 0.0485
Epoch 41/500
28/28 [=====] - ETA: 0s - loss: 3.0701 - f1_score: 0.0913

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 351ms/step - loss: 3.0701 - f1_score: 0.0913 - val_loss: 2.9928 - val_f1_score: 0.0611
Epoch 42/500
28/28 [=====] - 2s 82ms/step - loss: 3.0759 - f1_score: 0.0865 - val_loss: 3.0510 - val_f1_score: 0.0555
Epoch 43/500
28/28 [=====] - 2s 80ms/step - loss: 3.0380 - f1_score: 0.0865 - val_loss: 3.0741 - val_f1_score: 0.0472
Epoch 44/500
28/28 [=====] - 2s 80ms/step - loss: 2.9939 - f1_score: 0.1024 - val_loss: 3.0620 - val_f1_score: 0.0566
Epoch 45/500
28/28 [=====] - ETA: 0s - loss: 2.9947 - f1_score: 0.1031

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: 2.9947 - f1_score: 0.1031 - val_loss: 3.0143 - val_f1_score: 0.0752
Epoch 46/500
28/28 [=====] - 2s 80ms/step - loss: 2.9759 - f1_score: 0.0969 - val_loss: 3.0173 - val_f1_score: 0.0622
Epoch 47/500
28/28 [=====] - ETA: 0s - loss: 2.9446 - f1_score: 0.1074
```

```
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 [=====] - 29s 1s/step - loss: 2.9446 - f1_score:
0.1074 - val_loss: 2.9461 - val_f1_score: 0.0824
Epoch 48/500
28/28 [=====] - 2s 80ms/step - loss: 2.9224 - f1_score:
0.1127 - val_loss: 2.9339 - val_f1_score: 0.0604
Epoch 49/500
28/28 [=====] - 2s 81ms/step - loss: 2.9087 - f1_score:
0.1096 - val_loss: 2.9754 - val_f1_score: 0.0673
Epoch 50/500
28/28 [=====] - 2s 81ms/step - loss: 2.8692 - f1_score:
0.1220 - val_loss: 2.9329 - val_f1_score: 0.0817
Epoch 51/500
28/28 [=====] - 2s 79ms/step - loss: 2.8607 - f1_score:
0.1238 - val_loss: 2.9003 - val_f1_score: 0.0692
Epoch 52/500
28/28 [=====] - ETA: 0s - loss: 2.8236 - f1_score:
0.1239

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 399ms/step - loss: 2.8236 -
f1_score: 0.1239 - val_loss: 2.8661 - val_f1_score: 0.0880
Epoch 53/500
28/28 [=====] - 2s 80ms/step - loss: 2.8216 - f1_score:
0.1379 - val_loss: 2.9017 - val_f1_score: 0.0721
Epoch 54/500
28/28 [=====] - ETA: 0s - loss: 2.7865 - f1_score:
0.1327

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 366ms/step - loss: 2.7865 -
f1_score: 0.1327 - val_loss: 2.8179 - val_f1_score: 0.1149
```

```
Epoch 55/500
28/28 [=====] - 2s 82ms/step - loss: 2.8068 - f1_score: 0.1435 - val_loss: 2.8467 - val_f1_score: 0.1132
Epoch 56/500
28/28 [=====] - ETA: 0s - loss: 2.7298 - f1_score: 0.1493

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 [=====] - 15s 555ms/step - loss: 2.7298 - f1_score: 0.1493 - val_loss: 2.7738 - val_f1_score: 0.1290
Epoch 57/500
28/28 [=====] - 2s 80ms/step - loss: 2.6629 - f1_score: 0.1713 - val_loss: 2.7360 - val_f1_score: 0.1258
Epoch 58/500
28/28 [=====] - ETA: 0s - loss: 2.6526 - f1_score: 0.1671

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 406ms/step - loss: 2.6526 - f1_score: 0.1671 - val_loss: 2.7716 - val_f1_score: 0.1311
Epoch 59/500
28/28 [=====] - ETA: 0s - loss: 2.6079 - f1_score: 0.1782

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: 2.6079 - f1_score: 0.1782 - val_loss: 2.7017 - val_f1_score: 0.1753
Epoch 60/500
28/28 [=====] - 2s 80ms/step - loss: 2.5895 - f1_score: 0.1899 - val_loss: 2.7337 - val_f1_score: 0.1452
Epoch 61/500
28/28 [=====] - 2s 82ms/step - loss: 2.5269 - f1_score: 0.2096 - val_loss: 2.6199 - val_f1_score: 0.1453
```

```
Epoch 62/500
28/28 [=====] - 2s 82ms/step - loss: 2.4870 - f1_score: 0.2152 - val_loss: 2.6692 - val_f1_score: 0.1400
Epoch 63/500
28/28 [=====] - 2s 82ms/step - loss: 2.4338 - f1_score: 0.2297 - val_loss: 2.5424 - val_f1_score: 0.1640
Epoch 64/500
28/28 [=====] - 2s 81ms/step - loss: 2.4103 - f1_score: 0.2332 - val_loss: 2.6921 - val_f1_score: 0.1675
Epoch 65/500
28/28 [=====] - 2s 84ms/step - loss: 2.3947 - f1_score: 0.2436 - val_loss: 2.7329 - val_f1_score: 0.1557
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 2.3235 - f1_score: 0.2559

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 370ms/step - loss: 2.3235 - f1_score: 0.2559 - val_loss: 2.5647 - val_f1_score: 0.2098
Epoch 67/500
28/28 [=====] - 2s 83ms/step - loss: 2.2486 - f1_score: 0.2806 - val_loss: 2.5880 - val_f1_score: 0.1580
Epoch 68/500
28/28 [=====] - 2s 84ms/step - loss: 2.2906 - f1_score: 0.2721 - val_loss: 2.4740 - val_f1_score: 0.2044
Epoch 69/500
28/28 [=====] - ETA: 0s - loss: 2.1990 - f1_score: 0.2848

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 [=====] - 16s 591ms/step - loss: 2.1990 - f1_score: 0.2848 - val_loss: 2.3990 - val_f1_score: 0.2753
Epoch 70/500
28/28 [=====] - 2s 80ms/step - loss: 2.1791 - f1_score: 0.2893 - val_loss: 2.3889 - val_f1_score: 0.2321
Epoch 71/500
28/28 [=====] - 2s 82ms/step - loss: 2.1512 - f1_score: 0.3020 - val_loss: 2.3585 - val_f1_score: 0.2405
```

```
Epoch 72/500
28/28 [=====] - 2s 81ms/step - loss: 2.1115 - f1_score: 0.3151 - val_loss: 2.3318 - val_f1_score: 0.2552
Epoch 73/500
28/28 [=====] - 2s 86ms/step - loss: 2.0627 - f1_score: 0.3270 - val_loss: 2.5057 - val_f1_score: 0.2125
Epoch 74/500
28/28 [=====] - 2s 82ms/step - loss: 2.0630 - f1_score: 0.3284 - val_loss: 2.3631 - val_f1_score: 0.2349
Epoch 75/500
28/28 [=====] - 2s 83ms/step - loss: 2.0091 - f1_score: 0.3406 - val_loss: 2.4092 - val_f1_score: 0.2228
Epoch 76/500
28/28 [=====] - 2s 81ms/step - loss: 1.9430 - f1_score: 0.3626 - val_loss: 2.2691 - val_f1_score: 0.2408
Epoch 77/500
28/28 [=====] - 2s 82ms/step - loss: 1.8812 - f1_score: 0.3918 - val_loss: 2.3014 - val_f1_score: 0.2632
Epoch 78/500
28/28 [=====] - ETA: 0s - loss: 1.8883 - f1_score: 0.3843

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 455ms/step - loss: 1.8883 -
f1_score: 0.3843 - val_loss: 2.2095 - val_f1_score: 0.2939
Epoch 79/500
28/28 [=====] - ETA: 0s - loss: 1.9073 - f1_score: 0.3637

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 [=====] - 20s 750ms/step - loss: 1.9073 -
f1_score: 0.3637 - val_loss: 2.0898 - val_f1_score: 0.2942
Epoch 80/500
28/28 [=====] - ETA: 0s - loss: 1.8722 - f1_score: 0.3851

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: 1.8722 -
f1_score: 0.3851 - val_loss: 2.2655 - val_f1_score: 0.2953
Epoch 81/500
28/28 [=====] - 2s 82ms/step - loss: 1.7969 - f1_score:
0.4060 - val_loss: 2.2205 - val_f1_score: 0.2856
Epoch 82/500
28/28 [=====] - ETA: 0s - loss: 1.7766 - f1_score:
0.4183

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 406ms/step - loss: 1.7766 -
f1_score: 0.4183 - val_loss: 2.0949 - val_f1_score: 0.3196
Epoch 83/500
28/28 [=====] - ETA: 0s - loss: 1.7362 - f1_score:
0.4194

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: 1.7362 -
f1_score: 0.4194 - val_loss: 2.0945 - val_f1_score: 0.3210
Epoch 84/500
28/28 [=====] - 2s 79ms/step - loss: 1.7467 - f1_score:
0.4304 - val_loss: 2.0358 - val_f1_score: 0.3162
Epoch 85/500
28/28 [=====] - ETA: 0s - loss: 1.6931 - f1_score:
0.4408

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
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```
28/28 [=====] - 11s 410ms/step - loss: 1.6931 -  
f1_score: 0.4408 - val_loss: 2.1092 - val_f1_score: 0.3404  
Epoch 86/500  
28/28 [=====] - 2s 81ms/step - loss: 1.6725 - f1_score:  
0.4368 - val_loss: 2.1707 - val_f1_score: 0.3397  
Epoch 87/500  
28/28 [=====] - 2s 81ms/step - loss: 1.6186 - f1_score:  
0.4573 - val_loss: 2.0124 - val_f1_score: 0.3320  
Epoch 88/500  
28/28 [=====] - 2s 82ms/step - loss: 1.5895 - f1_score:  
0.4646 - val_loss: 2.0353 - val_f1_score: 0.3363  
Epoch 89/500  
28/28 [=====] - ETA: 0s - loss: 1.6046 - f1_score:  
0.4647  
  
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 [=====] - 14s 521ms/step - loss: 1.6046 -  
f1_score: 0.4647 - val_loss: 1.9533 - val_f1_score: 0.3828  
Epoch 90/500  
28/28 [=====] - 2s 80ms/step - loss: 1.5808 - f1_score:  
0.4665 - val_loss: 1.9722 - val_f1_score: 0.3687  
Epoch 91/500  
28/28 [=====] - 2s 81ms/step - loss: 1.5684 - f1_score:  
0.4678 - val_loss: 2.0922 - val_f1_score: 0.3157  
Epoch 92/500  
28/28 [=====] - 2s 83ms/step - loss: 1.5282 - f1_score:  
0.4894 - val_loss: 2.0642 - val_f1_score: 0.3543  
Epoch 93/500  
28/28 [=====] - 2s 81ms/step - loss: 1.5130 - f1_score:  
0.4956 - val_loss: 2.1015 - val_f1_score: 0.3373  
Epoch 94/500  
28/28 [=====] - 2s 83ms/step - loss: 1.4864 - f1_score:  
0.5001 - val_loss: 2.0052 - val_f1_score: 0.3344  
Epoch 95/500  
28/28 [=====] - 2s 82ms/step - loss: 1.4693 - f1_score:  
0.5046 - val_loss: 2.0703 - val_f1_score: 0.3608  
Epoch 96/500  
28/28 [=====] - ETA: 0s - loss: 1.4560 - f1_score:  
0.5064  
  
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 422ms/step - loss: 1.4560 - f1_score: 0.5064 - val_loss: 1.9077 - val_f1_score: 0.3935
Epoch 97/500
28/28 [=====] - 2s 81ms/step - loss: 1.3666 - f1_score: 0.5386 - val_loss: 1.8730 - val_f1_score: 0.3923
Epoch 98/500
28/28 [=====] - 2s 84ms/step - loss: 1.4397 - f1_score: 0.5236 - val_loss: 2.0236 - val_f1_score: 0.3703
Epoch 99/500
28/28 [=====] - 2s 82ms/step - loss: 1.3943 - f1_score: 0.5311 - val_loss: 1.9673 - val_f1_score: 0.3623
Epoch 100/500
28/28 [=====] - 2s 83ms/step - loss: 1.4239 - f1_score: 0.5259 - val_loss: 1.9465 - val_f1_score: 0.3899
Epoch 101/500
28/28 [=====] - 2s 85ms/step - loss: 1.3827 - f1_score: 0.5460 - val_loss: 2.1938 - val_f1_score: 0.3407
Epoch 102/500
28/28 [=====] - 2s 83ms/step - loss: 1.4115 - f1_score: 0.5154 - val_loss: 1.9136 - val_f1_score: 0.3864
Epoch 103/500
28/28 [=====] - ETA: 0s - loss: 1.3441 - f1_score: 0.5468
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 470ms/step - loss: 1.3441 - f1_score: 0.5468 - val_loss: 1.8724 - val_f1_score: 0.4052
Epoch 104/500
28/28 [=====] - 2s 80ms/step - loss: 1.3094 - f1_score: 0.5581 - val_loss: 1.9136 - val_f1_score: 0.3989
Epoch 105/500
28/28 [=====] - ETA: 0s - loss: 1.2789 - f1_score: 0.5779
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 418ms/step - loss: 1.2789 -  
f1_score: 0.5779 - val_loss: 1.8071 - val_f1_score: 0.4536  
Epoch 106/500  
28/28 [=====] - 2s 81ms/step - loss: 1.2868 - f1_score:  
0.5665 - val_loss: 2.0383 - val_f1_score: 0.3665  
Epoch 107/500  
28/28 [=====] - 2s 85ms/step - loss: 1.3232 - f1_score:  
0.5547 - val_loss: 2.0660 - val_f1_score: 0.3913  
Epoch 108/500  
28/28 [=====] - 2s 82ms/step - loss: 1.2347 - f1_score:  
0.5783 - val_loss: 1.9076 - val_f1_score: 0.4218  
Epoch 109/500  
28/28 [=====] - ETA: 0s - loss: 1.2157 - f1_score:  
0.5910  
  
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 421ms/step - loss: 1.2157 -  
f1_score: 0.5910 - val_loss: 1.8133 - val_f1_score: 0.4586  
Epoch 110/500  
28/28 [=====] - ETA: 0s - loss: 1.1998 - f1_score:  
0.6010  
  
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 394ms/step - loss: 1.1998 -  
f1_score: 0.6010 - val_loss: 1.8268 - val_f1_score: 0.4631  
Epoch 111/500  
28/28 [=====] - 2s 80ms/step - loss: 1.1681 - f1_score:  
0.5991 - val_loss: 2.0211 - val_f1_score: 0.4224  
Epoch 112/500  
28/28 [=====] - 2s 80ms/step - loss: 1.2273 - f1_score:  
0.5853 - val_loss: 2.0426 - val_f1_score: 0.4033  
Epoch 113/500  
28/28 [=====] - 2s 84ms/step - loss: 1.1714 - f1_score:  
0.6162 - val_loss: 2.1110 - val_f1_score: 0.4063  
Epoch 114/500  
28/28 [=====] - ETA: 0s - loss: 1.1414 - f1_score:  
0.6048
```

```
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 [=====] - 18s 670ms/step - loss: 1.1414 -
f1_score: 0.6048 - val_loss: 1.7589 - val_f1_score: 0.4749
Epoch 115/500
28/28 [=====] - ETA: 0s - loss: 1.1201 - f1_score:
0.6296

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 352ms/step - loss: 1.1201 -
f1_score: 0.6296 - val_loss: 1.7660 - val_f1_score: 0.4787
Epoch 116/500
28/28 [=====] - 2s 80ms/step - loss: 1.1037 - f1_score:
0.6317 - val_loss: 1.7556 - val_f1_score: 0.4397
Epoch 117/500
28/28 [=====] - 2s 80ms/step - loss: 1.1555 - f1_score:
0.6168 - val_loss: 1.9426 - val_f1_score: 0.4234
Epoch 118/500
28/28 [=====] - 2s 83ms/step - loss: 1.1564 - f1_score:
0.6080 - val_loss: 1.8045 - val_f1_score: 0.4600
Epoch 119/500
28/28 [=====] - 2s 81ms/step - loss: 1.1303 - f1_score:
0.6346 - val_loss: 1.7551 - val_f1_score: 0.4578
Epoch 120/500
28/28 [=====] - 2s 81ms/step - loss: 1.1355 - f1_score:
0.6376 - val_loss: 1.8849 - val_f1_score: 0.4567
Epoch 121/500
28/28 [=====] - 2s 81ms/step - loss: 1.0301 - f1_score:
0.6551 - val_loss: 1.8724 - val_f1_score: 0.4774
Epoch 122/500
28/28 [=====] - ETA: 0s - loss: 1.0001 - f1_score:
0.6761

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 386ms/step - loss: 1.0001 -  
f1_score: 0.6761 - val_loss: 1.7303 - val_f1_score: 0.4828  
Epoch 123/500  
28/28 [=====] - 2s 80ms/step - loss: 0.9720 - f1_score:  
0.6786 - val_loss: 2.0276 - val_f1_score: 0.4335  
Epoch 124/500  
28/28 [=====] - 2s 81ms/step - loss: 1.0109 - f1_score:  
0.6605 - val_loss: 1.8716 - val_f1_score: 0.4700  
Epoch 125/500  
28/28 [=====] - 2s 81ms/step - loss: 1.0447 - f1_score:  
0.6484 - val_loss: 1.9816 - val_f1_score: 0.4512  
Epoch 126/500  
28/28 [=====] - 2s 82ms/step - loss: 0.9775 - f1_score:  
0.6682 - val_loss: 1.8763 - val_f1_score: 0.4705  
Epoch 127/500  
28/28 [=====] - ETA: 0s - loss: 0.9807 - f1_score:  
0.6715  
  
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 430ms/step - loss: 0.9807 -  
f1_score: 0.6715 - val_loss: 1.7481 - val_f1_score: 0.5168  
Epoch 128/500  
28/28 [=====] - 2s 81ms/step - loss: 0.9728 - f1_score:  
0.6851 - val_loss: 1.9032 - val_f1_score: 0.4304  
Epoch 129/500  
28/28 [=====] - 2s 81ms/step - loss: 0.9209 - f1_score:  
0.6959 - val_loss: 1.7174 - val_f1_score: 0.5082  
Epoch 130/500  
28/28 [=====] - 2s 81ms/step - loss: 0.8856 - f1_score:  
0.7035 - val_loss: 1.7236 - val_f1_score: 0.4946  
Epoch 131/500  
28/28 [=====] - 2s 83ms/step - loss: 0.9429 - f1_score:  
0.6848 - val_loss: 1.8279 - val_f1_score: 0.5057  
Epoch 132/500  
28/28 [=====] - 2s 86ms/step - loss: 0.9132 - f1_score:  
0.6980 - val_loss: 1.9657 - val_f1_score: 0.4694  
Epoch 133/500  
28/28 [=====] - 2s 83ms/step - loss: 0.9820 - f1_score:  
0.6773 - val_loss: 1.9898 - val_f1_score: 0.4641  
Epoch 134/500  
28/28 [=====] - 2s 85ms/step - loss: 0.8906 - f1_score:  
0.7153 - val_loss: 1.7769 - val_f1_score: 0.5029  
Epoch 135/500
```

```
28/28 [=====] - 2s 83ms/step - loss: 0.8564 - f1_score: 0.7180 - val_loss: 1.8828 - val_f1_score: 0.4950
Epoch 136/500
28/28 [=====] - ETA: 0s - loss: 0.9201 - f1_score: 0.6962

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 417ms/step - loss: 0.9201 - f1_score: 0.6962 - val_loss: 1.6617 - val_f1_score: 0.5244
Epoch 137/500
28/28 [=====] - 2s 81ms/step - loss: 0.8535 - f1_score: 0.7272 - val_loss: 1.8608 - val_f1_score: 0.5159
Epoch 138/500
28/28 [=====] - 2s 82ms/step - loss: 0.8513 - f1_score: 0.7128 - val_loss: 1.8579 - val_f1_score: 0.5199
Epoch 139/500
28/28 [=====] - 2s 85ms/step - loss: 0.8149 - f1_score: 0.7433 - val_loss: 1.7729 - val_f1_score: 0.4776
Epoch 140/500
28/28 [=====] - 2s 83ms/step - loss: 0.8746 - f1_score: 0.7160 - val_loss: 2.0709 - val_f1_score: 0.4486
Epoch 141/500
28/28 [=====] - 2s 83ms/step - loss: 0.8732 - f1_score: 0.7184 - val_loss: 1.7666 - val_f1_score: 0.5160
Epoch 142/500
28/28 [=====] - 2s 83ms/step - loss: 0.7808 - f1_score: 0.7533 - val_loss: 1.8401 - val_f1_score: 0.5153
Epoch 143/500
28/28 [=====] - 2s 86ms/step - loss: 0.7320 - f1_score: 0.7658 - val_loss: 2.1053 - val_f1_score: 0.4865
Epoch 144/500
28/28 [=====] - ETA: 0s - loss: 0.8446 - f1_score: 0.7275

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 381ms/step - loss: 0.8446 - f1_score: 0.7275 - val_loss: 1.7259 - val_f1_score: 0.5532
Epoch 145/500
```

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28/28 [=====] - 2s 80ms/step - loss: 0.7506 - f1_score: 0.7540 - val_loss: 1.8412 - val_f1_score: 0.5120
Epoch 146/500
28/28 [=====] - 2s 82ms/step - loss: 0.7207 - f1_score: 0.7748 - val_loss: 1.8641 - val_f1_score: 0.5259
Epoch 147/500
28/28 [=====] - 2s 83ms/step - loss: 0.7397 - f1_score: 0.7648 - val_loss: 1.9775 - val_f1_score: 0.5388
Epoch 148/500
28/28 [=====] - 2s 83ms/step - loss: 0.7801 - f1_score: 0.7453 - val_loss: 1.9396 - val_f1_score: 0.5008
Epoch 149/500
28/28 [=====] - 2s 84ms/step - loss: 0.7619 - f1_score: 0.7565 - val_loss: 1.8635 - val_f1_score: 0.5056
Epoch 150/500
28/28 [=====] - 2s 85ms/step - loss: 0.7281 - f1_score: 0.7640 - val_loss: 2.2089 - val_f1_score: 0.4743
Epoch 151/500
28/28 [=====] - 2s 88ms/step - loss: 0.7839 - f1_score: 0.7427 - val_loss: 1.9817 - val_f1_score: 0.5144
Epoch 152/500
28/28 [=====] - 2s 84ms/step - loss: 0.6930 - f1_score: 0.7885 - val_loss: 1.9194 - val_f1_score: 0.4931
Epoch 153/500
28/28 [=====] - 2s 86ms/step - loss: 0.6494 - f1_score: 0.7958 - val_loss: 1.8712 - val_f1_score: 0.5486
Epoch 154/500
28/28 [=====] - 2s 84ms/step - loss: 0.7323 - f1_score: 0.7750 - val_loss: 1.9544 - val_f1_score: 0.5417
Epoch 155/500
28/28 [=====] - ETA: 0s - loss: 0.7390 - f1_score: 0.7628
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 428ms/step - loss: 0.7390 - f1_score: 0.7628 - val_loss: 2.0116 - val_f1_score: 0.5538
Epoch 156/500
28/28 [=====] - 2s 81ms/step - loss: 0.6878 - f1_score: 0.7798 - val_loss: 1.9012 - val_f1_score: 0.5342
Epoch 157/500
28/28 [=====] - 2s 90ms/step - loss: 0.7647 - f1_score: 0.7512 - val_loss: 2.0940 - val_f1_score: 0.5127
Epoch 158/500
```

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28/28 [=====] - 2s 84ms/step - loss: 0.6678 - f1_score: 0.7876 - val_loss: 1.9164 - val_f1_score: 0.5227
Epoch 159/500
28/28 [=====] - 2s 87ms/step - loss: 0.6218 - f1_score: 0.8124 - val_loss: 1.7822 - val_f1_score: 0.5387
Epoch 160/500
28/28 [=====] - 2s 87ms/step - loss: 0.6127 - f1_score: 0.8149 - val_loss: 2.0447 - val_f1_score: 0.5016
Epoch 161/500
28/28 [=====] - 2s 85ms/step - loss: 0.6626 - f1_score: 0.7927 - val_loss: 2.0477 - val_f1_score: 0.5229
Epoch 162/500
28/28 [=====] - 2s 85ms/step - loss: 0.6990 - f1_score: 0.7828 - val_loss: 1.9462 - val_f1_score: 0.5295
Epoch 163/500
28/28 [=====] - 2s 84ms/step - loss: 0.6313 - f1_score: 0.8006 - val_loss: 2.1066 - val_f1_score: 0.4771
Epoch 164/500
28/28 [=====] - 2s 86ms/step - loss: 0.6057 - f1_score: 0.8160 - val_loss: 1.8958 - val_f1_score: 0.5392
Epoch 165/500
28/28 [=====] - 2s 84ms/step - loss: 0.6015 - f1_score: 0.8118 - val_loss: 1.8386 - val_f1_score: 0.5227
Epoch 166/500
28/28 [=====] - 2s 89ms/step - loss: 0.5895 - f1_score: 0.8210 - val_loss: 1.8595 - val_f1_score: 0.5327
Epoch 167/500
28/28 [=====] - 2s 84ms/step - loss: 0.6346 - f1_score: 0.8009 - val_loss: 1.9190 - val_f1_score: 0.5425
Epoch 168/500
28/28 [=====] - 2s 89ms/step - loss: 0.5762 - f1_score: 0.8160 - val_loss: 1.8890 - val_f1_score: 0.5528
Epoch 169/500
28/28 [=====] - ETA: 0s - loss: 0.5649 - f1_score: 0.8248
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 453ms/step - loss: 0.5649 - f1_score: 0.8248 - val_loss: 1.9128 - val_f1_score: 0.5584
Epoch 170/500
28/28 [=====] - 2s 84ms/step - loss: 0.5812 - f1_score: 0.8200 - val_loss: 1.9161 - val_f1_score: 0.5488
Epoch 171/500
```

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28/28 [=====] - 2s 82ms/step - loss: 0.5574 - f1_score: 0.8212 - val_loss: 2.0552 - val_f1_score: 0.5352
Epoch 172/500
28/28 [=====] - 2s 87ms/step - loss: 0.5358 - f1_score: 0.8371 - val_loss: 1.9378 - val_f1_score: 0.5357
Epoch 173/500
28/28 [=====] - 2s 83ms/step - loss: 0.5311 - f1_score: 0.8387 - val_loss: 2.0999 - val_f1_score: 0.5163
Epoch 174/500
28/28 [=====] - 2s 87ms/step - loss: 0.6138 - f1_score: 0.8138 - val_loss: 2.1177 - val_f1_score: 0.5248
Epoch 175/500
28/28 [=====] - 2s 83ms/step - loss: 0.5088 - f1_score: 0.8468 - val_loss: 1.9725 - val_f1_score: 0.5346
Epoch 176/500
28/28 [=====] - 2s 89ms/step - loss: 0.7353 - f1_score: 0.7799 - val_loss: 2.2703 - val_f1_score: 0.4337
Epoch 177/500
28/28 [=====] - 2s 84ms/step - loss: 0.9745 - f1_score: 0.6869 - val_loss: 1.8861 - val_f1_score: 0.5034
Epoch 178/500
28/28 [=====] - ETA: 0s - loss: 0.6243 - f1_score: 0.8092
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 454ms/step - loss: 0.6243 - f1_score: 0.8092 - val_loss: 1.7989 - val_f1_score: 0.5700
Epoch 179/500
28/28 [=====] - ETA: 0s - loss: 0.4982 - f1_score: 0.8416
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 396ms/step - loss: 0.4982 - f1_score: 0.8416 - val_loss: 1.8839 - val_f1_score: 0.5731
Epoch 180/500
28/28 [=====] - 2s 81ms/step - loss: 0.5644 - f1_score: 0.8223 - val_loss: 1.9615 - val_f1_score: 0.5692
Epoch 181/500
```

```
28/28 [=====] - 2s 84ms/step - loss: 0.5042 - f1_score: 0.8481 - val_loss: 2.0091 - val_f1_score: 0.5336
Epoch 182/500
28/28 [=====] - 2s 82ms/step - loss: 0.4683 - f1_score: 0.8610 - val_loss: 1.8861 - val_f1_score: 0.5544
Epoch 183/500
28/28 [=====] - 2s 86ms/step - loss: 0.4850 - f1_score: 0.8524 - val_loss: 1.8658 - val_f1_score: 0.5412
Epoch 184/500
28/28 [=====] - ETA: 0s - loss: 0.4602 - f1_score: 0.8628

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 396ms/step - loss: 0.4602 - f1_score: 0.8628 - val_loss: 1.8945 - val_f1_score: 0.6039
Epoch 185/500
28/28 [=====] - 2s 81ms/step - loss: 0.4656 - f1_score: 0.8643 - val_loss: 2.0122 - val_f1_score: 0.5401
Epoch 186/500
28/28 [=====] - 2s 84ms/step - loss: 0.4823 - f1_score: 0.8561 - val_loss: 2.3040 - val_f1_score: 0.4840
Epoch 187/500
28/28 [=====] - 2s 82ms/step - loss: 0.7514 - f1_score: 0.7711 - val_loss: 2.0000 - val_f1_score: 0.5336
Epoch 188/500
28/28 [=====] - 2s 86ms/step - loss: 0.6072 - f1_score: 0.8132 - val_loss: 2.0921 - val_f1_score: 0.5412
Epoch 189/500
28/28 [=====] - 2s 83ms/step - loss: 0.5492 - f1_score: 0.8277 - val_loss: 2.1610 - val_f1_score: 0.5120
Epoch 190/500
28/28 [=====] - 2s 86ms/step - loss: 0.4831 - f1_score: 0.8557 - val_loss: 2.0699 - val_f1_score: 0.5405
Epoch 191/500
28/28 [=====] - 2s 83ms/step - loss: 0.4982 - f1_score: 0.8430 - val_loss: 1.9679 - val_f1_score: 0.5353
Epoch 192/500
28/28 [=====] - 2s 84ms/step - loss: 0.4938 - f1_score: 0.8487 - val_loss: 2.3905 - val_f1_score: 0.5332
Epoch 193/500
28/28 [=====] - 2s 86ms/step - loss: 0.5214 - f1_score: 0.8371 - val_loss: 2.1250 - val_f1_score: 0.5427
Epoch 194/500
```

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28/28 [=====] - 2s 85ms/step - loss: 0.4756 - f1_score: 0.8654 - val_loss: 2.0759 - val_f1_score: 0.5602
Epoch 195/500
28/28 [=====] - 2s 84ms/step - loss: 0.4348 - f1_score: 0.8768 - val_loss: 2.0184 - val_f1_score: 0.5460
Epoch 196/500
28/28 [=====] - 2s 85ms/step - loss: 0.4065 - f1_score: 0.8825 - val_loss: 2.1192 - val_f1_score: 0.5281
Epoch 197/500
28/28 [=====] - 2s 84ms/step - loss: 0.4154 - f1_score: 0.8829 - val_loss: 2.1653 - val_f1_score: 0.5594
Epoch 198/500
28/28 [=====] - 2s 86ms/step - loss: 0.4782 - f1_score: 0.8567 - val_loss: 2.0722 - val_f1_score: 0.5448
Epoch 199/500
28/28 [=====] - 2s 87ms/step - loss: 0.5711 - f1_score: 0.8231 - val_loss: 2.3100 - val_f1_score: 0.5086
Epoch 200/500
28/28 [=====] - 2s 84ms/step - loss: 0.4859 - f1_score: 0.8594 - val_loss: 2.6548 - val_f1_score: 0.4910
Epoch 201/500
28/28 [=====] - 2s 84ms/step - loss: 0.8009 - f1_score: 0.7594 - val_loss: 2.0100 - val_f1_score: 0.5466
Epoch 202/500
28/28 [=====] - 2s 85ms/step - loss: 0.5104 - f1_score: 0.8354 - val_loss: 2.0384 - val_f1_score: 0.5503
Epoch 203/500
28/28 [=====] - 2s 89ms/step - loss: 0.4005 - f1_score: 0.8813 - val_loss: 2.0131 - val_f1_score: 0.5717
Epoch 204/500
28/28 [=====] - 2s 85ms/step - loss: 0.3779 - f1_score: 0.8901 - val_loss: 2.1143 - val_f1_score: 0.5478
Epoch 205/500
28/28 [=====] - 2s 85ms/step - loss: 0.3726 - f1_score: 0.8949 - val_loss: 2.2198 - val_f1_score: 0.5344
Epoch 206/500
28/28 [=====] - 2s 87ms/step - loss: 0.3741 - f1_score: 0.8927 - val_loss: 2.3166 - val_f1_score: 0.5236
Epoch 207/500
28/28 [=====] - 2s 87ms/step - loss: 0.4122 - f1_score: 0.8795 - val_loss: 2.1143 - val_f1_score: 0.5541
Epoch 208/500
28/28 [=====] - 2s 84ms/step - loss: 0.5771 - f1_score: 0.8281 - val_loss: 2.3555 - val_f1_score: 0.5338
Epoch 209/500
28/28 [=====] - 2s 85ms/step - loss: 0.5352 - f1_score: 0.8456 - val_loss: 2.2701 - val_f1_score: 0.5361
Epoch 210/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.5065 - f1_score: 0.8422 - val_loss: 2.4228 - val_f1_score: 0.4970
Epoch 211/500
28/28 [=====] - 2s 88ms/step - loss: 0.4889 - f1_score: 0.8444 - val_loss: 2.1409 - val_f1_score: 0.5515
Epoch 212/500
28/28 [=====] - 2s 86ms/step - loss: 0.4029 - f1_score: 0.8787 - val_loss: 2.0752 - val_f1_score: 0.5484
Epoch 213/500
28/28 [=====] - 3s 94ms/step - loss: 0.3682 - f1_score: 0.8949 - val_loss: 2.2883 - val_f1_score: 0.5478
Epoch 214/500
28/28 [=====] - 2s 85ms/step - loss: 0.3632 - f1_score: 0.8943 - val_loss: 2.2664 - val_f1_score: 0.5379
Epoch 215/500
28/28 [=====] - 3s 94ms/step - loss: 0.3870 - f1_score: 0.8926 - val_loss: 2.2522 - val_f1_score: 0.5325
Epoch 216/500
28/28 [=====] - 2s 84ms/step - loss: 0.3471 - f1_score: 0.9058 - val_loss: 2.2801 - val_f1_score: 0.5791
Epoch 217/500
28/28 [=====] - 3s 96ms/step - loss: 0.3696 - f1_score: 0.8967 - val_loss: 2.3797 - val_f1_score: 0.5401
Epoch 218/500
28/28 [=====] - 3s 92ms/step - loss: 0.3577 - f1_score: 0.9075 - val_loss: 2.2757 - val_f1_score: 0.5634
Epoch 219/500
28/28 [=====] - 3s 96ms/step - loss: 0.4152 - f1_score: 0.8851 - val_loss: 2.2125 - val_f1_score: 0.5590
Epoch 220/500
28/28 [=====] - 2s 87ms/step - loss: 0.4229 - f1_score: 0.8741 - val_loss: 2.1371 - val_f1_score: 0.5508
Epoch 221/500
28/28 [=====] - 3s 97ms/step - loss: 0.3418 - f1_score: 0.9065 - val_loss: 2.1753 - val_f1_score: 0.5792
Epoch 222/500
28/28 [=====] - 2s 87ms/step - loss: 0.4730 - f1_score: 0.8619 - val_loss: 2.2145 - val_f1_score: 0.5530
Epoch 223/500
28/28 [=====] - 3s 93ms/step - loss: 0.3608 - f1_score: 0.8956 - val_loss: 2.2012 - val_f1_score: 0.5757
Epoch 224/500
28/28 [=====] - 2s 86ms/step - loss: 0.3536 - f1_score: 0.8951 - val_loss: 2.2692 - val_f1_score: 0.5372
Epoch 225/500
28/28 [=====] - 3s 96ms/step - loss: 0.3607 - f1_score: 0.9015 - val_loss: 2.3371 - val_f1_score: 0.5654
Epoch 226/500
```

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28/28 [=====] - 3s 92ms/step - loss: 0.5569 - f1_score: 0.8472 - val_loss: 2.3301 - val_f1_score: 0.5109
Epoch 227/500
28/28 [=====] - 3s 92ms/step - loss: 0.7264 - f1_score: 0.7881 - val_loss: 2.3277 - val_f1_score: 0.5163
Epoch 228/500
28/28 [=====] - 2s 86ms/step - loss: 0.5032 - f1_score: 0.8517 - val_loss: 2.2987 - val_f1_score: 0.5257
Epoch 229/500
28/28 [=====] - 3s 95ms/step - loss: 0.3966 - f1_score: 0.8849 - val_loss: 2.0706 - val_f1_score: 0.5819
Epoch 230/500
28/28 [=====] - 2s 87ms/step - loss: 0.3477 - f1_score: 0.9043 - val_loss: 2.2678 - val_f1_score: 0.5422
Epoch 231/500
28/28 [=====] - 3s 93ms/step - loss: 0.3982 - f1_score: 0.8965 - val_loss: 2.2496 - val_f1_score: 0.5189
Epoch 232/500
28/28 [=====] - 2s 85ms/step - loss: 0.4003 - f1_score: 0.8876 - val_loss: 2.1530 - val_f1_score: 0.5468
Epoch 233/500
28/28 [=====] - 3s 90ms/step - loss: 0.3194 - f1_score: 0.9196 - val_loss: 2.1068 - val_f1_score: 0.6010
Epoch 234/500
28/28 [=====] - 2s 85ms/step - loss: 0.2663 - f1_score: 0.9355 - val_loss: 2.2650 - val_f1_score: 0.5527
Epoch 235/500
28/28 [=====] - 2s 90ms/step - loss: 0.3493 - f1_score: 0.9011 - val_loss: 2.5771 - val_f1_score: 0.5233
Epoch 236/500
28/28 [=====] - 2s 85ms/step - loss: 0.3929 - f1_score: 0.8876 - val_loss: 2.5600 - val_f1_score: 0.5284
Epoch 237/500
28/28 [=====] - 2s 88ms/step - loss: 0.3286 - f1_score: 0.9095 - val_loss: 2.3314 - val_f1_score: 0.5714
Epoch 238/500
28/28 [=====] - 2s 89ms/step - loss: 0.3585 - f1_score: 0.8977 - val_loss: 2.3138 - val_f1_score: 0.5492
Epoch 239/500
28/28 [=====] - 2s 88ms/step - loss: 0.3554 - f1_score: 0.9037 - val_loss: 2.6578 - val_f1_score: 0.5018
Epoch 240/500
28/28 [=====] - 2s 86ms/step - loss: 0.4156 - f1_score: 0.8822 - val_loss: 2.4261 - val_f1_score: 0.5329
Epoch 241/500
28/28 [=====] - 2s 89ms/step - loss: 0.2706 - f1_score: 0.9301 - val_loss: 2.3782 - val_f1_score: 0.5551
Epoch 242/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.2589 - f1_score: 0.9332 - val_loss: 2.4387 - val_f1_score: 0.5493
Epoch 243/500
28/28 [=====] - 3s 92ms/step - loss: 0.2668 - f1_score: 0.9345 - val_loss: 2.5324 - val_f1_score: 0.5532
Epoch 244/500
28/28 [=====] - 2s 85ms/step - loss: 0.2680 - f1_score: 0.9299 - val_loss: 2.4363 - val_f1_score: 0.5536
Epoch 245/500
28/28 [=====] - 3s 93ms/step - loss: 0.4364 - f1_score: 0.8746 - val_loss: 2.2050 - val_f1_score: 0.5694
Epoch 246/500
28/28 [=====] - 2s 85ms/step - loss: 0.4270 - f1_score: 0.8724 - val_loss: 2.3707 - val_f1_score: 0.5580
Epoch 247/500
28/28 [=====] - 3s 94ms/step - loss: 0.5366 - f1_score: 0.8577 - val_loss: 3.1269 - val_f1_score: 0.4275
Epoch 248/500
28/28 [=====] - 2s 88ms/step - loss: 0.8228 - f1_score: 0.7788 - val_loss: 2.2167 - val_f1_score: 0.5289
Epoch 249/500
28/28 [=====] - 2s 88ms/step - loss: 0.4633 - f1_score: 0.8707 - val_loss: 2.0400 - val_f1_score: 0.5613
Epoch 250/500
28/28 [=====] - 2s 87ms/step - loss: 0.2965 - f1_score: 0.9230 - val_loss: 2.2664 - val_f1_score: 0.5622
Epoch 251/500
28/28 [=====] - 2s 84ms/step - loss: 0.3061 - f1_score: 0.9197 - val_loss: 2.1885 - val_f1_score: 0.5776
Epoch 252/500
28/28 [=====] - 2s 85ms/step - loss: 0.2426 - f1_score: 0.9429 - val_loss: 2.1851 - val_f1_score: 0.5687
Epoch 253/500
28/28 [=====] - 3s 90ms/step - loss: 0.2463 - f1_score: 0.9421 - val_loss: 2.3244 - val_f1_score: 0.5702
Epoch 254/500
28/28 [=====] - 2s 85ms/step - loss: 0.2204 - f1_score: 0.9500 - val_loss: 2.3500 - val_f1_score: 0.5666
Epoch 255/500
28/28 [=====] - 3s 91ms/step - loss: 0.2218 - f1_score: 0.9495 - val_loss: 2.4515 - val_f1_score: 0.5668
Epoch 256/500
28/28 [=====] - 2s 85ms/step - loss: 0.2447 - f1_score: 0.9374 - val_loss: 2.5669 - val_f1_score: 0.5588
Epoch 257/500
28/28 [=====] - 2s 85ms/step - loss: 0.3648 - f1_score: 0.8995 - val_loss: 2.8775 - val_f1_score: 0.5062
Epoch 258/500
```

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28/28 [=====] - 2s 84ms/step - loss: 0.5130 - f1_score: 0.8572 - val_loss: 2.1167 - val_f1_score: 0.6004
Epoch 259/500
28/28 [=====] - 2s 84ms/step - loss: 0.3444 - f1_score: 0.9045 - val_loss: 2.2120 - val_f1_score: 0.5688
Epoch 260/500
28/28 [=====] - 3s 91ms/step - loss: 0.3049 - f1_score: 0.9203 - val_loss: 2.4072 - val_f1_score: 0.5285
Epoch 261/500
28/28 [=====] - 2s 85ms/step - loss: 0.2565 - f1_score: 0.9317 - val_loss: 2.2708 - val_f1_score: 0.5381
Epoch 262/500
28/28 [=====] - 2s 87ms/step - loss: 0.1992 - f1_score: 0.9590 - val_loss: 2.2653 - val_f1_score: 0.5854
Epoch 263/500
28/28 [=====] - ETA: 0s - loss: 0.2122 - f1_score: 0.9525

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 476ms/step - loss: 0.2122 - f1_score: 0.9525 - val_loss: 2.1044 - val_f1_score: 0.6108
Epoch 264/500
28/28 [=====] - 2s 87ms/step - loss: 0.2920 - f1_score: 0.9219 - val_loss: 2.4341 - val_f1_score: 0.5770
Epoch 265/500
28/28 [=====] - 2s 83ms/step - loss: 0.5448 - f1_score: 0.8514 - val_loss: 2.7145 - val_f1_score: 0.5475
Epoch 266/500
28/28 [=====] - 2s 88ms/step - loss: 0.6080 - f1_score: 0.8287 - val_loss: 2.4022 - val_f1_score: 0.5393
Epoch 267/500
28/28 [=====] - 2s 85ms/step - loss: 0.3724 - f1_score: 0.8918 - val_loss: 2.4198 - val_f1_score: 0.5509
Epoch 268/500
28/28 [=====] - 3s 93ms/step - loss: 0.2910 - f1_score: 0.9219 - val_loss: 2.5210 - val_f1_score: 0.5457
Epoch 269/500
28/28 [=====] - 2s 86ms/step - loss: 0.4221 - f1_score: 0.8887 - val_loss: 2.4761 - val_f1_score: 0.5701
Epoch 270/500
28/28 [=====] - 3s 92ms/step - loss: 0.4160 - f1_score: 0.8861 - val_loss: 2.4427 - val_f1_score: 0.5447
Epoch 271/500
```

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28/28 [=====] - 2s 84ms/step - loss: 0.2859 - f1_score: 0.9314 - val_loss: 2.5030 - val_f1_score: 0.5612
Epoch 272/500
28/28 [=====] - 3s 90ms/step - loss: 0.2584 - f1_score: 0.9382 - val_loss: 2.4109 - val_f1_score: 0.5500
Epoch 273/500
28/28 [=====] - 2s 86ms/step - loss: 0.2331 - f1_score: 0.9460 - val_loss: 2.4852 - val_f1_score: 0.5153
Epoch 274/500
28/28 [=====] - 3s 92ms/step - loss: 0.2309 - f1_score: 0.9470 - val_loss: 2.5079 - val_f1_score: 0.5361
Epoch 275/500
28/28 [=====] - 2s 85ms/step - loss: 0.2322 - f1_score: 0.9473 - val_loss: 2.5483 - val_f1_score: 0.5686
Epoch 276/500
28/28 [=====] - 3s 96ms/step - loss: 0.1979 - f1_score: 0.9606 - val_loss: 2.4638 - val_f1_score: 0.5760
Epoch 277/500
28/28 [=====] - 2s 85ms/step - loss: 0.1937 - f1_score: 0.9604 - val_loss: 2.5302 - val_f1_score: 0.5467
Epoch 278/500
28/28 [=====] - 3s 95ms/step - loss: 0.2212 - f1_score: 0.9496 - val_loss: 2.5836 - val_f1_score: 0.5600
Epoch 279/500
28/28 [=====] - 2s 86ms/step - loss: 0.2853 - f1_score: 0.9335 - val_loss: 2.6246 - val_f1_score: 0.5613
Epoch 280/500
28/28 [=====] - 3s 92ms/step - loss: 0.5023 - f1_score: 0.8628 - val_loss: 2.8570 - val_f1_score: 0.5113
Epoch 281/500
28/28 [=====] - 2s 85ms/step - loss: 0.4485 - f1_score: 0.8795 - val_loss: 2.4307 - val_f1_score: 0.5320
Epoch 282/500
28/28 [=====] - 3s 92ms/step - loss: 0.3341 - f1_score: 0.9061 - val_loss: 2.4606 - val_f1_score: 0.5568
Epoch 283/500
28/28 [=====] - 2s 86ms/step - loss: 0.2979 - f1_score: 0.9258 - val_loss: 2.5472 - val_f1_score: 0.5340
Epoch 284/500
28/28 [=====] - 3s 92ms/step - loss: 0.2607 - f1_score: 0.9328 - val_loss: 2.2717 - val_f1_score: 0.5416
Epoch 285/500
28/28 [=====] - 2s 85ms/step - loss: 0.2567 - f1_score: 0.9377 - val_loss: 2.4352 - val_f1_score: 0.5442
Epoch 286/500
28/28 [=====] - 3s 95ms/step - loss: 0.2497 - f1_score: 0.9410 - val_loss: 2.4780 - val_f1_score: 0.5884
Epoch 287/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.2102 - f1_score: 0.9538 - val_loss: 2.4802 - val_f1_score: 0.5514
Epoch 288/500
28/28 [=====] - 3s 92ms/step - loss: 0.2372 - f1_score: 0.9465 - val_loss: 2.4486 - val_f1_score: 0.5706
Epoch 289/500
28/28 [=====] - 2s 86ms/step - loss: 0.2848 - f1_score: 0.9330 - val_loss: 2.6228 - val_f1_score: 0.5319
Epoch 290/500
28/28 [=====] - 3s 91ms/step - loss: 0.2988 - f1_score: 0.9198 - val_loss: 2.6025 - val_f1_score: 0.5328
Epoch 291/500
28/28 [=====] - 2s 86ms/step - loss: 0.4152 - f1_score: 0.8931 - val_loss: 2.3488 - val_f1_score: 0.5384
Epoch 292/500
28/28 [=====] - 3s 94ms/step - loss: 0.3444 - f1_score: 0.9091 - val_loss: 2.6338 - val_f1_score: 0.5705
Epoch 293/500
28/28 [=====] - 2s 85ms/step - loss: 0.3044 - f1_score: 0.9209 - val_loss: 2.3109 - val_f1_score: 0.5855
Epoch 294/500
28/28 [=====] - 3s 97ms/step - loss: 0.2606 - f1_score: 0.9338 - val_loss: 2.6994 - val_f1_score: 0.5951
Epoch 295/500
28/28 [=====] - 3s 90ms/step - loss: 0.2508 - f1_score: 0.9375 - val_loss: 2.6092 - val_f1_score: 0.5799
Epoch 296/500
28/28 [=====] - 3s 94ms/step - loss: 0.2133 - f1_score: 0.9541 - val_loss: 2.3765 - val_f1_score: 0.5814
Epoch 297/500
28/28 [=====] - 2s 87ms/step - loss: 0.2291 - f1_score: 0.9459 - val_loss: 2.6520 - val_f1_score: 0.5488
Epoch 298/500
28/28 [=====] - 3s 93ms/step - loss: 0.3566 - f1_score: 0.9202 - val_loss: 3.1489 - val_f1_score: 0.5379
Epoch 299/500
28/28 [=====] - 2s 86ms/step - loss: 0.5464 - f1_score: 0.8535 - val_loss: 2.4037 - val_f1_score: 0.5453
Epoch 300/500
28/28 [=====] - 3s 93ms/step - loss: 0.2761 - f1_score: 0.9264 - val_loss: 2.3899 - val_f1_score: 0.5727
Epoch 301/500
28/28 [=====] - 2s 86ms/step - loss: 0.2336 - f1_score: 0.9452 - val_loss: 2.5477 - val_f1_score: 0.5748
Epoch 302/500
28/28 [=====] - 3s 94ms/step - loss: 0.1986 - f1_score: 0.9582 - val_loss: 2.7296 - val_f1_score: 0.5498
Epoch 303/500
```

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28/28 [=====] - 2s 87ms/step - loss: 0.2285 - f1_score: 0.9509 - val_loss: 2.4859 - val_f1_score: 0.5804
Epoch 304/500
28/28 [=====] - 2s 89ms/step - loss: 0.2546 - f1_score: 0.9394 - val_loss: 2.7562 - val_f1_score: 0.5450
Epoch 305/500
28/28 [=====] - 2s 85ms/step - loss: 0.3449 - f1_score: 0.9073 - val_loss: 2.9926 - val_f1_score: 0.4941
Epoch 306/500
28/28 [=====] - 3s 93ms/step - loss: 0.3058 - f1_score: 0.9231 - val_loss: 2.6630 - val_f1_score: 0.5345
Epoch 307/500
28/28 [=====] - 2s 86ms/step - loss: 0.3052 - f1_score: 0.9200 - val_loss: 2.4453 - val_f1_score: 0.5661
Epoch 308/500
28/28 [=====] - 3s 91ms/step - loss: 0.2709 - f1_score: 0.9339 - val_loss: 2.4370 - val_f1_score: 0.5794
Epoch 309/500
28/28 [=====] - 2s 86ms/step - loss: 0.3172 - f1_score: 0.9174 - val_loss: 2.4922 - val_f1_score: 0.5714
Epoch 310/500
28/28 [=====] - 3s 95ms/step - loss: 0.2995 - f1_score: 0.9234 - val_loss: 2.6337 - val_f1_score: 0.5826
Epoch 311/500
28/28 [=====] - 2s 86ms/step - loss: 0.5234 - f1_score: 0.8621 - val_loss: 2.6021 - val_f1_score: 0.5529
Epoch 312/500
28/28 [=====] - 3s 95ms/step - loss: 0.4436 - f1_score: 0.8743 - val_loss: 2.6591 - val_f1_score: 0.5293
Epoch 313/500
28/28 [=====] - 3s 90ms/step - loss: 0.2922 - f1_score: 0.9165 - val_loss: 2.5323 - val_f1_score: 0.5465
Epoch 314/500
28/28 [=====] - 3s 91ms/step - loss: 0.1970 - f1_score: 0.9583 - val_loss: 2.4128 - val_f1_score: 0.5781
Epoch 315/500
28/28 [=====] - 2s 89ms/step - loss: 0.2207 - f1_score: 0.9505 - val_loss: 2.5653 - val_f1_score: 0.6080
Epoch 316/500
28/28 [=====] - 2s 87ms/step - loss: 0.1878 - f1_score: 0.9603 - val_loss: 2.6436 - val_f1_score: 0.5744
Epoch 317/500
28/28 [=====] - 2s 87ms/step - loss: 0.1897 - f1_score: 0.9592 - val_loss: 2.4881 - val_f1_score: 0.5696
Epoch 318/500
28/28 [=====] - 3s 90ms/step - loss: 0.1768 - f1_score: 0.9676 - val_loss: 2.5310 - val_f1_score: 0.5870
Epoch 319/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.1762 - f1_score: 0.9683 - val_loss: 2.7597 - val_f1_score: 0.5592
Epoch 320/500
28/28 [=====] - 2s 86ms/step - loss: 0.3138 - f1_score: 0.9192 - val_loss: 2.7643 - val_f1_score: 0.5973
Epoch 321/500
28/28 [=====] - 2s 88ms/step - loss: 0.2488 - f1_score: 0.9371 - val_loss: 2.6284 - val_f1_score: 0.5515
Epoch 322/500
28/28 [=====] - 3s 93ms/step - loss: 0.1980 - f1_score: 0.9590 - val_loss: 2.5162 - val_f1_score: 0.5855
Epoch 323/500
28/28 [=====] - 2s 87ms/step - loss: 0.2520 - f1_score: 0.9389 - val_loss: 2.6015 - val_f1_score: 0.5451
Epoch 324/500
28/28 [=====] - 3s 91ms/step - loss: 0.2033 - f1_score: 0.9543 - val_loss: 2.7760 - val_f1_score: 0.5461
Epoch 325/500
28/28 [=====] - 2s 85ms/step - loss: 0.2103 - f1_score: 0.9548 - val_loss: 3.2479 - val_f1_score: 0.5182
Epoch 326/500
28/28 [=====] - 3s 93ms/step - loss: 0.3944 - f1_score: 0.9052 - val_loss: 3.0787 - val_f1_score: 0.5040
Epoch 327/500
28/28 [=====] - 2s 86ms/step - loss: 0.4770 - f1_score: 0.8704 - val_loss: 2.4519 - val_f1_score: 0.5466
Epoch 328/500
28/28 [=====] - 3s 91ms/step - loss: 0.3434 - f1_score: 0.9132 - val_loss: 2.4369 - val_f1_score: 0.5560
Epoch 329/500
28/28 [=====] - 2s 88ms/step - loss: 0.2958 - f1_score: 0.9214 - val_loss: 2.5081 - val_f1_score: 0.5435
Epoch 330/500
28/28 [=====] - 3s 94ms/step - loss: 0.2177 - f1_score: 0.9478 - val_loss: 2.4457 - val_f1_score: 0.5771
Epoch 331/500
28/28 [=====] - 2s 86ms/step - loss: 0.2155 - f1_score: 0.9506 - val_loss: 2.5040 - val_f1_score: 0.6053
Epoch 332/500
28/28 [=====] - 3s 92ms/step - loss: 0.2065 - f1_score: 0.9510 - val_loss: 2.4297 - val_f1_score: 0.5741
Epoch 333/500
28/28 [=====] - 2s 86ms/step - loss: 0.2465 - f1_score: 0.9400 - val_loss: 2.5488 - val_f1_score: 0.5575
Epoch 334/500
28/28 [=====] - 3s 97ms/step - loss: 0.2598 - f1_score: 0.9336 - val_loss: 2.7723 - val_f1_score: 0.5465
Epoch 335/500
```

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28/28 [=====] - 2s 87ms/step - loss: 0.4029 - f1_score: 0.8988 - val_loss: 2.6002 - val_f1_score: 0.5448
Epoch 336/500
28/28 [=====] - 3s 93ms/step - loss: 0.2647 - f1_score: 0.9310 - val_loss: 2.5921 - val_f1_score: 0.5435
Epoch 337/500
28/28 [=====] - 2s 85ms/step - loss: 0.2348 - f1_score: 0.9443 - val_loss: 2.3759 - val_f1_score: 0.5694
Epoch 338/500
28/28 [=====] - 3s 94ms/step - loss: 0.1964 - f1_score: 0.9541 - val_loss: 2.6311 - val_f1_score: 0.5812
Epoch 339/500
28/28 [=====] - 3s 90ms/step - loss: 0.1689 - f1_score: 0.9676 - val_loss: 2.5982 - val_f1_score: 0.5696
Epoch 340/500
28/28 [=====] - 3s 98ms/step - loss: 0.1642 - f1_score: 0.9695 - val_loss: 2.7263 - val_f1_score: 0.5524
Epoch 341/500
28/28 [=====] - 2s 86ms/step - loss: 0.2031 - f1_score: 0.9557 - val_loss: 2.6455 - val_f1_score: 0.5715
Epoch 342/500
28/28 [=====] - 3s 94ms/step - loss: 0.1952 - f1_score: 0.9590 - val_loss: 2.6223 - val_f1_score: 0.5736
Epoch 343/500
28/28 [=====] - 2s 86ms/step - loss: 0.2041 - f1_score: 0.9507 - val_loss: 2.9773 - val_f1_score: 0.5718
Epoch 344/500
28/28 [=====] - 3s 93ms/step - loss: 0.2387 - f1_score: 0.9422 - val_loss: 2.6220 - val_f1_score: 0.6026
Epoch 345/500
28/28 [=====] - 2s 86ms/step - loss: 0.2839 - f1_score: 0.9349 - val_loss: 2.7219 - val_f1_score: 0.5314
Epoch 346/500
28/28 [=====] - 3s 94ms/step - loss: 0.2213 - f1_score: 0.9461 - val_loss: 2.6441 - val_f1_score: 0.6089
Epoch 347/500
28/28 [=====] - 2s 86ms/step - loss: 0.1902 - f1_score: 0.9596 - val_loss: 2.6314 - val_f1_score: 0.5666
Epoch 348/500
28/28 [=====] - 3s 94ms/step - loss: 0.3488 - f1_score: 0.9092 - val_loss: 2.6490 - val_f1_score: 0.5502
Epoch 349/500
28/28 [=====] - 3s 93ms/step - loss: 0.3196 - f1_score: 0.9158 - val_loss: 2.3704 - val_f1_score: 0.5839
Epoch 350/500
28/28 [=====] - 3s 94ms/step - loss: 0.1963 - f1_score: 0.9586 - val_loss: 2.6144 - val_f1_score: 0.5847
Epoch 351/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.1832 - f1_score: 0.9628 - val_loss: 2.6284 - val_f1_score: 0.5674
Epoch 352/500
28/28 [=====] - 3s 93ms/step - loss: 0.2001 - f1_score: 0.9532 - val_loss: 2.7669 - val_f1_score: 0.5717
Epoch 353/500
28/28 [=====] - 2s 87ms/step - loss: 0.2016 - f1_score: 0.9549 - val_loss: 2.8097 - val_f1_score: 0.5762
Epoch 354/500
28/28 [=====] - ETA: 0s - loss: 0.2065 - f1_score: 0.9557

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 [=====] - 14s 526ms/step - loss: 0.2065 - f1_score: 0.9557 - val_loss: 2.4601 - val_f1_score: 0.6123
Epoch 355/500
28/28 [=====] - 2s 84ms/step - loss: 0.3375 - f1_score: 0.9183 - val_loss: 2.5648 - val_f1_score: 0.5671
Epoch 356/500
28/28 [=====] - 2s 82ms/step - loss: 0.2524 - f1_score: 0.9354 - val_loss: 2.7876 - val_f1_score: 0.5355
Epoch 357/500
28/28 [=====] - 2s 89ms/step - loss: 1.6526 - f1_score: 0.6567 - val_loss: 2.3728 - val_f1_score: 0.4304
Epoch 358/500
28/28 [=====] - 2s 89ms/step - loss: 1.1929 - f1_score: 0.6504 - val_loss: 2.1287 - val_f1_score: 0.5039
Epoch 359/500
28/28 [=====] - 3s 106ms/step - loss: 0.6222 - f1_score: 0.8178 - val_loss: 2.0993 - val_f1_score: 0.5302
Epoch 360/500
28/28 [=====] - 3s 93ms/step - loss: 0.4122 - f1_score: 0.8818 - val_loss: 2.1136 - val_f1_score: 0.5557
Epoch 361/500
28/28 [=====] - 3s 105ms/step - loss: 0.3048 - f1_score: 0.9220 - val_loss: 2.2629 - val_f1_score: 0.5541
Epoch 362/500
28/28 [=====] - 3s 103ms/step - loss: 0.3246 - f1_score: 0.9167 - val_loss: 2.2562 - val_f1_score: 0.5469
Epoch 363/500
28/28 [=====] - 3s 103ms/step - loss: 0.2683 - f1_score: 0.9304 - val_loss: 2.4053 - val_f1_score: 0.5204
Epoch 364/500
```

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28/28 [=====] - 3s 107ms/step - loss: 0.2691 -  
f1_score: 0.9310 - val_loss: 2.1965 - val_f1_score: 0.5788  
Epoch 365/500  
28/28 [=====] - 3s 98ms/step - loss: 0.1841 - f1_score:  
0.9684 - val_loss: 2.3589 - val_f1_score: 0.5576  
Epoch 366/500  
28/28 [=====] - 3s 106ms/step - loss: 0.1617 -  
f1_score: 0.9706 - val_loss: 2.3320 - val_f1_score: 0.5892  
Epoch 367/500  
28/28 [=====] - 2s 88ms/step - loss: 0.1675 - f1_score:  
0.9683 - val_loss: 2.4554 - val_f1_score: 0.5734  
Epoch 368/500  
28/28 [=====] - 3s 94ms/step - loss: 0.1594 - f1_score:  
0.9727 - val_loss: 2.4218 - val_f1_score: 0.6021  
Epoch 369/500  
28/28 [=====] - 2s 88ms/step - loss: 0.1606 - f1_score:  
0.9707 - val_loss: 2.7256 - val_f1_score: 0.5585  
Epoch 370/500  
28/28 [=====] - 3s 94ms/step - loss: 0.3026 - f1_score:  
0.9256 - val_loss: 2.4457 - val_f1_score: 0.5852  
Epoch 371/500  
28/28 [=====] - 2s 87ms/step - loss: 0.3642 - f1_score:  
0.9102 - val_loss: 2.7572 - val_f1_score: 0.5370  
Epoch 372/500  
28/28 [=====] - 3s 94ms/step - loss: 0.2909 - f1_score:  
0.9238 - val_loss: 2.3772 - val_f1_score: 0.5564  
Epoch 373/500  
28/28 [=====] - 2s 87ms/step - loss: 0.1875 - f1_score:  
0.9602 - val_loss: 2.5021 - val_f1_score: 0.6093  
Epoch 374/500  
28/28 [=====] - 3s 105ms/step - loss: 0.1929 -  
f1_score: 0.9583 - val_loss: 2.5513 - val_f1_score: 0.5768  
Epoch 375/500  
28/28 [=====] - 3s 90ms/step - loss: 0.1754 - f1_score:  
0.9606 - val_loss: 2.4379 - val_f1_score: 0.5718  
Epoch 376/500  
28/28 [=====] - 3s 120ms/step - loss: 0.1585 -  
f1_score: 0.9726 - val_loss: 2.6390 - val_f1_score: 0.5964  
Epoch 377/500  
28/28 [=====] - 3s 94ms/step - loss: 0.1768 - f1_score:  
0.9652 - val_loss: 2.6185 - val_f1_score: 0.5852  
Epoch 378/500  
28/28 [=====] - 3s 89ms/step - loss: 0.3329 - f1_score:  
0.9188 - val_loss: 2.6523 - val_f1_score: 0.5497  
Epoch 379/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3288 - f1_score:  
0.9161 - val_loss: 2.9561 - val_f1_score: 0.5308  
Epoch 380/500
```

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28/28 [=====] - 3s 91ms/step - loss: 0.2914 - f1_score: 0.9254 - val_loss: 2.5675 - val_f1_score: 0.5653
Epoch 381/500
28/28 [=====] - 3s 108ms/step - loss: 0.2285 - f1_score: 0.9468 - val_loss: 2.7857 - val_f1_score: 0.5644
Epoch 382/500
28/28 [=====] - 3s 90ms/step - loss: 0.2478 - f1_score: 0.9448 - val_loss: 2.5768 - val_f1_score: 0.5468
Epoch 383/500
28/28 [=====] - 3s 111ms/step - loss: 0.2536 - f1_score: 0.9432 - val_loss: 2.5042 - val_f1_score: 0.5841
Epoch 384/500
28/28 [=====] - 3s 103ms/step - loss: 0.2747 - f1_score: 0.9322 - val_loss: 2.5197 - val_f1_score: 0.5513
Epoch 385/500
28/28 [=====] - 3s 99ms/step - loss: 0.2241 - f1_score: 0.9497 - val_loss: 2.5580 - val_f1_score: 0.5754
Epoch 386/500
28/28 [=====] - ETA: 0s - loss: 0.1525 - f1_score: 0.9746
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 493ms/step - loss: 0.1525 - f1_score: 0.9746 - val_loss: 2.3565 - val_f1_score: 0.6139
Epoch 387/500
28/28 [=====] - 2s 82ms/step - loss: 0.1249 - f1_score: 0.9851 - val_loss: 2.5310 - val_f1_score: 0.5804
Epoch 388/500
28/28 [=====] - 3s 93ms/step - loss: 0.1211 - f1_score: 0.9857 - val_loss: 2.6192 - val_f1_score: 0.5843
Epoch 389/500
28/28 [=====] - 2s 88ms/step - loss: 0.1416 - f1_score: 0.9785 - val_loss: 2.6837 - val_f1_score: 0.5763
Epoch 390/500
28/28 [=====] - 3s 96ms/step - loss: 0.1766 - f1_score: 0.9600 - val_loss: 2.7233 - val_f1_score: 0.5804
Epoch 391/500
28/28 [=====] - 2s 86ms/step - loss: 0.1752 - f1_score: 0.9649 - val_loss: 2.9146 - val_f1_score: 0.5417
Epoch 392/500
28/28 [=====] - 3s 99ms/step - loss: 0.2360 - f1_score: 0.9519 - val_loss: 2.6364 - val_f1_score: 0.5594
Epoch 393/500
```

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28/28 [=====] - 2s 87ms/step - loss: 0.2771 - f1_score: 0.9323 - val_loss: 2.5551 - val_f1_score: 0.5821
Epoch 394/500
28/28 [=====] - 3s 104ms/step - loss: 0.3581 - f1_score: 0.9077 - val_loss: 2.6975 - val_f1_score: 0.5670
Epoch 395/500
28/28 [=====] - 2s 88ms/step - loss: 0.2268 - f1_score: 0.9543 - val_loss: 2.4925 - val_f1_score: 0.6072
Epoch 396/500
28/28 [=====] - 3s 95ms/step - loss: 0.3700 - f1_score: 0.9044 - val_loss: 2.6065 - val_f1_score: 0.5547
Epoch 397/500
28/28 [=====] - 3s 91ms/step - loss: 0.2416 - f1_score: 0.9387 - val_loss: 2.4449 - val_f1_score: 0.6065
Epoch 398/500
28/28 [=====] - 3s 93ms/step - loss: 0.1771 - f1_score: 0.9660 - val_loss: 2.8769 - val_f1_score: 0.5601
Epoch 399/500
28/28 [=====] - 2s 87ms/step - loss: 0.2353 - f1_score: 0.9442 - val_loss: 2.7056 - val_f1_score: 0.5682
Epoch 400/500
28/28 [=====] - 3s 98ms/step - loss: 0.1955 - f1_score: 0.9623 - val_loss: 2.8683 - val_f1_score: 0.5471
Epoch 401/500
28/28 [=====] - 2s 86ms/step - loss: 0.1506 - f1_score: 0.9765 - val_loss: 2.8054 - val_f1_score: 0.5683
Epoch 402/500
28/28 [=====] - 3s 93ms/step - loss: 0.1324 - f1_score: 0.9755 - val_loss: 2.7298 - val_f1_score: 0.5798
Epoch 403/500
28/28 [=====] - 3s 90ms/step - loss: 0.1446 - f1_score: 0.9755 - val_loss: 2.9154 - val_f1_score: 0.5789
Epoch 404/500
28/28 [=====] - 3s 98ms/step - loss: 0.1563 - f1_score: 0.9697 - val_loss: 2.8038 - val_f1_score: 0.5752
Epoch 405/500
28/28 [=====] - 2s 89ms/step - loss: 0.1292 - f1_score: 0.9821 - val_loss: 2.6621 - val_f1_score: 0.5710
Epoch 406/500
28/28 [=====] - 3s 104ms/step - loss: 0.1213 - f1_score: 0.9823 - val_loss: 2.8643 - val_f1_score: 0.5863
Epoch 407/500
28/28 [=====] - 3s 100ms/step - loss: 0.1154 - f1_score: 0.9868 - val_loss: 2.7201 - val_f1_score: 0.6107
Epoch 408/500
28/28 [=====] - 3s 92ms/step - loss: 0.1090 - f1_score: 0.9875 - val_loss: 2.6433 - val_f1_score: 0.6046
Epoch 409/500
```

```
28/28 [=====] - 3s 99ms/step - loss: 0.1161 - f1_score: 0.9826 - val_loss: 2.7940 - val_f1_score: 0.5716
Epoch 410/500
28/28 [=====] - 3s 93ms/step - loss: 0.1550 - f1_score: 0.9675 - val_loss: 2.7537 - val_f1_score: 0.5964
Epoch 411/500
28/28 [=====] - 3s 103ms/step - loss: 0.2030 - f1_score: 0.9618 - val_loss: 2.6747 - val_f1_score: 0.5922
Epoch 412/500
28/28 [=====] - 2s 87ms/step - loss: 0.2921 - f1_score: 0.9296 - val_loss: 2.7232 - val_f1_score: 0.5687
Epoch 413/500
28/28 [=====] - ETA: 0s - loss: 0.2502 - f1_score: 0.9464

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 [=====] - 14s 516ms/step - loss: 0.2502 - f1_score: 0.9464 - val_loss: 2.5617 - val_f1_score: 0.6227
Epoch 414/500
28/28 [=====] - 2s 83ms/step - loss: 0.1896 - f1_score: 0.9580 - val_loss: 2.9799 - val_f1_score: 0.5662
Epoch 415/500
28/28 [=====] - 2s 86ms/step - loss: 0.2370 - f1_score: 0.9523 - val_loss: 2.6752 - val_f1_score: 0.5906
Epoch 416/500
28/28 [=====] - 2s 84ms/step - loss: 0.3528 - f1_score: 0.9100 - val_loss: 2.6701 - val_f1_score: 0.5684
Epoch 417/500
28/28 [=====] - 2s 90ms/step - loss: 0.3571 - f1_score: 0.9117 - val_loss: 2.7528 - val_f1_score: 0.5629
Epoch 418/500
28/28 [=====] - ETA: 0s - loss: 0.2242 - f1_score: 0.9502

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 [=====] - 14s 500ms/step - loss: 0.2242 - f1_score: 0.9502 - val_loss: 2.5495 - val_f1_score: 0.6290
Epoch 419/500
```

```
28/28 [=====] - 2s 82ms/step - loss: 0.1521 - f1_score: 0.9745 - val_loss: 2.6260 - val_f1_score: 0.5832
Epoch 420/500
28/28 [=====] - 2s 89ms/step - loss: 0.1582 - f1_score: 0.9733 - val_loss: 2.9585 - val_f1_score: 0.5699
Epoch 421/500
28/28 [=====] - 2s 85ms/step - loss: 0.2099 - f1_score: 0.9525 - val_loss: 2.7951 - val_f1_score: 0.5723
Epoch 422/500
28/28 [=====] - 2s 86ms/step - loss: 0.2883 - f1_score: 0.9302 - val_loss: 2.6752 - val_f1_score: 0.5549
Epoch 423/500
28/28 [=====] - 2s 86ms/step - loss: 0.3476 - f1_score: 0.9171 - val_loss: 2.4138 - val_f1_score: 0.5692
Epoch 424/500
28/28 [=====] - 3s 91ms/step - loss: 0.2130 - f1_score: 0.9544 - val_loss: 2.7740 - val_f1_score: 0.5890
Epoch 425/500
28/28 [=====] - 2s 85ms/step - loss: 0.2813 - f1_score: 0.9357 - val_loss: 2.6075 - val_f1_score: 0.5990
Epoch 426/500
28/28 [=====] - 3s 92ms/step - loss: 0.2023 - f1_score: 0.9497 - val_loss: 2.7464 - val_f1_score: 0.5842
Epoch 427/500
28/28 [=====] - 3s 94ms/step - loss: 0.1678 - f1_score: 0.9663 - val_loss: 2.7555 - val_f1_score: 0.5767
Epoch 428/500
28/28 [=====] - 3s 104ms/step - loss: 0.1774 - f1_score: 0.9611 - val_loss: 2.5673 - val_f1_score: 0.5744
Epoch 429/500
28/28 [=====] - 3s 91ms/step - loss: 0.1756 - f1_score: 0.9658 - val_loss: 2.5229 - val_f1_score: 0.6160
Epoch 430/500
28/28 [=====] - ETA: 0s - loss: 0.1280 - f1_score: 0.9814
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 [=====] - 14s 521ms/step - loss: 0.1280 - f1_score: 0.9814 - val_loss: 2.6731 - val_f1_score: 0.6316
Epoch 431/500
28/28 [=====] - 2s 83ms/step - loss: 0.1189 - f1_score: 0.9847 - val_loss: 2.7533 - val_f1_score: 0.5983
Epoch 432/500
```

```
28/28 [=====] - ETA: 0s - loss: 0.1248 - f1_score: 0.9819
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 [=====] - 14s 499ms/step - loss: 0.1248 - f1_score: 0.9819 - val_loss: 2.5031 - val_f1_score: 0.6356
Epoch 433/500
28/28 [=====] - 2s 87ms/step - loss: 0.8459 - f1_score: 0.8176 - val_loss: 2.7239 - val_f1_score: 0.4960
Epoch 434/500
28/28 [=====] - 2s 85ms/step - loss: 0.7187 - f1_score: 0.8080 - val_loss: 2.5229 - val_f1_score: 0.5359
Epoch 435/500
28/28 [=====] - 3s 92ms/step - loss: 0.3156 - f1_score: 0.9174 - val_loss: 2.4486 - val_f1_score: 0.5822
Epoch 436/500
28/28 [=====] - 2s 84ms/step - loss: 0.2602 - f1_score: 0.9365 - val_loss: 2.6482 - val_f1_score: 0.5541
Epoch 437/500
28/28 [=====] - 3s 93ms/step - loss: 0.2991 - f1_score: 0.9244 - val_loss: 2.7663 - val_f1_score: 0.5425
Epoch 438/500
28/28 [=====] - 2s 86ms/step - loss: 0.4196 - f1_score: 0.8984 - val_loss: 2.5874 - val_f1_score: 0.5068
Epoch 439/500
28/28 [=====] - 3s 94ms/step - loss: 0.2960 - f1_score: 0.9263 - val_loss: 2.6592 - val_f1_score: 0.5564
Epoch 440/500
28/28 [=====] - 2s 85ms/step - loss: 0.1906 - f1_score: 0.9619 - val_loss: 2.8153 - val_f1_score: 0.5719
Epoch 441/500
28/28 [=====] - 3s 102ms/step - loss: 0.1480 - f1_score: 0.9764 - val_loss: 2.8294 - val_f1_score: 0.5650
Epoch 442/500
28/28 [=====] - 2s 88ms/step - loss: 0.1078 - f1_score: 0.9901 - val_loss: 2.7411 - val_f1_score: 0.5902
Epoch 443/500
28/28 [=====] - 3s 92ms/step - loss: 0.1131 - f1_score: 0.9876 - val_loss: 2.8286 - val_f1_score: 0.5719
Epoch 444/500
28/28 [=====] - 2s 87ms/step - loss: 0.1228 - f1_score: 0.9839 - val_loss: 2.7482 - val_f1_score: 0.5522
Epoch 445/500
```

```
28/28 [=====] - 3s 104ms/step - loss: 0.2211 -  
f1_score: 0.9530 - val_loss: 2.7085 - val_f1_score: 0.5982  
Epoch 446/500  
28/28 [=====] - 2s 88ms/step - loss: 0.2046 - f1_score:  
0.9554 - val_loss: 3.1791 - val_f1_score: 0.4912  
Epoch 447/500  
28/28 [=====] - 3s 95ms/step - loss: 0.2501 - f1_score:  
0.9374 - val_loss: 2.5669 - val_f1_score: 0.5642  
Epoch 448/500  
28/28 [=====] - 2s 87ms/step - loss: 0.1622 - f1_score:  
0.9726 - val_loss: 2.7660 - val_f1_score: 0.5865  
Epoch 449/500  
28/28 [=====] - 3s 102ms/step - loss: 0.1224 -  
f1_score: 0.9816 - val_loss: 2.7799 - val_f1_score: 0.5805  
Epoch 450/500  
28/28 [=====] - 2s 88ms/step - loss: 0.1051 - f1_score:  
0.9893 - val_loss: 2.8804 - val_f1_score: 0.5776  
Epoch 451/500  
28/28 [=====] - 3s 98ms/step - loss: 0.1039 - f1_score:  
0.9892 - val_loss: 2.9106 - val_f1_score: 0.5843  
Epoch 452/500  
28/28 [=====] - 3s 91ms/step - loss: 0.1499 - f1_score:  
0.9769 - val_loss: 3.0098 - val_f1_score: 0.5929  
Epoch 453/500  
28/28 [=====] - 3s 95ms/step - loss: 0.1768 - f1_score:  
0.9652 - val_loss: 2.5592 - val_f1_score: 0.6036  
Epoch 454/500  
28/28 [=====] - 2s 89ms/step - loss: 0.2037 - f1_score:  
0.9598 - val_loss: 3.1283 - val_f1_score: 0.5417  
Epoch 455/500  
28/28 [=====] - 3s 100ms/step - loss: 0.1808 -  
f1_score: 0.9607 - val_loss: 2.9292 - val_f1_score: 0.5849  
Epoch 456/500  
28/28 [=====] - 3s 92ms/step - loss: 0.1617 - f1_score:  
0.9658 - val_loss: 2.7095 - val_f1_score: 0.5846  
Epoch 457/500  
28/28 [=====] - 3s 101ms/step - loss: 0.1167 -  
f1_score: 0.9868 - val_loss: 2.8344 - val_f1_score: 0.5926  
Epoch 458/500  
28/28 [=====] - 3s 100ms/step - loss: 0.2045 -  
f1_score: 0.9554 - val_loss: 3.0867 - val_f1_score: 0.5391  
Epoch 459/500  
28/28 [=====] - 3s 92ms/step - loss: 0.1853 - f1_score:  
0.9570 - val_loss: 2.8162 - val_f1_score: 0.5825  
Epoch 460/500  
28/28 [=====] - 3s 100ms/step - loss: 0.1795 -  
f1_score: 0.9681 - val_loss: 2.7735 - val_f1_score: 0.6009  
Epoch 461/500
```

```
28/28 [=====] - 3s 91ms/step - loss: 0.1605 - f1_score: 0.9683 - val_loss: 3.0578 - val_f1_score: 0.5461
Epoch 462/500
28/28 [=====] - 3s 94ms/step - loss: 0.4516 - f1_score: 0.8977 - val_loss: 3.6565 - val_f1_score: 0.4563
Epoch 463/500
28/28 [=====] - 2s 88ms/step - loss: 0.8054 - f1_score: 0.7983 - val_loss: 2.6786 - val_f1_score: 0.4968
Epoch 464/500
28/28 [=====] - 3s 101ms/step - loss: 0.3616 - f1_score: 0.9039 - val_loss: 2.4574 - val_f1_score: 0.5890
Epoch 465/500
28/28 [=====] - 3s 93ms/step - loss: 0.2074 - f1_score: 0.9491 - val_loss: 2.4803 - val_f1_score: 0.5925
Epoch 466/500
28/28 [=====] - 3s 110ms/step - loss: 0.2411 - f1_score: 0.9452 - val_loss: 2.7244 - val_f1_score: 0.5788
Epoch 467/500
28/28 [=====] - 3s 90ms/step - loss: 0.1632 - f1_score: 0.9682 - val_loss: 2.6295 - val_f1_score: 0.5879
Epoch 468/500
28/28 [=====] - 3s 110ms/step - loss: 0.1188 - f1_score: 0.9854 - val_loss: 2.5855 - val_f1_score: 0.5864
Epoch 469/500
28/28 [=====] - 3s 99ms/step - loss: 0.1241 - f1_score: 0.9847 - val_loss: 2.7084 - val_f1_score: 0.5925
Epoch 470/500
28/28 [=====] - 3s 97ms/step - loss: 0.1220 - f1_score: 0.9814 - val_loss: 2.7278 - val_f1_score: 0.5976
Epoch 471/500
28/28 [=====] - 3s 96ms/step - loss: 0.1769 - f1_score: 0.9661 - val_loss: 2.8961 - val_f1_score: 0.6010
Epoch 472/500
28/28 [=====] - 2s 90ms/step - loss: 0.2019 - f1_score: 0.9548 - val_loss: 2.6400 - val_f1_score: 0.5775
Epoch 473/500
28/28 [=====] - 3s 102ms/step - loss: 0.1780 - f1_score: 0.9616 - val_loss: 2.7478 - val_f1_score: 0.5708
Epoch 474/500
28/28 [=====] - 2s 88ms/step - loss: 0.1439 - f1_score: 0.9746 - val_loss: 2.6640 - val_f1_score: 0.5716
Epoch 475/500
28/28 [=====] - 3s 99ms/step - loss: 0.1428 - f1_score: 0.9773 - val_loss: 2.7783 - val_f1_score: 0.6061
Epoch 476/500
28/28 [=====] - ETA: 0s - loss: 0.2219 - f1_score: 0.9531
```

```
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 497ms/step - loss: 0.2219 - f1_score: 0.9531 - val_loss: 2.4111 - val_f1_score: 0.6367
Epoch 477/500
28/28 [=====] - 2s 83ms/step - loss: 0.1612 - f1_score: 0.9670 - val_loss: 2.5994 - val_f1_score: 0.6150
Epoch 478/500
28/28 [=====] - 2s 84ms/step - loss: 0.1455 - f1_score: 0.9772 - val_loss: 2.7411 - val_f1_score: 0.5891
Epoch 479/500
28/28 [=====] - 2s 89ms/step - loss: 0.1334 - f1_score: 0.9841 - val_loss: 2.7094 - val_f1_score: 0.5793
Epoch 480/500
28/28 [=====] - 2s 84ms/step - loss: 0.1870 - f1_score: 0.9617 - val_loss: 3.0643 - val_f1_score: 0.5129
Epoch 481/500
28/28 [=====] - 3s 91ms/step - loss: 0.2436 - f1_score: 0.9518 - val_loss: 2.8871 - val_f1_score: 0.5506
Epoch 482/500
28/28 [=====] - 2s 86ms/step - loss: 0.2488 - f1_score: 0.9429 - val_loss: 2.7217 - val_f1_score: 0.5961
Epoch 483/500
28/28 [=====] - 3s 91ms/step - loss: 0.1371 - f1_score: 0.9782 - val_loss: 2.5740 - val_f1_score: 0.6181
Epoch 484/500
28/28 [=====] - 2s 86ms/step - loss: 0.1511 - f1_score: 0.9744 - val_loss: 2.8349 - val_f1_score: 0.5974
Epoch 485/500
28/28 [=====] - 3s 94ms/step - loss: 0.1718 - f1_score: 0.9667 - val_loss: 2.9961 - val_f1_score: 0.5636
Epoch 486/500
28/28 [=====] - 2s 86ms/step - loss: 0.2239 - f1_score: 0.9558 - val_loss: 2.8556 - val_f1_score: 0.5685
Epoch 487/500
28/28 [=====] - 3s 93ms/step - loss: 0.1477 - f1_score: 0.9766 - val_loss: 2.7456 - val_f1_score: 0.5853
Epoch 488/500
28/28 [=====] - 2s 86ms/step - loss: 0.1571 - f1_score: 0.9715 - val_loss: 2.6490 - val_f1_score: 0.6032
Epoch 489/500
28/28 [=====] - 3s 96ms/step - loss: 0.2274 - f1_score: 0.9495 - val_loss: 2.6805 - val_f1_score: 0.6014
```

```

Epoch 490/500
28/28 [=====] - 2s 89ms/step - loss: 0.1439 - f1_score: 0.9747 - val_loss: 2.5532 - val_f1_score: 0.6215
Epoch 491/500
28/28 [=====] - 3s 96ms/step - loss: 0.1307 - f1_score: 0.9801 - val_loss: 2.6642 - val_f1_score: 0.6159
Epoch 492/500
28/28 [=====] - 2s 87ms/step - loss: 0.1150 - f1_score: 0.9877 - val_loss: 2.9053 - val_f1_score: 0.5902
Epoch 493/500
28/28 [=====] - 3s 99ms/step - loss: 0.1393 - f1_score: 0.9745 - val_loss: 2.7381 - val_f1_score: 0.5881
Epoch 494/500
28/28 [=====] - 2s 90ms/step - loss: 0.1442 - f1_score: 0.9735 - val_loss: 2.9261 - val_f1_score: 0.5681
Epoch 495/500
28/28 [=====] - 3s 92ms/step - loss: 0.1698 - f1_score: 0.9635 - val_loss: 2.6613 - val_f1_score: 0.6016
Epoch 496/500
28/28 [=====] - 3s 93ms/step - loss: 0.2301 - f1_score: 0.9476 - val_loss: 3.1512 - val_f1_score: 0.5599
Epoch 497/500
28/28 [=====] - 3s 101ms/step - loss: 0.2745 - f1_score: 0.9361 - val_loss: 2.8571 - val_f1_score: 0.5615
Epoch 498/500
28/28 [=====] - 3s 104ms/step - loss: 0.2702 - f1_score: 0.9343 - val_loss: 2.6909 - val_f1_score: 0.5995
Epoch 499/500
28/28 [=====] - 3s 91ms/step - loss: 0.2011 - f1_score: 0.9536 - val_loss: 2.7096 - val_f1_score: 0.6024
Epoch 500/500
28/28 [=====] - 3s 99ms/step - loss: 0.1821 - f1_score: 0.9602 - val_loss: 2.7070 - val_f1_score: 0.5943

```

```
[141]: # convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

```
[142]: hist_df = pd.read_csv('1 LSTM/history.csv', index_col=0)
hist_df.tail()
```

	loss	f1_score	val_loss	val_f1_score
495	0.230123	0.947644	3.151237	0.559927
496	0.274543	0.936120	2.857149	0.561510

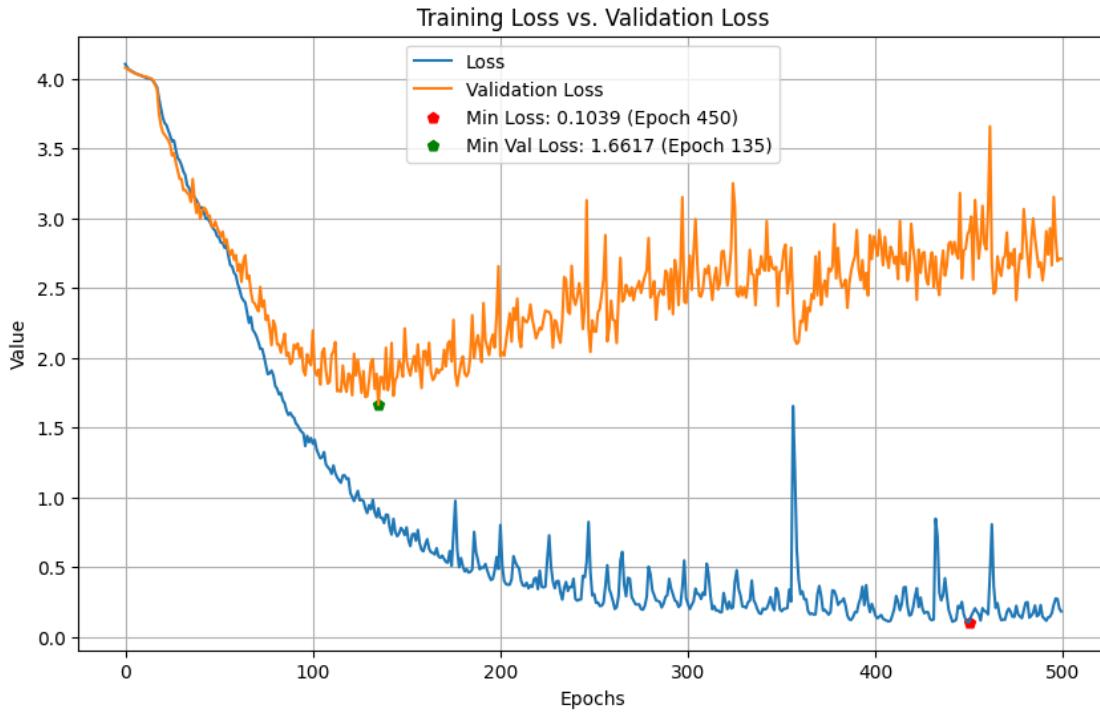
```
497 0.270153 0.934313 2.690917      0.599531
498 0.201144 0.953558 2.709644      0.602369
499 0.182115 0.960175 2.707047      0.594282
```

```
[143]: # 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()
```



```
[144]: # 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()

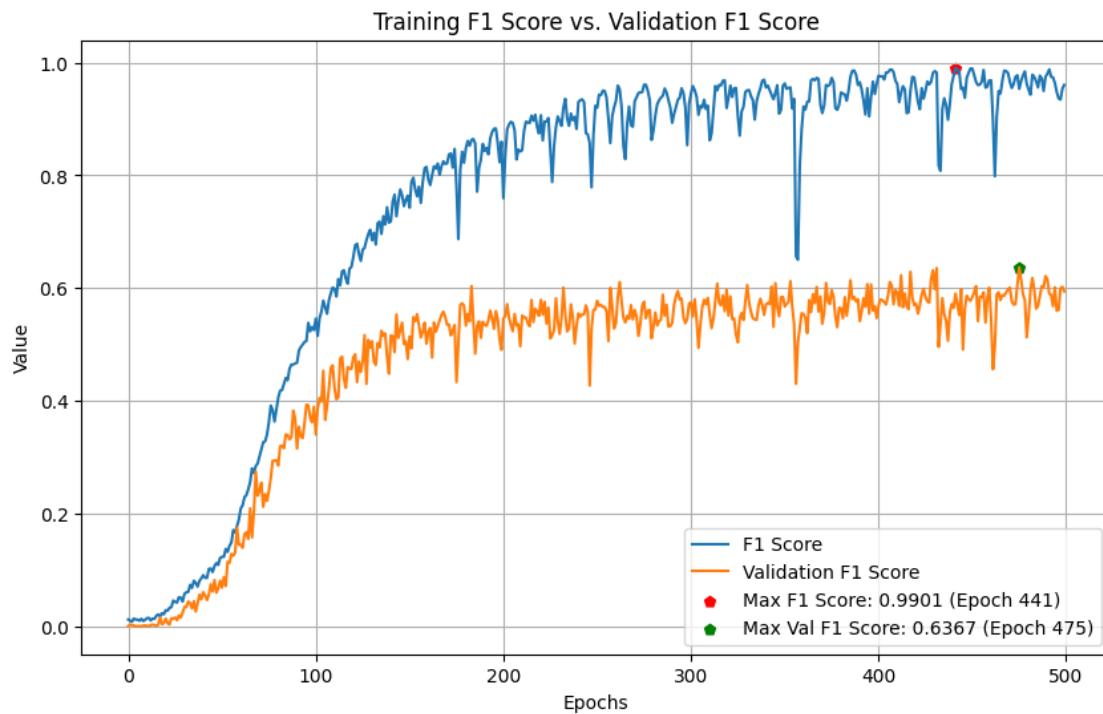
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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()

```



```

[145]: 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	0.889	1.000	0.941	8
BACKPACK	0.800	0.667	0.727	6
BASKETBALL	0.900	0.900	0.900	10
BEE	0.600	0.300	0.400	10
BELT	1.000	0.250	0.400	4
BITE	0.143	0.125	0.133	8
BREAKFAST	0.667	0.333	0.444	6
CANCER	1.000	0.500	0.667	8

CHRISTMAS	0.625	0.833	0.714	6
CONFUSED	0.714	0.833	0.769	6
DARK	1.000	0.750	0.857	4
DEAF	0.125	0.167	0.143	6
DECIDE	1.000	1.000	1.000	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.400	0.333	0.364	6
DINNER	1.000	0.250	0.400	8
DOG	0.250	0.333	0.286	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	0.000	0.000	0.000	4
EAT	0.600	0.500	0.545	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.462	0.750	0.571	8
FINE	0.222	0.500	0.308	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	0.800	0.667	0.727	6
GUESS	1.000	0.875	0.933	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.500	0.500	0.500	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	1.000	1.000	1.000	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.400	0.500	0.444	8
LUNCH	0.800	0.500	0.615	8
MAPLE	0.667	0.500	0.571	4
MEAT	0.417	0.833	0.556	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.455	0.625	0.526	8
NOON	0.800	1.000	0.889	8
PARTY	0.615	1.000	0.762	8
PATIENT	0.231	0.500	0.316	6
RAZOR	0.250	0.500	0.333	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.500	0.750	0.600	8
SHAVE	0.667	0.600	0.632	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.500	0.250	0.333	4
THEY	1.000	0.500	0.667	4
TWINS	0.625	0.625	0.625	8
WHATFOR	0.500	0.500	0.500	10
accuracy			0.611	324
macro avg	0.661	0.595	0.594	324
weighted avg	0.674	0.611	0.610	324

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

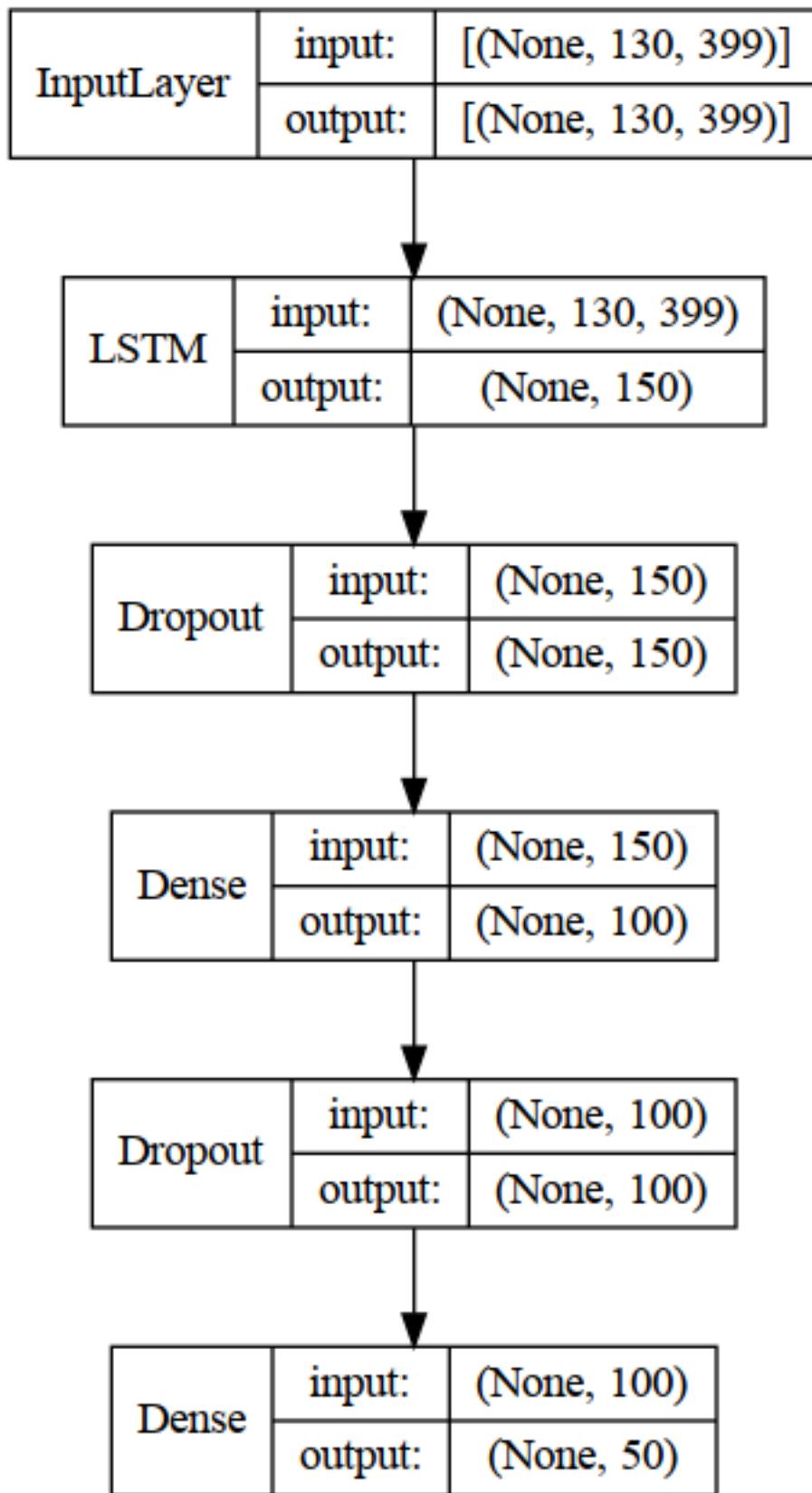
```
[147]: reconstructed_model.summary()
```

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
<hr/>		
lstm_1 (LSTM)	(None, 150)	330000
dropout_2 (Dropout)	(None, 150)	0
dense_2 (Dense)	(None, 100)	15100
dropout_3 (Dropout)	(None, 100)	0
dense_3 (Dense)	(None, 50)	5050
<hr/>		
Total params: 350,150		
Trainable params: 350,150		
Non-trainable params: 0		

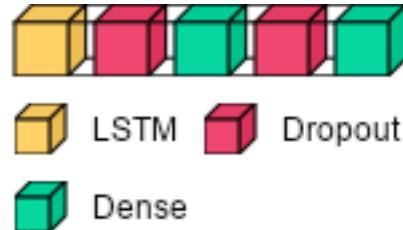
```
[148]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

```
[148]:
```



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

[151]:



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

```
11/11 [=====] - 1s 15ms/step - loss: 2.4111 - f1_score: 0.6367
```

[149]: [2.4111263751983643, 0.6366979479789734]

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

```
84/84 [=====] - 2s 19ms/step - loss: 0.0956 - f1_score: 0.9900
```

[150]: [0.09559568762779236, 0.9899914264678955]

```
[152]: 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 14ms/step
      precision    recall  f1-score   support
```

		precision	recall	f1-score	support
AXE	0.889	1.000	0.941	8	
BACKPACK	1.000	1.000	1.000	6	
BASKETBALL	0.900	0.900	0.900	10	
BEE	0.600	0.300	0.400	10	
BELT	1.000	0.750	0.857	4	
BITE	0.333	0.125	0.182	8	
BREAKFAST	0.833	0.833	0.833	6	
CANCER	1.000	0.500	0.667	8	
CHRISTMAS	0.545	1.000	0.706	6	
CONFUSED	0.500	0.833	0.625	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	0.625	0.769	8
DEVELOP	0.333	0.333	0.333	6
DINNER	1.000	0.250	0.400	8
DOG	0.250	0.333	0.286	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	0.000	0.000	0.000	4
EAT	0.625	0.833	0.714	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.429	0.750	0.545	8
FINE	0.333	0.500	0.400	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.833	0.833	0.833	6
GUESS	0.875	0.875	0.875	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.625	0.833	0.714	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	1.000	1.000	1.000	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.333	0.250	0.286	8
LUNCH	0.600	0.375	0.462	8
MAPLE	0.667	0.500	0.571	4
MEAT	0.400	0.667	0.500	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.667	1.000	0.800	8
NOON	0.875	0.875	0.875	8
PARTY	0.615	1.000	0.762	8
PATIENT	0.000	0.000	0.000	6
RAZOR	0.500	1.000	0.667	4
RIVER	0.833	0.833	0.833	6
ROCKINGCHAIR	0.667	0.750	0.706	8
SHAVE	0.750	0.600	0.667	10
SINK	1.000	0.667	0.800	6
SQUEEZE	0.000	0.000	0.000	4
THEY	1.000	0.750	0.857	4
TWINS	0.667	0.750	0.706	8
WHATFOR	0.444	0.400	0.421	10
accuracy			0.657	324
macro avg	0.668	0.653	0.637	324
weighted avg	0.684	0.657	0.646	324

## 4.2 Hyperparameter Tuning 2 LSTM Layers

```
[60]: 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)
```

```
/tmp/ipykernel_316180/3334091018.py:5: DeprecationWarning: `import kerastuner`  
is deprecated, please use `import keras_tuner`.  
from kerastuner.tuners import Hyperband
```

```
[61]: 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/CSPNext/hyperband/',
    project_name='2_LSTM',
    overwrite=False)
```

INFO:tensorflow:Reloading Tuner from  
 /media/kristian/HDD/ASL\_Citizen/CSPNext/hyperband/2\_LSTM/tuner0.json

```
[62]: 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'}
```

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

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

```
Trial 720 Complete [00h 29m 05s]
val_f1_score: 0.6098112463951111
```

```
Best val_f1_score So Far: 0.6521124839782715
Total elapsed time: 14h 31m 32s
INFO:tensorflow:Oracle triggered exit
```

```
[66]: 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
```

```
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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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.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
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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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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._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
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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
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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._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.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
```

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

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

```
Trial 0665 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: 0659
Score: 0.6521124839782715
```

```
Trial 0695 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: 0688
Score: 0.6384186148643494
```

```
Trial 0593 summary
Hyperparameters:
dense_activation: selu
units_1: 50
regularizer_1: 0.00014019410557845397
units_2: 200
regularizer_2: 0.00011334414085900249
dropout_1: 0.0
units_4: 120
dropout_2: 0.5
learning_rate: 0.000617885235880975
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0588
Score: 0.6364830732345581
```

```
Trial 0659 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: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0643
Score: 0.6252790987491608
```

```
Trial 0422 summary
Hyperparameters:
dense_activation: selu
units_1: 125
regularizer_1: 0.0029044390072926946
units_2: 75
regularizer_2: 0.0038287047044982298
dropout_1: 0.1
units_4: 90
dropout_2: 0.05
learning_rate: 0.0002554705805046948
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0420
Score: 0.6225647330284119
```

```
Trial 0710 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: 0702
Score: 0.6169518530368805
```

```
Trial 0594 summary
Hyperparameters:
dense_activation: selu
units_1: 75
regularizer_1: 0.0015691926121565343
units_2: 200
regularizer_2: 0.0006112420398328798
dropout_1: 0.25
units_4: 80
dropout_2: 0.15000000000000002
learning_rate: 0.00023623746207603882
tuner/epochs: 300
```

```
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0592
Score: 0.6133473515510559
```

```
Trial 0696 summary
Hyperparameters:
dense_activation: selu
units_1: 75
regularizer_1: 0.00028876663931139905
units_2: 175
regularizer_2: 0.002068490996729264
dropout_1: 0.05
units_4: 70
dropout_2: 0.6000000000000001
learning_rate: 0.00015774253193313493
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0691
Score: 0.610099732875824
```

```
Trial 0719 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: 0.6098112463951111
```

```
Trial 0588 summary
Hyperparameters:
dense_activation: selu
units_1: 50
regularizer_1: 0.00014019410557845397
units_2: 200
regularizer_2: 0.00011334414085900249
```

```
dropout_1: 0.0
units_4: 120
dropout_2: 0.5
learning_rate: 0.000617885235880975
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0576
Score: 0.6053167879581451
```

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

11/11 [=====] - 2s 72ms/step - loss: 2.1651 - f1_score: 0.6556
```

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

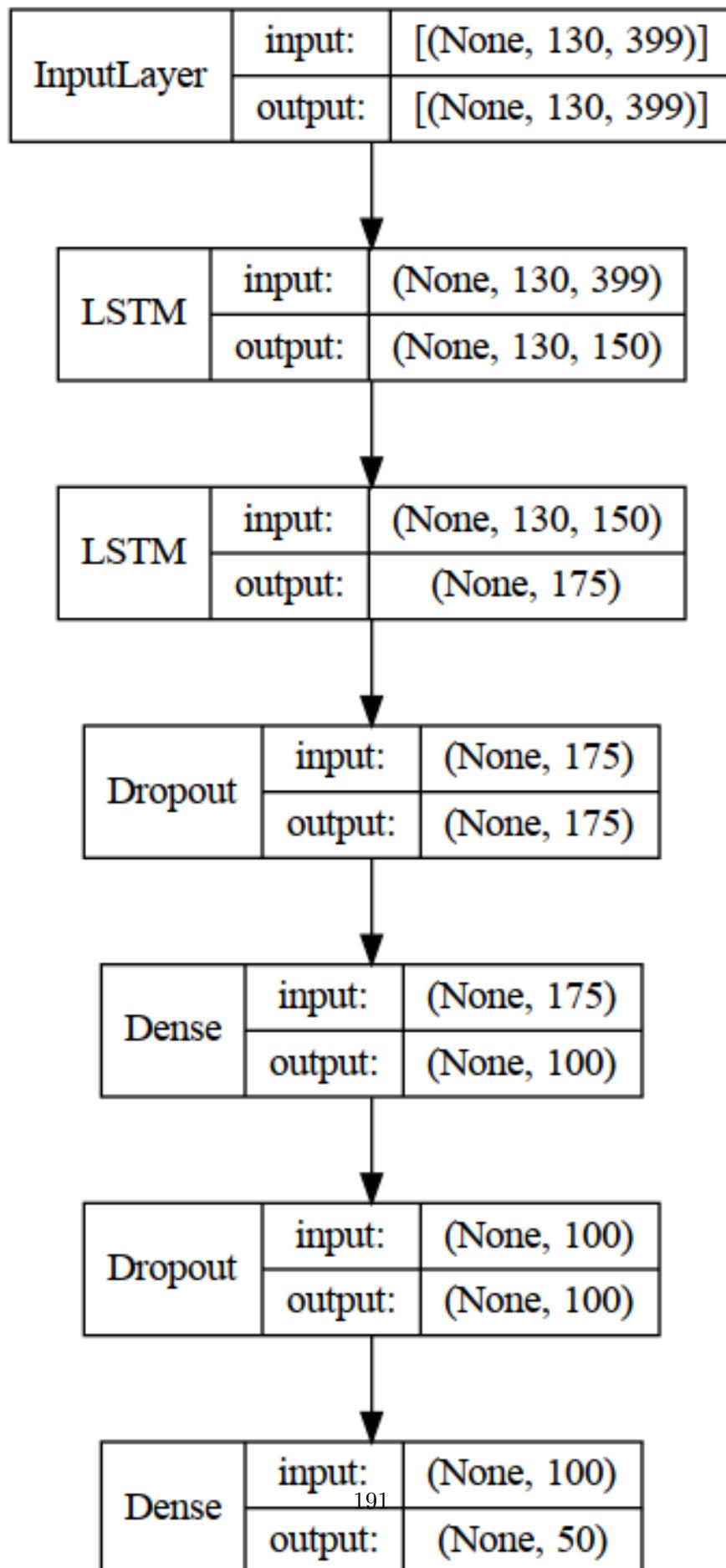
84/84 [=====] - 2s 25ms/step - loss: 0.4180 - f1_score: 0.9920
```

```
[70]: 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
```

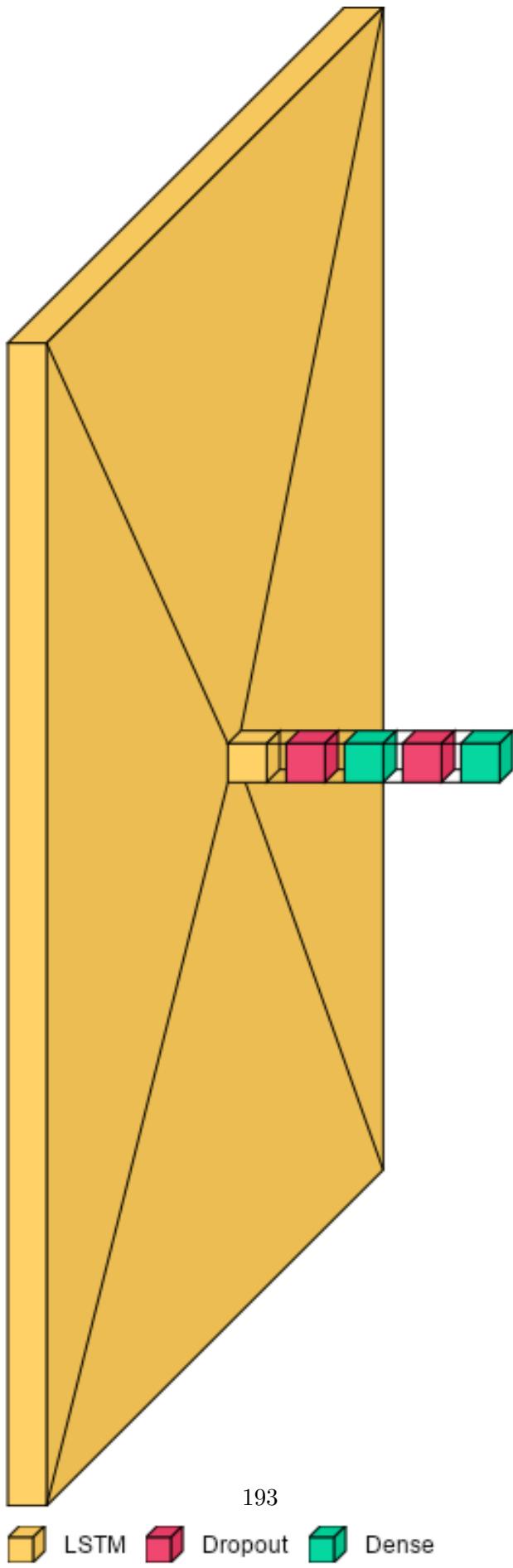
```
[71]: plot_model(best_model, show_shapes=True, show_layer_names=False)

[71]:
```



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

```
[72]:
```



```
[73]: 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 22ms/step

	precision	recall	f1-score	support
AXE	1.000	0.875	0.933	8
BACKPACK	0.667	0.667	0.667	6
BASKETBALL	0.800	0.800	0.800	10
BEE	0.667	0.400	0.500	10
BELT	0.667	1.000	0.800	4
BITE	0.667	0.250	0.364	8
BREAKFAST	0.571	0.667	0.615	6
CANCER	0.889	1.000	0.941	8
CHRISTMAS	1.000	0.833	0.909	6
CONFUSED	0.667	0.667	0.667	6
DARK	1.000	1.000	1.000	4
DEAF	0.000	0.000	0.000	6
DECIDE	1.000	1.000	1.000	6
DEMAND	1.000	1.000	1.000	8
DEVELOP	0.500	0.500	0.500	6
DINNER	0.875	0.875	0.875	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	0.750	0.500	0.600	6
EDIT	0.625	0.833	0.714	6
ELEVATOR	0.400	0.750	0.522	8
FINE	0.500	0.500	0.500	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	1.000	0.750	0.857	8
HALLOWEEN	0.667	1.000	0.800	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	0.000	0.000	0.000	4
LOCK	0.857	0.750	0.800	8
LUNCH	0.667	0.500	0.571	8
MAPLE	0.500	1.000	0.667	4
MEAT	0.600	1.000	0.750	6
MECHANIC	0.800	1.000	0.889	4

MICROSCOPE	1.000	0.375	0.545	8
MOVIE	0.667	0.750	0.706	8
NOON	0.889	1.000	0.941	8
PARTY	1.000	0.750	0.857	8
PATIENT	0.375	0.500	0.429	6
RAZOR	0.500	0.250	0.333	4
RIVER	0.667	1.000	0.800	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.556	0.500	0.526	10
SINK	0.500	0.333	0.400	6
SQUEEZE	0.500	0.500	0.500	4
THEY	0.333	0.500	0.400	4
TWINS	0.267	0.500	0.348	8
WHATFOR	0.857	0.600	0.706	10
accuracy			0.682	324
macro avg	0.686	0.667	0.656	324
weighted avg	0.709	0.682	0.675	324

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

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

```
[89]: 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 169ms/step - loss: 6.6922 -  
f1\_score: 0.0132 - val\_loss: 6.4883 - val\_f1\_score: 0.0011

Epoch 2/500  
28/28 [=====] - 4s 134ms/step - loss: 6.3104 -  
f1\_score: 0.0107 - val\_loss: 6.1154 - val\_f1\_score: 7.8947e-04

Epoch 3/500  
28/28 [=====] - 4s 133ms/step - loss: 5.9594 -  
f1\_score: 0.0094 - val\_loss: 5.7930 - val\_f1\_score: 0.0029

Epoch 4/500  
28/28 [=====] - 4s 134ms/step - loss: 5.6523 -  
f1\_score: 0.0108 - val\_loss: 5.5102 - val\_f1\_score: 0.0119  
Epoch 5/500  
28/28 [=====] - 4s 132ms/step - loss: 5.3874 -  
f1\_score: 0.0125 - val\_loss: 5.2675 - val\_f1\_score: 0.0112  
Epoch 6/500  
28/28 [=====] - 4s 134ms/step - loss: 5.1305 -  
f1\_score: 0.0141 - val\_loss: 5.0545 - val\_f1\_score: 0.0023  
Epoch 7/500  
28/28 [=====] - 4s 132ms/step - loss: 4.8882 -  
f1\_score: 0.0181 - val\_loss: 4.7495 - val\_f1\_score: 0.0074  
Epoch 8/500  
28/28 [=====] - 4s 135ms/step - loss: 4.6863 -  
f1\_score: 0.0265 - val\_loss: 4.5590 - val\_f1\_score: 0.0061  
Epoch 9/500  
28/28 [=====] - 4s 135ms/step - loss: 4.4890 -  
f1\_score: 0.0329 - val\_loss: 4.3381 - val\_f1\_score: 0.0233  
Epoch 10/500  
28/28 [=====] - 4s 137ms/step - loss: 4.3257 -  
f1\_score: 0.0388 - val\_loss: 4.1313 - val\_f1\_score: 0.0289  
Epoch 11/500  
28/28 [=====] - 4s 136ms/step - loss: 4.1958 -  
f1\_score: 0.0440 - val\_loss: 4.0137 - val\_f1\_score: 0.0243  
Epoch 12/500  
28/28 [=====] - 4s 138ms/step - loss: 4.0680 -  
f1\_score: 0.0481 - val\_loss: 3.9101 - val\_f1\_score: 0.0375  
Epoch 13/500  
28/28 [=====] - 4s 142ms/step - loss: 3.9711 -  
f1\_score: 0.0577 - val\_loss: 3.8596 - val\_f1\_score: 0.0351  
Epoch 14/500  
28/28 [=====] - 4s 140ms/step - loss: 3.8935 -  
f1\_score: 0.0675 - val\_loss: 3.7515 - val\_f1\_score: 0.0403  
Epoch 15/500  
28/28 [=====] - 4s 138ms/step - loss: 3.7987 -  
f1\_score: 0.0747 - val\_loss: 3.6821 - val\_f1\_score: 0.0577  
Epoch 16/500  
28/28 [=====] - 4s 141ms/step - loss: 3.7380 -  
f1\_score: 0.0781 - val\_loss: 3.6368 - val\_f1\_score: 0.0704  
Epoch 17/500  
28/28 [=====] - 4s 140ms/step - loss: 3.6600 -  
f1\_score: 0.0918 - val\_loss: 3.5426 - val\_f1\_score: 0.0727  
Epoch 18/500  
28/28 [=====] - 4s 139ms/step - loss: 3.5920 -  
f1\_score: 0.1100 - val\_loss: 3.5372 - val\_f1\_score: 0.0953  
Epoch 19/500  
28/28 [=====] - 4s 143ms/step - loss: 3.5156 -  
f1\_score: 0.1152 - val\_loss: 3.5104 - val\_f1\_score: 0.0971

Epoch 20/500  
28/28 [=====] - 4s 139ms/step - loss: 3.3991 -  
f1\_score: 0.1461 - val\_loss: 3.3211 - val\_f1\_score: 0.1440  
Epoch 21/500  
28/28 [=====] - 4s 143ms/step - loss: 3.3318 -  
f1\_score: 0.1529 - val\_loss: 3.2228 - val\_f1\_score: 0.1693  
Epoch 22/500  
28/28 [=====] - 4s 141ms/step - loss: 3.2184 -  
f1\_score: 0.1764 - val\_loss: 3.2352 - val\_f1\_score: 0.1266  
Epoch 23/500  
28/28 [=====] - 4s 141ms/step - loss: 3.1466 -  
f1\_score: 0.1977 - val\_loss: 3.0823 - val\_f1\_score: 0.2045  
Epoch 24/500  
28/28 [=====] - 4s 141ms/step - loss: 3.0626 -  
f1\_score: 0.1999 - val\_loss: 2.9657 - val\_f1\_score: 0.2121  
Epoch 25/500  
28/28 [=====] - 4s 140ms/step - loss: 2.9303 -  
f1\_score: 0.2505 - val\_loss: 2.8950 - val\_f1\_score: 0.2480  
Epoch 26/500  
28/28 [=====] - 4s 141ms/step - loss: 2.8589 -  
f1\_score: 0.2576 - val\_loss: 2.9268 - val\_f1\_score: 0.2377  
Epoch 27/500  
28/28 [=====] - 4s 143ms/step - loss: 2.8012 -  
f1\_score: 0.2700 - val\_loss: 2.7343 - val\_f1\_score: 0.2754  
Epoch 28/500  
28/28 [=====] - 4s 140ms/step - loss: 2.7344 -  
f1\_score: 0.2959 - val\_loss: 2.7824 - val\_f1\_score: 0.2689  
Epoch 29/500  
28/28 [=====] - 4s 142ms/step - loss: 2.6141 -  
f1\_score: 0.3150 - val\_loss: 2.7272 - val\_f1\_score: 0.2690  
Epoch 30/500  
28/28 [=====] - 4s 141ms/step - loss: 2.5489 -  
f1\_score: 0.3321 - val\_loss: 2.5194 - val\_f1\_score: 0.3129  
Epoch 31/500  
28/28 [=====] - 4s 141ms/step - loss: 2.5057 -  
f1\_score: 0.3525 - val\_loss: 2.5998 - val\_f1\_score: 0.2997  
Epoch 32/500  
28/28 [=====] - 4s 141ms/step - loss: 2.4441 -  
f1\_score: 0.3688 - val\_loss: 2.6527 - val\_f1\_score: 0.2986  
Epoch 33/500  
28/28 [=====] - 4s 142ms/step - loss: 2.4031 -  
f1\_score: 0.3671 - val\_loss: 2.4595 - val\_f1\_score: 0.3396  
Epoch 34/500  
28/28 [=====] - 4s 140ms/step - loss: 2.3506 -  
f1\_score: 0.3832 - val\_loss: 2.3812 - val\_f1\_score: 0.4087  
Epoch 35/500  
28/28 [=====] - 4s 145ms/step - loss: 2.2856 -  
f1\_score: 0.4110 - val\_loss: 2.3825 - val\_f1\_score: 0.3883

```
Epoch 36/500
28/28 [=====] - 4s 144ms/step - loss: 2.2112 -
f1_score: 0.4347 - val_loss: 2.4292 - val_f1_score: 0.3508
Epoch 37/500
28/28 [=====] - 4s 144ms/step - loss: 2.2091 -
f1_score: 0.4246 - val_loss: 2.5015 - val_f1_score: 0.3745
Epoch 38/500
28/28 [=====] - 4s 145ms/step - loss: 2.1363 -
f1_score: 0.4522 - val_loss: 2.2400 - val_f1_score: 0.4374
Epoch 39/500
28/28 [=====] - 4s 141ms/step - loss: 2.1564 -
f1_score: 0.4428 - val_loss: 2.3012 - val_f1_score: 0.4483
Epoch 40/500
28/28 [=====] - 4s 143ms/step - loss: 2.0173 -
f1_score: 0.4939 - val_loss: 2.1973 - val_f1_score: 0.4340
Epoch 41/500
28/28 [=====] - 4s 143ms/step - loss: 1.9735 -
f1_score: 0.4977 - val_loss: 2.3421 - val_f1_score: 0.3775
Epoch 42/500
28/28 [=====] - 4s 143ms/step - loss: 1.9484 -
f1_score: 0.5075 - val_loss: 2.1883 - val_f1_score: 0.4507
Epoch 43/500
28/28 [=====] - 4s 146ms/step - loss: 1.9206 -
f1_score: 0.5329 - val_loss: 2.2974 - val_f1_score: 0.4241
Epoch 44/500
28/28 [=====] - 4s 143ms/step - loss: 1.9122 -
f1_score: 0.5149 - val_loss: 2.2700 - val_f1_score: 0.4158
Epoch 45/500
28/28 [=====] - 4s 143ms/step - loss: 1.8276 -
f1_score: 0.5469 - val_loss: 2.1421 - val_f1_score: 0.4336
Epoch 46/500
28/28 [=====] - 4s 143ms/step - loss: 1.7608 -
f1_score: 0.5704 - val_loss: 2.1915 - val_f1_score: 0.4650
Epoch 47/500
28/28 [=====] - 4s 143ms/step - loss: 1.7229 -
f1_score: 0.5802 - val_loss: 2.0389 - val_f1_score: 0.4934
Epoch 48/500
28/28 [=====] - 4s 145ms/step - loss: 1.7503 -
f1_score: 0.5621 - val_loss: 2.1286 - val_f1_score: 0.4666
Epoch 49/500
28/28 [=====] - 4s 142ms/step - loss: 1.7286 -
f1_score: 0.5721 - val_loss: 2.1035 - val_f1_score: 0.4745
Epoch 50/500
28/28 [=====] - 4s 143ms/step - loss: 1.7406 -
f1_score: 0.5586 - val_loss: 2.0074 - val_f1_score: 0.4762
Epoch 51/500
28/28 [=====] - 4s 146ms/step - loss: 1.6356 -
f1_score: 0.6005 - val_loss: 2.0627 - val_f1_score: 0.4975
```

Epoch 52/500  
28/28 [=====] - 4s 145ms/step - loss: 1.6061 -  
f1\_score: 0.6200 - val\_loss: 2.0635 - val\_f1\_score: 0.4766  
Epoch 53/500  
28/28 [=====] - 4s 147ms/step - loss: 1.5787 -  
f1\_score: 0.6232 - val\_loss: 2.2180 - val\_f1\_score: 0.4301  
Epoch 54/500  
28/28 [=====] - 4s 143ms/step - loss: 1.5890 -  
f1\_score: 0.6130 - val\_loss: 2.0228 - val\_f1\_score: 0.4761  
Epoch 55/500  
28/28 [=====] - 4s 144ms/step - loss: 1.5270 -  
f1\_score: 0.6359 - val\_loss: 1.9649 - val\_f1\_score: 0.5124  
Epoch 56/500  
28/28 [=====] - 4s 149ms/step - loss: 1.5289 -  
f1\_score: 0.6271 - val\_loss: 1.9427 - val\_f1\_score: 0.5344  
Epoch 57/500  
28/28 [=====] - 4s 149ms/step - loss: 1.4830 -  
f1\_score: 0.6506 - val\_loss: 2.0045 - val\_f1\_score: 0.4974  
Epoch 58/500  
28/28 [=====] - 4s 151ms/step - loss: 1.4964 -  
f1\_score: 0.6462 - val\_loss: 1.9307 - val\_f1\_score: 0.5243  
Epoch 59/500  
28/28 [=====] - 4s 151ms/step - loss: 1.3733 -  
f1\_score: 0.6782 - val\_loss: 1.8980 - val\_f1\_score: 0.5483  
Epoch 60/500  
28/28 [=====] - 4s 146ms/step - loss: 1.3991 -  
f1\_score: 0.6673 - val\_loss: 1.9934 - val\_f1\_score: 0.5366  
Epoch 61/500  
28/28 [=====] - 4s 146ms/step - loss: 1.3518 -  
f1\_score: 0.6849 - val\_loss: 1.8365 - val\_f1\_score: 0.5510  
Epoch 62/500  
28/28 [=====] - 4s 147ms/step - loss: 1.3611 -  
f1\_score: 0.6860 - val\_loss: 1.8659 - val\_f1\_score: 0.5435  
Epoch 63/500  
28/28 [=====] - 4s 144ms/step - loss: 1.3112 -  
f1\_score: 0.7002 - val\_loss: 1.8231 - val\_f1\_score: 0.5410  
Epoch 64/500  
28/28 [=====] - 4s 147ms/step - loss: 1.2603 -  
f1\_score: 0.7260 - val\_loss: 1.8188 - val\_f1\_score: 0.5738  
Epoch 65/500  
28/28 [=====] - 4s 145ms/step - loss: 1.2820 -  
f1\_score: 0.7123 - val\_loss: 1.8158 - val\_f1\_score: 0.5405  
Epoch 66/500  
28/28 [=====] - 4s 145ms/step - loss: 1.2587 -  
f1\_score: 0.7134 - val\_loss: 1.9801 - val\_f1\_score: 0.5226  
Epoch 67/500  
28/28 [=====] - 4s 150ms/step - loss: 1.2109 -  
f1\_score: 0.7308 - val\_loss: 1.8806 - val\_f1\_score: 0.5689

Epoch 68/500  
28/28 [=====] - 4s 144ms/step - loss: 1.1917 -  
f1\_score: 0.7357 - val\_loss: 1.8836 - val\_f1\_score: 0.5285  
Epoch 69/500  
28/28 [=====] - 4s 148ms/step - loss: 1.1614 -  
f1\_score: 0.7465 - val\_loss: 2.1330 - val\_f1\_score: 0.5366  
Epoch 70/500  
28/28 [=====] - 4s 149ms/step - loss: 1.3215 -  
f1\_score: 0.7043 - val\_loss: 1.9058 - val\_f1\_score: 0.5128  
Epoch 71/500  
28/28 [=====] - 4s 147ms/step - loss: 1.2783 -  
f1\_score: 0.7060 - val\_loss: 1.8532 - val\_f1\_score: 0.5791  
Epoch 72/500  
28/28 [=====] - 4s 150ms/step - loss: 1.1564 -  
f1\_score: 0.7462 - val\_loss: 1.8275 - val\_f1\_score: 0.5756  
Epoch 73/500  
28/28 [=====] - 4s 145ms/step - loss: 1.1012 -  
f1\_score: 0.7658 - val\_loss: 1.9270 - val\_f1\_score: 0.5520  
Epoch 74/500  
28/28 [=====] - 4s 146ms/step - loss: 1.1100 -  
f1\_score: 0.7691 - val\_loss: 1.9600 - val\_f1\_score: 0.5352  
Epoch 75/500  
28/28 [=====] - 4s 147ms/step - loss: 1.0521 -  
f1\_score: 0.7827 - val\_loss: 1.9251 - val\_f1\_score: 0.5508  
Epoch 76/500  
28/28 [=====] - 4s 152ms/step - loss: 1.0981 -  
f1\_score: 0.7758 - val\_loss: 1.9008 - val\_f1\_score: 0.5735  
Epoch 77/500  
28/28 [=====] - 4s 146ms/step - loss: 1.0639 -  
f1\_score: 0.7765 - val\_loss: 2.0665 - val\_f1\_score: 0.5213  
Epoch 78/500  
28/28 [=====] - 4s 147ms/step - loss: 1.1338 -  
f1\_score: 0.7556 - val\_loss: 1.9347 - val\_f1\_score: 0.5368  
Epoch 79/500  
28/28 [=====] - 4s 146ms/step - loss: 1.0399 -  
f1\_score: 0.7919 - val\_loss: 2.0827 - val\_f1\_score: 0.5137  
Epoch 80/500  
28/28 [=====] - 4s 146ms/step - loss: 1.1335 -  
f1\_score: 0.7488 - val\_loss: 1.9825 - val\_f1\_score: 0.5629  
Epoch 81/500  
28/28 [=====] - 4s 146ms/step - loss: 1.0542 -  
f1\_score: 0.7745 - val\_loss: 2.0402 - val\_f1\_score: 0.5250  
Epoch 82/500  
28/28 [=====] - 4s 143ms/step - loss: 0.9967 -  
f1\_score: 0.8017 - val\_loss: 1.8983 - val\_f1\_score: 0.5252  
Epoch 83/500  
28/28 [=====] - 4s 145ms/step - loss: 0.9194 -  
f1\_score: 0.8206 - val\_loss: 1.8188 - val\_f1\_score: 0.5868

Epoch 84/500  
28/28 [=====] - 4s 144ms/step - loss: 0.9615 -  
f1\_score: 0.8185 - val\_loss: 1.8207 - val\_f1\_score: 0.5950  
Epoch 85/500  
28/28 [=====] - 4s 145ms/step - loss: 0.9234 -  
f1\_score: 0.8193 - val\_loss: 2.1946 - val\_f1\_score: 0.5203  
Epoch 86/500  
28/28 [=====] - 4s 145ms/step - loss: 0.8796 -  
f1\_score: 0.8439 - val\_loss: 1.9448 - val\_f1\_score: 0.5809  
Epoch 87/500  
28/28 [=====] - 4s 146ms/step - loss: 0.8689 -  
f1\_score: 0.8459 - val\_loss: 2.1084 - val\_f1\_score: 0.5195  
Epoch 88/500  
28/28 [=====] - 4s 151ms/step - loss: 0.8994 -  
f1\_score: 0.8276 - val\_loss: 2.0542 - val\_f1\_score: 0.5440  
Epoch 89/500  
28/28 [=====] - 4s 147ms/step - loss: 0.8528 -  
f1\_score: 0.8488 - val\_loss: 1.8971 - val\_f1\_score: 0.5704  
Epoch 90/500  
28/28 [=====] - 4s 145ms/step - loss: 0.8240 -  
f1\_score: 0.8514 - val\_loss: 1.9005 - val\_f1\_score: 0.5554  
Epoch 91/500  
28/28 [=====] - 4s 149ms/step - loss: 0.8338 -  
f1\_score: 0.8510 - val\_loss: 2.0327 - val\_f1\_score: 0.5282  
Epoch 92/500  
28/28 [=====] - 4s 151ms/step - loss: 0.8183 -  
f1\_score: 0.8615 - val\_loss: 1.8135 - val\_f1\_score: 0.6116  
Epoch 93/500  
28/28 [=====] - 4s 146ms/step - loss: 0.7701 -  
f1\_score: 0.8732 - val\_loss: 1.9344 - val\_f1\_score: 0.5885  
Epoch 94/500  
28/28 [=====] - 4s 147ms/step - loss: 0.7917 -  
f1\_score: 0.8647 - val\_loss: 2.0110 - val\_f1\_score: 0.5672  
Epoch 95/500  
28/28 [=====] - 4s 146ms/step - loss: 0.8920 -  
f1\_score: 0.8310 - val\_loss: 1.9711 - val\_f1\_score: 0.5965  
Epoch 96/500  
28/28 [=====] - 4s 147ms/step - loss: 0.8006 -  
f1\_score: 0.8608 - val\_loss: 1.9758 - val\_f1\_score: 0.5624  
Epoch 97/500  
28/28 [=====] - 4s 147ms/step - loss: 0.8053 -  
f1\_score: 0.8576 - val\_loss: 1.8587 - val\_f1\_score: 0.6463  
Epoch 98/500  
28/28 [=====] - 4s 148ms/step - loss: 0.8936 -  
f1\_score: 0.8247 - val\_loss: 2.1750 - val\_f1\_score: 0.5261  
Epoch 99/500  
28/28 [=====] - 4s 144ms/step - loss: 0.8899 -  
f1\_score: 0.8218 - val\_loss: 2.0957 - val\_f1\_score: 0.5475

Epoch 100/500  
28/28 [=====] - 4s 147ms/step - loss: 0.9563 -  
f1\_score: 0.8074 - val\_loss: 2.2689 - val\_f1\_score: 0.4945  
Epoch 101/500  
28/28 [=====] - 4s 149ms/step - loss: 1.1509 -  
f1\_score: 0.7594 - val\_loss: 2.0617 - val\_f1\_score: 0.5794  
Epoch 102/500  
28/28 [=====] - 4s 150ms/step - loss: 0.8320 -  
f1\_score: 0.8472 - val\_loss: 2.1076 - val\_f1\_score: 0.5405  
Epoch 103/500  
28/28 [=====] - 4s 150ms/step - loss: 0.7808 -  
f1\_score: 0.8599 - val\_loss: 1.9754 - val\_f1\_score: 0.5860  
Epoch 104/500  
28/28 [=====] - 4s 152ms/step - loss: 0.7424 -  
f1\_score: 0.8773 - val\_loss: 1.8788 - val\_f1\_score: 0.6014  
Epoch 105/500  
28/28 [=====] - 4s 147ms/step - loss: 0.6710 -  
f1\_score: 0.9107 - val\_loss: 1.9251 - val\_f1\_score: 0.5982  
Epoch 106/500  
28/28 [=====] - 4s 150ms/step - loss: 0.6803 -  
f1\_score: 0.8967 - val\_loss: 2.1150 - val\_f1\_score: 0.5476  
Epoch 107/500  
28/28 [=====] - 4s 149ms/step - loss: 0.7307 -  
f1\_score: 0.8794 - val\_loss: 1.9410 - val\_f1\_score: 0.6014  
Epoch 108/500  
28/28 [=====] - 4s 146ms/step - loss: 0.6703 -  
f1\_score: 0.8987 - val\_loss: 1.8586 - val\_f1\_score: 0.6014  
Epoch 109/500  
28/28 [=====] - 4s 147ms/step - loss: 0.6446 -  
f1\_score: 0.9025 - val\_loss: 2.0324 - val\_f1\_score: 0.5956  
Epoch 110/500  
28/28 [=====] - 4s 149ms/step - loss: 0.6551 -  
f1\_score: 0.9010 - val\_loss: 2.0208 - val\_f1\_score: 0.5816  
Epoch 111/500  
28/28 [=====] - 4s 145ms/step - loss: 0.6782 -  
f1\_score: 0.8915 - val\_loss: 1.9503 - val\_f1\_score: 0.6138  
Epoch 112/500  
28/28 [=====] - 4s 148ms/step - loss: 0.6380 -  
f1\_score: 0.9092 - val\_loss: 1.9560 - val\_f1\_score: 0.5988  
Epoch 113/500  
28/28 [=====] - 4s 146ms/step - loss: 0.7776 -  
f1\_score: 0.8661 - val\_loss: 2.4447 - val\_f1\_score: 0.5139  
Epoch 114/500  
28/28 [=====] - 4s 146ms/step - loss: 0.7212 -  
f1\_score: 0.8802 - val\_loss: 2.3659 - val\_f1\_score: 0.5155  
Epoch 115/500  
28/28 [=====] - 4s 144ms/step - loss: 1.0026 -  
f1\_score: 0.7902 - val\_loss: 2.0931 - val\_f1\_score: 0.5895

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Epoch 116/500
28/28 [=====] - 4s 144ms/step - loss: 0.7839 -
f1_score: 0.8620 - val_loss: 2.0267 - val_f1_score: 0.5939
Epoch 117/500
28/28 [=====] - 4s 148ms/step - loss: 0.6920 -
f1_score: 0.8913 - val_loss: 1.9595 - val_f1_score: 0.5706
Epoch 118/500
28/28 [=====] - 4s 146ms/step - loss: 0.6114 -
f1_score: 0.9179 - val_loss: 2.1046 - val_f1_score: 0.5474
Epoch 119/500
28/28 [=====] - 4s 151ms/step - loss: 0.6102 -
f1_score: 0.9167 - val_loss: 2.0208 - val_f1_score: 0.6053
Epoch 120/500
28/28 [=====] - 4s 147ms/step - loss: 0.5945 -
f1_score: 0.9212 - val_loss: 1.9270 - val_f1_score: 0.6316
Epoch 121/500
28/28 [=====] - 4s 151ms/step - loss: 0.6124 -
f1_score: 0.9144 - val_loss: 2.0079 - val_f1_score: 0.6180
Epoch 122/500
28/28 [=====] - 4s 144ms/step - loss: 0.5860 -
f1_score: 0.9263 - val_loss: 1.9585 - val_f1_score: 0.6201
Epoch 123/500
28/28 [=====] - 4s 147ms/step - loss: 0.6103 -
f1_score: 0.9207 - val_loss: 2.1464 - val_f1_score: 0.5774
Epoch 124/500
28/28 [=====] - 4s 147ms/step - loss: 0.6015 -
f1_score: 0.9148 - val_loss: 1.9300 - val_f1_score: 0.6404
Epoch 125/500
28/28 [=====] - 4s 149ms/step - loss: 0.6039 -
f1_score: 0.9150 - val_loss: 2.0487 - val_f1_score: 0.5931
Epoch 126/500
28/28 [=====] - 4s 148ms/step - loss: 0.5579 -
f1_score: 0.9312 - val_loss: 2.0095 - val_f1_score: 0.5953
Epoch 127/500
28/28 [=====] - 4s 145ms/step - loss: 0.5420 -
f1_score: 0.9340 - val_loss: 1.9399 - val_f1_score: 0.6265
Epoch 128/500
28/28 [=====] - 4s 146ms/step - loss: 0.7362 -
f1_score: 0.8768 - val_loss: 2.2579 - val_f1_score: 0.5360
Epoch 129/500
28/28 [=====] - 4s 146ms/step - loss: 0.6646 -
f1_score: 0.8949 - val_loss: 2.1227 - val_f1_score: 0.5889
Epoch 130/500
28/28 [=====] - 4s 146ms/step - loss: 0.8802 -
f1_score: 0.8385 - val_loss: 2.0658 - val_f1_score: 0.5813
Epoch 131/500
28/28 [=====] - 4s 149ms/step - loss: 0.6760 -
f1_score: 0.8885 - val_loss: 1.9268 - val_f1_score: 0.5890
```

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Epoch 132/500
28/28 [=====] - 4s 154ms/step - loss: 0.5742 -
f1_score: 0.9290 - val_loss: 1.9660 - val_f1_score: 0.6054
Epoch 133/500
28/28 [=====] - 4s 144ms/step - loss: 0.5615 -
f1_score: 0.9281 - val_loss: 1.9968 - val_f1_score: 0.6250
Epoch 134/500
28/28 [=====] - 4s 149ms/step - loss: 0.4932 -
f1_score: 0.9546 - val_loss: 1.8750 - val_f1_score: 0.6115
Epoch 135/500
28/28 [=====] - 4s 146ms/step - loss: 0.4714 -
f1_score: 0.9623 - val_loss: 1.8360 - val_f1_score: 0.6287
Epoch 136/500
28/28 [=====] - 4s 148ms/step - loss: 0.4769 -
f1_score: 0.9599 - val_loss: 1.9285 - val_f1_score: 0.6313
Epoch 137/500
28/28 [=====] - 4s 148ms/step - loss: 0.5951 -
f1_score: 0.9203 - val_loss: 2.1839 - val_f1_score: 0.5745
Epoch 138/500
28/28 [=====] - 4s 149ms/step - loss: 1.0093 -
f1_score: 0.8027 - val_loss: 2.2824 - val_f1_score: 0.5422
Epoch 139/500
28/28 [=====] - 4s 145ms/step - loss: 0.7455 -
f1_score: 0.8616 - val_loss: 1.8984 - val_f1_score: 0.5900
Epoch 140/500
28/28 [=====] - 4s 160ms/step - loss: 0.6186 -
f1_score: 0.9041 - val_loss: 1.9717 - val_f1_score: 0.6130
Epoch 141/500
28/28 [=====] - 4s 149ms/step - loss: 0.5701 -
f1_score: 0.9228 - val_loss: 1.9562 - val_f1_score: 0.5968
Epoch 142/500
28/28 [=====] - 4s 150ms/step - loss: 0.5309 -
f1_score: 0.9340 - val_loss: 1.9512 - val_f1_score: 0.6188
Epoch 143/500
28/28 [=====] - 4s 148ms/step - loss: 0.5867 -
f1_score: 0.9207 - val_loss: 2.1012 - val_f1_score: 0.6122
Epoch 144/500
28/28 [=====] - 4s 152ms/step - loss: 0.5763 -
f1_score: 0.9210 - val_loss: 2.0809 - val_f1_score: 0.5413
Epoch 145/500
28/28 [=====] - ETA: 0s - loss: 0.5929 - f1_score:
0.9186

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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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INFO:tensorflow:Assets written to: 2 LSTM/assets

28/28 [=====] - 23s 832ms/step - loss: 0.5929 -  
f1\_score: 0.9186 - val\_loss: 1.8514 - val\_f1\_score: 0.6580  
Epoch 146/500

28/28 [=====] - 4s 137ms/step - loss: 0.4986 -  
f1\_score: 0.9477 - val\_loss: 1.9482 - val\_f1\_score: 0.6254  
Epoch 147/500

28/28 [=====] - 4s 139ms/step - loss: 0.4805 -  
f1\_score: 0.9574 - val\_loss: 1.9239 - val\_f1\_score: 0.6172  
Epoch 148/500

28/28 [=====] - 4s 140ms/step - loss: 0.4418 -  
f1\_score: 0.9664 - val\_loss: 1.9552 - val\_f1\_score: 0.6287  
Epoch 149/500

28/28 [=====] - 4s 143ms/step - loss: 0.4331 -  
f1\_score: 0.9715 - val\_loss: 2.0271 - val\_f1\_score: 0.6129  
Epoch 150/500

28/28 [=====] - 4s 144ms/step - loss: 0.4204 -  
f1\_score: 0.9751 - val\_loss: 2.0258 - val\_f1\_score: 0.6120  
Epoch 151/500

28/28 [=====] - 4s 143ms/step - loss: 0.4102 -  
f1\_score: 0.9806 - val\_loss: 2.0187 - val\_f1\_score: 0.6152  
Epoch 152/500

28/28 [=====] - 4s 144ms/step - loss: 0.4813 -  
f1\_score: 0.9499 - val\_loss: 2.1037 - val\_f1\_score: 0.6354  
Epoch 153/500

28/28 [=====] - 4s 145ms/step - loss: 0.4944 -  
f1\_score: 0.9412 - val\_loss: 2.1273 - val\_f1\_score: 0.6289  
Epoch 154/500

28/28 [=====] - 4s 143ms/step - loss: 0.4817 -  
f1\_score: 0.9545 - val\_loss: 2.1786 - val\_f1\_score: 0.6031  
Epoch 155/500

28/28 [=====] - 4s 143ms/step - loss: 0.5622 -  
f1\_score: 0.9231 - val\_loss: 2.0784 - val\_f1\_score: 0.5853  
Epoch 156/500

28/28 [=====] - 4s 143ms/step - loss: 0.5722 -  
f1\_score: 0.9174 - val\_loss: 2.1617 - val\_f1\_score: 0.5709  
Epoch 157/500

28/28 [=====] - 4s 144ms/step - loss: 0.6152 -  
f1\_score: 0.9026 - val\_loss: 2.0898 - val\_f1\_score: 0.6168  
Epoch 158/500

28/28 [=====] - 4s 145ms/step - loss: 0.4955 -  
f1\_score: 0.9476 - val\_loss: 2.1233 - val\_f1\_score: 0.6187  
Epoch 159/500

28/28 [=====] - 4s 147ms/step - loss: 0.4374 -  
f1\_score: 0.9649 - val\_loss: 2.0196 - val\_f1\_score: 0.6317  
Epoch 160/500

28/28 [=====] - 4s 150ms/step - loss: 0.4649 -

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f1_score: 0.9562 - val_loss: 1.8225 - val_f1_score: 0.6291
Epoch 161/500
28/28 [=====] - 4s 151ms/step - loss: 0.4218 -
f1_score: 0.9675 - val_loss: 2.1711 - val_f1_score: 0.6048
Epoch 162/500
28/28 [=====] - 4s 154ms/step - loss: 0.4328 -
f1_score: 0.9631 - val_loss: 1.9865 - val_f1_score: 0.6374
Epoch 163/500
28/28 [=====] - 4s 149ms/step - loss: 0.5819 -
f1_score: 0.9188 - val_loss: 2.1550 - val_f1_score: 0.5865
Epoch 164/500
28/28 [=====] - 4s 154ms/step - loss: 0.5575 -
f1_score: 0.9206 - val_loss: 2.2892 - val_f1_score: 0.6045
Epoch 165/500
28/28 [=====] - 4s 146ms/step - loss: 0.7723 -
f1_score: 0.8619 - val_loss: 1.9702 - val_f1_score: 0.5962
Epoch 166/500
28/28 [=====] - 4s 149ms/step - loss: 0.5967 -
f1_score: 0.9090 - val_loss: 2.1055 - val_f1_score: 0.6092
Epoch 167/500
28/28 [=====] - 4s 147ms/step - loss: 0.4971 -
f1_score: 0.9403 - val_loss: 2.0558 - val_f1_score: 0.6482
Epoch 168/500
28/28 [=====] - 4s 148ms/step - loss: 0.4854 -
f1_score: 0.9457 - val_loss: 1.9866 - val_f1_score: 0.6272
Epoch 169/500
28/28 [=====] - 4s 147ms/step - loss: 0.6451 -
f1_score: 0.8984 - val_loss: 2.3050 - val_f1_score: 0.5729
Epoch 170/500
28/28 [=====] - 4s 146ms/step - loss: 0.7647 -
f1_score: 0.8572 - val_loss: 2.2609 - val_f1_score: 0.5629
Epoch 171/500
28/28 [=====] - 4s 147ms/step - loss: 0.5570 -
f1_score: 0.9261 - val_loss: 2.0786 - val_f1_score: 0.6483
Epoch 172/500
28/28 [=====] - 4s 146ms/step - loss: 0.5238 -
f1_score: 0.9296 - val_loss: 2.1227 - val_f1_score: 0.6243
Epoch 173/500
28/28 [=====] - 4s 146ms/step - loss: 0.5192 -
f1_score: 0.9291 - val_loss: 2.0432 - val_f1_score: 0.6349
Epoch 174/500
28/28 [=====] - 4s 154ms/step - loss: 0.4522 -
f1_score: 0.9614 - val_loss: 2.0740 - val_f1_score: 0.6448
Epoch 175/500
28/28 [=====] - 4s 148ms/step - loss: 0.4193 -
f1_score: 0.9674 - val_loss: 2.0011 - val_f1_score: 0.6344
Epoch 176/500
28/28 [=====] - 4s 144ms/step - loss: 0.4000 -
```

```
f1_score: 0.9731 - val_loss: 2.0002 - val_f1_score: 0.6497
Epoch 177/500
28/28 [=====] - ETA: 0s - loss: 0.3883 - f1_score: 0.9771

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 772ms/step - loss: 0.3883 -
f1_score: 0.9771 - val_loss: 1.9893 - val_f1_score: 0.6591
Epoch 178/500
28/28 [=====] - 4s 137ms/step - loss: 0.3923 -
f1_score: 0.9746 - val_loss: 1.9714 - val_f1_score: 0.6506
Epoch 179/500
28/28 [=====] - ETA: 0s - loss: 0.3709 - f1_score: 0.9829

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 815ms/step - loss: 0.3709 -
f1_score: 0.9829 - val_loss: 2.0222 - val_f1_score: 0.6631
Epoch 180/500
28/28 [=====] - 4s 137ms/step - loss: 0.3579 -
f1_score: 0.9858 - val_loss: 1.9827 - val_f1_score: 0.6529
Epoch 181/500
28/28 [=====] - 4s 140ms/step - loss: 0.3680 -
f1_score: 0.9834 - val_loss: 2.0773 - val_f1_score: 0.6362
Epoch 182/500
28/28 [=====] - 4s 143ms/step - loss: 0.3563 -
f1_score: 0.9859 - val_loss: 2.0709 - val_f1_score: 0.6366
Epoch 183/500
28/28 [=====] - 4s 143ms/step - loss: 0.3444 -
f1_score: 0.9924 - val_loss: 1.9720 - val_f1_score: 0.6565
Epoch 184/500
28/28 [=====] - 4s 143ms/step - loss: 0.3408 -
f1_score: 0.9908 - val_loss: 2.1067 - val_f1_score: 0.6506
Epoch 185/500
28/28 [=====] - ETA: 0s - loss: 0.3394 - f1_score: 0.9909
```

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WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 713ms/step - loss: 0.3394 -
f1_score: 0.9909 - val_loss: 2.1049 - val_f1_score: 0.6634
Epoch 186/500
28/28 [=====] - 4s 137ms/step - loss: 0.3792 -
f1_score: 0.9757 - val_loss: 2.1270 - val_f1_score: 0.6378
Epoch 187/500
28/28 [=====] - 4s 141ms/step - loss: 0.3661 -
f1_score: 0.9784 - val_loss: 2.0814 - val_f1_score: 0.6466
Epoch 188/500
28/28 [=====] - 4s 143ms/step - loss: 0.3486 -
f1_score: 0.9857 - val_loss: 2.1484 - val_f1_score: 0.6343
Epoch 189/500
28/28 [=====] - 4s 143ms/step - loss: 0.3453 -
f1_score: 0.9837 - val_loss: 2.1974 - val_f1_score: 0.6184
Epoch 190/500
28/28 [=====] - 4s 145ms/step - loss: 0.3589 -
f1_score: 0.9809 - val_loss: 2.2863 - val_f1_score: 0.6290
Epoch 191/500
28/28 [=====] - 4s 146ms/step - loss: 0.3939 -
f1_score: 0.9701 - val_loss: 2.2273 - val_f1_score: 0.6440
Epoch 192/500
28/28 [=====] - 4s 146ms/step - loss: 0.5259 -
f1_score: 0.9277 - val_loss: 2.2387 - val_f1_score: 0.6310
Epoch 193/500
28/28 [=====] - 4s 147ms/step - loss: 0.7717 -
f1_score: 0.8528 - val_loss: 2.5428 - val_f1_score: 0.5678
Epoch 194/500
28/28 [=====] - 4s 145ms/step - loss: 0.7041 -
f1_score: 0.8749 - val_loss: 2.5958 - val_f1_score: 0.5413
Epoch 195/500
28/28 [=====] - 4s 147ms/step - loss: 0.4873 -
f1_score: 0.9414 - val_loss: 2.0697 - val_f1_score: 0.6173
Epoch 196/500
28/28 [=====] - 4s 145ms/step - loss: 0.4388 -
f1_score: 0.9536 - val_loss: 2.2685 - val_f1_score: 0.6175
Epoch 197/500
28/28 [=====] - 4s 149ms/step - loss: 0.5228 -
f1_score: 0.9299 - val_loss: 2.1596 - val_f1_score: 0.5979
Epoch 198/500
28/28 [=====] - 4s 145ms/step - loss: 0.5600 -
```

```
f1_score: 0.9139 - val_loss: 2.1933 - val_f1_score: 0.6032
Epoch 199/500
28/28 [=====] - 4s 148ms/step - loss: 0.4735 -
f1_score: 0.9455 - val_loss: 2.2007 - val_f1_score: 0.6003
Epoch 200/500
28/28 [=====] - 4s 144ms/step - loss: 0.4118 -
f1_score: 0.9635 - val_loss: 2.2119 - val_f1_score: 0.6021
Epoch 201/500
28/28 [=====] - 4s 152ms/step - loss: 0.3670 -
f1_score: 0.9807 - val_loss: 2.1323 - val_f1_score: 0.6329
Epoch 202/500
28/28 [=====] - 4s 146ms/step - loss: 0.3827 -
f1_score: 0.9725 - val_loss: 2.1780 - val_f1_score: 0.6439
Epoch 203/500
28/28 [=====] - 4s 145ms/step - loss: 0.5276 -
f1_score: 0.9274 - val_loss: 2.2519 - val_f1_score: 0.6006
Epoch 204/500
28/28 [=====] - 4s 148ms/step - loss: 0.5091 -
f1_score: 0.9283 - val_loss: 2.2274 - val_f1_score: 0.6064
Epoch 205/500
28/28 [=====] - 4s 148ms/step - loss: 0.4128 -
f1_score: 0.9603 - val_loss: 2.4631 - val_f1_score: 0.6195
Epoch 206/500
28/28 [=====] - 4s 145ms/step - loss: 0.3944 -
f1_score: 0.9668 - val_loss: 2.1067 - val_f1_score: 0.6188
Epoch 207/500
28/28 [=====] - 4s 145ms/step - loss: 0.3842 -
f1_score: 0.9717 - val_loss: 2.2707 - val_f1_score: 0.6056
Epoch 208/500
28/28 [=====] - 4s 149ms/step - loss: 0.3803 -
f1_score: 0.9749 - val_loss: 2.3811 - val_f1_score: 0.5948
Epoch 209/500
28/28 [=====] - 4s 147ms/step - loss: 0.5471 -
f1_score: 0.9348 - val_loss: 2.3638 - val_f1_score: 0.6077
Epoch 210/500
28/28 [=====] - 4s 145ms/step - loss: 0.6509 -
f1_score: 0.8945 - val_loss: 2.2754 - val_f1_score: 0.5900
Epoch 211/500
28/28 [=====] - ETA: 0s - loss: 0.4313 - f1_score:
0.9535

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 749ms/step - loss: 0.4313 -  
f1_score: 0.9535 - val_loss: 2.0551 - val_f1_score: 0.6741  
Epoch 212/500  
28/28 [=====] - 4s 139ms/step - loss: 0.3784 -  
f1_score: 0.9745 - val_loss: 2.0925 - val_f1_score: 0.6162  
Epoch 213/500  
28/28 [=====] - 4s 143ms/step - loss: 0.3363 -  
f1_score: 0.9881 - val_loss: 1.9103 - val_f1_score: 0.6653  
Epoch 214/500  
28/28 [=====] - 4s 143ms/step - loss: 0.3301 -  
f1_score: 0.9876 - val_loss: 2.1043 - val_f1_score: 0.6403  
Epoch 215/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4818 -  
f1_score: 0.9453 - val_loss: 2.4076 - val_f1_score: 0.5924  
Epoch 216/500  
28/28 [=====] - 4s 145ms/step - loss: 0.6294 -  
f1_score: 0.8990 - val_loss: 2.3002 - val_f1_score: 0.6011  
Epoch 217/500  
28/28 [=====] - 4s 144ms/step - loss: 0.4874 -  
f1_score: 0.9368 - val_loss: 2.0520 - val_f1_score: 0.6479  
Epoch 218/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3993 -  
f1_score: 0.9683 - val_loss: 2.1299 - val_f1_score: 0.6448  
Epoch 219/500  
28/28 [=====] - ETA: 0s - loss: 0.3500 - f1_score:  
0.9810  
WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,  
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,  
lstm_cell_7_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 687ms/step - loss: 0.3500 -  
f1_score: 0.9810 - val_loss: 1.9713 - val_f1_score: 0.6803  
Epoch 220/500  
28/28 [=====] - 4s 139ms/step - loss: 0.3258 -  
f1_score: 0.9926 - val_loss: 1.9637 - val_f1_score: 0.6659  
Epoch 221/500  
28/28 [=====] - ETA: 0s - loss: 0.3124 - f1_score:  
0.9971  
WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,  
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,  
lstm_cell_7_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: 0.3124 -  
f1\_score: 0.9971 - val\_loss: 1.9239 - val\_f1\_score: 0.6850  
Epoch 222/500

28/28 [=====] - 4s 136ms/step - loss: 0.3110 -  
f1\_score: 0.9938 - val\_loss: 2.0078 - val\_f1\_score: 0.6704  
Epoch 223/500

28/28 [=====] - 4s 139ms/step - loss: 0.3062 -  
f1\_score: 0.9962 - val\_loss: 1.9924 - val\_f1\_score: 0.6754  
Epoch 224/500

28/28 [=====] - 4s 140ms/step - loss: 0.3000 -  
f1\_score: 0.9962 - val\_loss: 1.9979 - val\_f1\_score: 0.6758  
Epoch 225/500

28/28 [=====] - 4s 142ms/step - loss: 0.3013 -  
f1\_score: 0.9942 - val\_loss: 2.0185 - val\_f1\_score: 0.6709  
Epoch 226/500

28/28 [=====] - 4s 145ms/step - loss: 0.3021 -  
f1\_score: 0.9919 - val\_loss: 2.0773 - val\_f1\_score: 0.6572  
Epoch 227/500

28/28 [=====] - 4s 144ms/step - loss: 0.2970 -  
f1\_score: 0.9954 - val\_loss: 2.0855 - val\_f1\_score: 0.6652  
Epoch 228/500

28/28 [=====] - 4s 144ms/step - loss: 0.2983 -  
f1\_score: 0.9929 - val\_loss: 2.0009 - val\_f1\_score: 0.6698  
Epoch 229/500

28/28 [=====] - 4s 144ms/step - loss: 0.2901 -  
f1\_score: 0.9971 - val\_loss: 2.0498 - val\_f1\_score: 0.6595  
Epoch 230/500

28/28 [=====] - 4s 144ms/step - loss: 0.2909 -  
f1\_score: 0.9948 - val\_loss: 2.0986 - val\_f1\_score: 0.6683  
Epoch 231/500

28/28 [=====] - 4s 145ms/step - loss: 0.2998 -  
f1\_score: 0.9935 - val\_loss: 2.0796 - val\_f1\_score: 0.6739  
Epoch 232/500

28/28 [=====] - 4s 144ms/step - loss: 0.2940 -  
f1\_score: 0.9942 - val\_loss: 2.0780 - val\_f1\_score: 0.6665  
Epoch 233/500

28/28 [=====] - 4s 145ms/step - loss: 0.2905 -  
f1\_score: 0.9960 - val\_loss: 2.0522 - val\_f1\_score: 0.6809  
Epoch 234/500

28/28 [=====] - 4s 145ms/step - loss: 0.3265 -  
f1\_score: 0.9847 - val\_loss: 2.4023 - val\_f1\_score: 0.6252  
Epoch 235/500

28/28 [=====] - 4s 145ms/step - loss: 0.4148 -  
f1\_score: 0.9559 - val\_loss: 2.9703 - val\_f1\_score: 0.5599  
Epoch 236/500

28/28 [=====] - 4s 145ms/step - loss: 0.6968 -

```
f1_score: 0.8760 - val_loss: 2.6031 - val_f1_score: 0.5789
Epoch 237/500
28/28 [=====] - 4s 143ms/step - loss: 0.8139 -
f1_score: 0.8430 - val_loss: 2.1238 - val_f1_score: 0.5888
Epoch 238/500
28/28 [=====] - 4s 150ms/step - loss: 0.6214 -
f1_score: 0.8967 - val_loss: 2.1379 - val_f1_score: 0.6313
Epoch 239/500
28/28 [=====] - 4s 148ms/step - loss: 0.5559 -
f1_score: 0.9152 - val_loss: 2.0119 - val_f1_score: 0.6604
Epoch 240/500
28/28 [=====] - 4s 148ms/step - loss: 0.3959 -
f1_score: 0.9624 - val_loss: 2.2157 - val_f1_score: 0.5965
Epoch 241/500
28/28 [=====] - 4s 148ms/step - loss: 0.3763 -
f1_score: 0.9632 - val_loss: 2.1794 - val_f1_score: 0.6200
Epoch 242/500
28/28 [=====] - 4s 154ms/step - loss: 0.3565 -
f1_score: 0.9739 - val_loss: 2.1625 - val_f1_score: 0.6246
Epoch 243/500
28/28 [=====] - 4s 145ms/step - loss: 0.3542 -
f1_score: 0.9763 - val_loss: 2.1731 - val_f1_score: 0.6414
Epoch 244/500
28/28 [=====] - 4s 147ms/step - loss: 0.3243 -
f1_score: 0.9843 - val_loss: 2.1789 - val_f1_score: 0.6483
Epoch 245/500
28/28 [=====] - 4s 147ms/step - loss: 0.3064 -
f1_score: 0.9910 - val_loss: 2.0473 - val_f1_score: 0.6430
Epoch 246/500
28/28 [=====] - 4s 147ms/step - loss: 0.2988 -
f1_score: 0.9943 - val_loss: 1.9983 - val_f1_score: 0.6614
Epoch 247/500
28/28 [=====] - 4s 149ms/step - loss: 0.2907 -
f1_score: 0.9960 - val_loss: 2.0775 - val_f1_score: 0.6420
Epoch 248/500
28/28 [=====] - 4s 149ms/step - loss: 0.2855 -
f1_score: 0.9962 - val_loss: 2.0481 - val_f1_score: 0.6577
Epoch 249/500
28/28 [=====] - 4s 145ms/step - loss: 0.2842 -
f1_score: 0.9954 - val_loss: 1.9889 - val_f1_score: 0.6657
Epoch 250/500
28/28 [=====] - 4s 156ms/step - loss: 0.2800 -
f1_score: 0.9976 - val_loss: 1.9094 - val_f1_score: 0.6651
Epoch 251/500
28/28 [=====] - 4s 154ms/step - loss: 0.2806 -
f1_score: 0.9965 - val_loss: 2.0087 - val_f1_score: 0.6711
Epoch 252/500
28/28 [=====] - 4s 155ms/step - loss: 0.2788 -
```

```
f1_score: 0.9963 - val_loss: 1.9626 - val_f1_score: 0.6586
Epoch 253/500
28/28 [=====] - 4s 154ms/step - loss: 0.2745 -
f1_score: 0.9977 - val_loss: 2.0471 - val_f1_score: 0.6682
Epoch 254/500
28/28 [=====] - 4s 149ms/step - loss: 0.2736 -
f1_score: 0.9985 - val_loss: 2.0268 - val_f1_score: 0.6730
Epoch 255/500
28/28 [=====] - 4s 147ms/step - loss: 0.2691 -
f1_score: 0.9972 - val_loss: 1.9653 - val_f1_score: 0.6738
Epoch 256/500
28/28 [=====] - 4s 150ms/step - loss: 0.2707 -
f1_score: 0.9973 - val_loss: 2.0483 - val_f1_score: 0.6771
Epoch 257/500
28/28 [=====] - 4s 148ms/step - loss: 0.3275 -
f1_score: 0.9778 - val_loss: 2.4939 - val_f1_score: 0.6030
Epoch 258/500
28/28 [=====] - 4s 146ms/step - loss: 0.4677 -
f1_score: 0.9332 - val_loss: 2.4543 - val_f1_score: 0.5881
Epoch 259/500
28/28 [=====] - 4s 146ms/step - loss: 0.6215 -
f1_score: 0.8971 - val_loss: 2.9855 - val_f1_score: 0.5185
Epoch 260/500
28/28 [=====] - 4s 148ms/step - loss: 0.6915 -
f1_score: 0.8700 - val_loss: 2.3325 - val_f1_score: 0.6136
Epoch 261/500
28/28 [=====] - 4s 145ms/step - loss: 0.5790 -
f1_score: 0.9108 - val_loss: 2.4026 - val_f1_score: 0.5639
Epoch 262/500
28/28 [=====] - 4s 148ms/step - loss: 0.4964 -
f1_score: 0.9299 - val_loss: 2.1841 - val_f1_score: 0.6327
Epoch 263/500
28/28 [=====] - 4s 146ms/step - loss: 0.3595 -
f1_score: 0.9693 - val_loss: 1.9610 - val_f1_score: 0.6212
Epoch 264/500
28/28 [=====] - 4s 148ms/step - loss: 0.3323 -
f1_score: 0.9812 - val_loss: 2.0413 - val_f1_score: 0.6356
Epoch 265/500
28/28 [=====] - 4s 149ms/step - loss: 0.2925 -
f1_score: 0.9919 - val_loss: 2.0424 - val_f1_score: 0.6515
Epoch 266/500
28/28 [=====] - 4s 153ms/step - loss: 0.2822 -
f1_score: 0.9956 - val_loss: 1.9514 - val_f1_score: 0.6595
Epoch 267/500
28/28 [=====] - 4s 145ms/step - loss: 0.2792 -
f1_score: 0.9959 - val_loss: 1.9854 - val_f1_score: 0.6754
Epoch 268/500
28/28 [=====] - 4s 147ms/step - loss: 0.2942 -
```

```
f1_score: 0.9910 - val_loss: 1.9142 - val_f1_score: 0.6664
Epoch 269/500
28/28 [=====] - ETA: 0s - loss: 0.2867 - f1_score: 0.9947

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 801ms/step - loss: 0.2867 -
f1_score: 0.9947 - val_loss: 1.9608 - val_f1_score: 0.6941
Epoch 270/500
28/28 [=====] - 4s 138ms/step - loss: 0.2777 -
f1_score: 0.9958 - val_loss: 1.9809 - val_f1_score: 0.6652
Epoch 271/500
28/28 [=====] - 4s 143ms/step - loss: 0.2737 -
f1_score: 0.9966 - val_loss: 1.9640 - val_f1_score: 0.6806
Epoch 272/500
28/28 [=====] - 4s 146ms/step - loss: 0.2665 -
f1_score: 0.9977 - val_loss: 1.9542 - val_f1_score: 0.6673
Epoch 273/500
28/28 [=====] - 4s 143ms/step - loss: 0.2636 -
f1_score: 0.9989 - val_loss: 1.8845 - val_f1_score: 0.6804
Epoch 274/500
28/28 [=====] - ETA: 0s - loss: 0.2618 - f1_score: 0.9992

WARNING:absl:Found untraced functions such as lstm_cell_6_layer_call_fn,
lstm_cell_6_layer_call_and_return_conditional_losses, lstm_cell_7_layer_call_fn,
lstm_cell_7_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 674ms/step - loss: 0.2618 -
f1_score: 0.9992 - val_loss: 1.8845 - val_f1_score: 0.7144
Epoch 275/500
28/28 [=====] - 4s 137ms/step - loss: 0.2617 -
f1_score: 0.9972 - val_loss: 2.0680 - val_f1_score: 0.6533
Epoch 276/500
28/28 [=====] - 4s 142ms/step - loss: 0.2593 -
f1_score: 0.9988 - val_loss: 2.1391 - val_f1_score: 0.6618
Epoch 277/500
28/28 [=====] - 4s 144ms/step - loss: 0.2584 -
f1_score: 0.9988 - val_loss: 2.0083 - val_f1_score: 0.6838
```

Epoch 278/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2550 -  
f1\_score: 0.9980 - val\_loss: 1.9013 - val\_f1\_score: 0.6822  
Epoch 279/500  
28/28 [=====] - 4s 142ms/step - loss: 0.2745 -  
f1\_score: 0.9900 - val\_loss: 2.3058 - val\_f1\_score: 0.6330  
Epoch 280/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3501 -  
f1\_score: 0.9668 - val\_loss: 2.5436 - val\_f1\_score: 0.5822  
Epoch 281/500  
28/28 [=====] - 4s 147ms/step - loss: 0.6448 -  
f1\_score: 0.8946 - val\_loss: 2.5248 - val\_f1\_score: 0.5840  
Epoch 282/500  
28/28 [=====] - 4s 148ms/step - loss: 0.6587 -  
f1\_score: 0.8824 - val\_loss: 2.3640 - val\_f1\_score: 0.6037  
Epoch 283/500  
28/28 [=====] - 4s 146ms/step - loss: 0.4672 -  
f1\_score: 0.9293 - val\_loss: 2.2729 - val\_f1\_score: 0.6391  
Epoch 284/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4039 -  
f1\_score: 0.9496 - val\_loss: 2.0365 - val\_f1\_score: 0.6346  
Epoch 285/500  
28/28 [=====] - 4s 155ms/step - loss: 0.3653 -  
f1\_score: 0.9647 - val\_loss: 2.0851 - val\_f1\_score: 0.6673  
Epoch 286/500  
28/28 [=====] - 4s 154ms/step - loss: 0.3468 -  
f1\_score: 0.9691 - val\_loss: 2.2109 - val\_f1\_score: 0.6479  
Epoch 287/500  
28/28 [=====] - 4s 151ms/step - loss: 0.3171 -  
f1\_score: 0.9817 - val\_loss: 2.0399 - val\_f1\_score: 0.6215  
Epoch 288/500  
28/28 [=====] - 4s 158ms/step - loss: 0.2974 -  
f1\_score: 0.9848 - val\_loss: 2.0921 - val\_f1\_score: 0.6649  
Epoch 289/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2794 -  
f1\_score: 0.9914 - val\_loss: 1.9715 - val\_f1\_score: 0.6693  
Epoch 290/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2759 -  
f1\_score: 0.9945 - val\_loss: 2.1983 - val\_f1\_score: 0.6546  
Epoch 291/500  
28/28 [=====] - 4s 144ms/step - loss: 0.3417 -  
f1\_score: 0.9759 - val\_loss: 2.1954 - val\_f1\_score: 0.6406  
Epoch 292/500  
28/28 [=====] - 4s 147ms/step - loss: 0.6898 -  
f1\_score: 0.8842 - val\_loss: 2.2919 - val\_f1\_score: 0.5928  
Epoch 293/500  
28/28 [=====] - 4s 147ms/step - loss: 3.5335 -  
f1\_score: 0.2948 - val\_loss: 3.7042 - val\_f1\_score: 0.0258

Epoch 294/500  
28/28 [=====] - 4s 147ms/step - loss: 3.6868 -  
f1\_score: 0.0629 - val\_loss: 3.3862 - val\_f1\_score: 0.0720  
Epoch 295/500  
28/28 [=====] - 4s 146ms/step - loss: 3.3430 -  
f1\_score: 0.1070 - val\_loss: 3.0152 - val\_f1\_score: 0.1395  
Epoch 296/500  
28/28 [=====] - 4s 146ms/step - loss: 3.0291 -  
f1\_score: 0.1713 - val\_loss: 2.6458 - val\_f1\_score: 0.2620  
Epoch 297/500  
28/28 [=====] - 4s 145ms/step - loss: 2.6509 -  
f1\_score: 0.2680 - val\_loss: 2.3995 - val\_f1\_score: 0.3110  
Epoch 298/500  
28/28 [=====] - 4s 147ms/step - loss: 2.2978 -  
f1\_score: 0.3675 - val\_loss: 2.2498 - val\_f1\_score: 0.3967  
Epoch 299/500  
28/28 [=====] - 4s 147ms/step - loss: 2.0432 -  
f1\_score: 0.4456 - val\_loss: 2.0675 - val\_f1\_score: 0.4255  
Epoch 300/500  
28/28 [=====] - 4s 148ms/step - loss: 1.7417 -  
f1\_score: 0.5394 - val\_loss: 2.0385 - val\_f1\_score: 0.4589  
Epoch 301/500  
28/28 [=====] - 4s 149ms/step - loss: 1.5417 -  
f1\_score: 0.5943 - val\_loss: 2.0158 - val\_f1\_score: 0.4658  
Epoch 302/500  
28/28 [=====] - 4s 145ms/step - loss: 1.3694 -  
f1\_score: 0.6531 - val\_loss: 1.9028 - val\_f1\_score: 0.5569  
Epoch 303/500  
28/28 [=====] - 4s 146ms/step - loss: 1.2185 -  
f1\_score: 0.6945 - val\_loss: 2.0621 - val\_f1\_score: 0.5128  
Epoch 304/500  
28/28 [=====] - 4s 147ms/step - loss: 1.1076 -  
f1\_score: 0.7437 - val\_loss: 1.9241 - val\_f1\_score: 0.5647  
Epoch 305/500  
28/28 [=====] - 4s 146ms/step - loss: 0.9862 -  
f1\_score: 0.7632 - val\_loss: 1.7765 - val\_f1\_score: 0.6046  
Epoch 306/500  
28/28 [=====] - 4s 148ms/step - loss: 0.8429 -  
f1\_score: 0.8127 - val\_loss: 1.8785 - val\_f1\_score: 0.5909  
Epoch 307/500  
28/28 [=====] - 4s 146ms/step - loss: 0.8580 -  
f1\_score: 0.8104 - val\_loss: 1.9099 - val\_f1\_score: 0.5906  
Epoch 308/500  
28/28 [=====] - 4s 145ms/step - loss: 0.7938 -  
f1\_score: 0.8365 - val\_loss: 1.9974 - val\_f1\_score: 0.5915  
Epoch 309/500  
28/28 [=====] - 4s 148ms/step - loss: 0.7326 -  
f1\_score: 0.8484 - val\_loss: 1.9021 - val\_f1\_score: 0.5816

Epoch 310/500  
28/28 [=====] - 4s 147ms/step - loss: 0.6454 -  
f1\_score: 0.8809 - val\_loss: 1.9240 - val\_f1\_score: 0.6139  
Epoch 311/500  
28/28 [=====] - 4s 150ms/step - loss: 0.5596 -  
f1\_score: 0.9011 - val\_loss: 2.0031 - val\_f1\_score: 0.5941  
Epoch 312/500  
28/28 [=====] - 4s 150ms/step - loss: 0.5499 -  
f1\_score: 0.9042 - val\_loss: 2.0348 - val\_f1\_score: 0.6019  
Epoch 313/500  
28/28 [=====] - 4s 150ms/step - loss: 0.5771 -  
f1\_score: 0.9070 - val\_loss: 2.0231 - val\_f1\_score: 0.6033  
Epoch 314/500  
28/28 [=====] - 4s 153ms/step - loss: 0.5354 -  
f1\_score: 0.9177 - val\_loss: 1.8686 - val\_f1\_score: 0.6523  
Epoch 315/500  
28/28 [=====] - 4s 152ms/step - loss: 0.5088 -  
f1\_score: 0.9251 - val\_loss: 2.1698 - val\_f1\_score: 0.6241  
Epoch 316/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4995 -  
f1\_score: 0.9296 - val\_loss: 1.9663 - val\_f1\_score: 0.6474  
Epoch 317/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4112 -  
f1\_score: 0.9590 - val\_loss: 2.0218 - val\_f1\_score: 0.6407  
Epoch 318/500  
28/28 [=====] - 4s 150ms/step - loss: 0.4489 -  
f1\_score: 0.9405 - val\_loss: 1.9173 - val\_f1\_score: 0.6231  
Epoch 319/500  
28/28 [=====] - 4s 148ms/step - loss: 0.5041 -  
f1\_score: 0.9259 - val\_loss: 1.9815 - val\_f1\_score: 0.6283  
Epoch 320/500  
28/28 [=====] - 4s 147ms/step - loss: 0.4435 -  
f1\_score: 0.9442 - val\_loss: 1.8228 - val\_f1\_score: 0.6593  
Epoch 321/500  
28/28 [=====] - 4s 147ms/step - loss: 0.4594 -  
f1\_score: 0.9441 - val\_loss: 2.2354 - val\_f1\_score: 0.6052  
Epoch 322/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4844 -  
f1\_score: 0.9282 - val\_loss: 2.0243 - val\_f1\_score: 0.6206  
Epoch 323/500  
28/28 [=====] - 4s 149ms/step - loss: 0.3934 -  
f1\_score: 0.9626 - val\_loss: 1.8789 - val\_f1\_score: 0.6684  
Epoch 324/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4481 -  
f1\_score: 0.9526 - val\_loss: 2.6524 - val\_f1\_score: 0.5238  
Epoch 325/500  
28/28 [=====] - 4s 145ms/step - loss: 1.0004 -  
f1\_score: 0.7860 - val\_loss: 2.2928 - val\_f1\_score: 0.5868

Epoch 326/500  
28/28 [=====] - 4s 148ms/step - loss: 0.6002 -  
f1\_score: 0.8883 - val\_loss: 2.1695 - val\_f1\_score: 0.6217  
Epoch 327/500  
28/28 [=====] - 4s 149ms/step - loss: 0.7995 -  
f1\_score: 0.8345 - val\_loss: 1.9582 - val\_f1\_score: 0.6003  
Epoch 328/500  
28/28 [=====] - 4s 152ms/step - loss: 0.4748 -  
f1\_score: 0.9353 - val\_loss: 2.0872 - val\_f1\_score: 0.5936  
Epoch 329/500  
28/28 [=====] - 4s 150ms/step - loss: 0.3942 -  
f1\_score: 0.9667 - val\_loss: 1.9491 - val\_f1\_score: 0.6491  
Epoch 330/500  
28/28 [=====] - 4s 152ms/step - loss: 0.3417 -  
f1\_score: 0.9828 - val\_loss: 1.9978 - val\_f1\_score: 0.6654  
Epoch 331/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3205 -  
f1\_score: 0.9862 - val\_loss: 1.9634 - val\_f1\_score: 0.6681  
Epoch 332/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3202 -  
f1\_score: 0.9864 - val\_loss: 1.8630 - val\_f1\_score: 0.6486  
Epoch 333/500  
28/28 [=====] - 4s 150ms/step - loss: 0.3199 -  
f1\_score: 0.9852 - val\_loss: 1.8811 - val\_f1\_score: 0.6761  
Epoch 334/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3026 -  
f1\_score: 0.9932 - val\_loss: 2.0037 - val\_f1\_score: 0.6729  
Epoch 335/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3589 -  
f1\_score: 0.9709 - val\_loss: 2.0972 - val\_f1\_score: 0.6584  
Epoch 336/500  
28/28 [=====] - 4s 152ms/step - loss: 0.3811 -  
f1\_score: 0.9628 - val\_loss: 2.0303 - val\_f1\_score: 0.6464  
Epoch 337/500  
28/28 [=====] - 4s 150ms/step - loss: 0.3507 -  
f1\_score: 0.9730 - val\_loss: 1.8602 - val\_f1\_score: 0.6946  
Epoch 338/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3521 -  
f1\_score: 0.9727 - val\_loss: 2.0646 - val\_f1\_score: 0.6585  
Epoch 339/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3275 -  
f1\_score: 0.9806 - val\_loss: 1.9307 - val\_f1\_score: 0.6960  
Epoch 340/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3348 -  
f1\_score: 0.9760 - val\_loss: 2.0666 - val\_f1\_score: 0.6708  
Epoch 341/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3317 -  
f1\_score: 0.9778 - val\_loss: 2.1046 - val\_f1\_score: 0.6656

Epoch 342/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3087 -  
f1\_score: 0.9869 - val\_loss: 2.0056 - val\_f1\_score: 0.6697  
Epoch 343/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3140 -  
f1\_score: 0.9838 - val\_loss: 1.9617 - val\_f1\_score: 0.6782  
Epoch 344/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2998 -  
f1\_score: 0.9905 - val\_loss: 2.1582 - val\_f1\_score: 0.6776  
Epoch 345/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2867 -  
f1\_score: 0.9929 - val\_loss: 4.3449 - val\_f1\_score: 0.4045  
Epoch 346/500  
28/28 [=====] - 4s 148ms/step - loss: 1.0522 -  
f1\_score: 0.8191 - val\_loss: 1.8816 - val\_f1\_score: 0.6415  
Epoch 347/500  
28/28 [=====] - 4s 147ms/step - loss: 0.5198 -  
f1\_score: 0.9140 - val\_loss: 2.0923 - val\_f1\_score: 0.6336  
Epoch 348/500  
28/28 [=====] - 4s 144ms/step - loss: 0.4325 -  
f1\_score: 0.9467 - val\_loss: 2.2127 - val\_f1\_score: 0.6387  
Epoch 349/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3835 -  
f1\_score: 0.9610 - val\_loss: 2.1075 - val\_f1\_score: 0.6240  
Epoch 350/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3123 -  
f1\_score: 0.9879 - val\_loss: 1.9696 - val\_f1\_score: 0.6760  
Epoch 351/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2918 -  
f1\_score: 0.9931 - val\_loss: 1.9972 - val\_f1\_score: 0.6762  
Epoch 352/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2916 -  
f1\_score: 0.9930 - val\_loss: 2.0357 - val\_f1\_score: 0.6344  
Epoch 353/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2893 -  
f1\_score: 0.9914 - val\_loss: 2.0814 - val\_f1\_score: 0.6753  
Epoch 354/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2922 -  
f1\_score: 0.9900 - val\_loss: 1.9762 - val\_f1\_score: 0.6721  
Epoch 355/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2824 -  
f1\_score: 0.9948 - val\_loss: 1.9621 - val\_f1\_score: 0.6934  
Epoch 356/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2905 -  
f1\_score: 0.9892 - val\_loss: 1.9640 - val\_f1\_score: 0.6776  
Epoch 357/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2734 -  
f1\_score: 0.9954 - val\_loss: 2.0953 - val\_f1\_score: 0.6617

Epoch 358/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2660 -  
f1\_score: 0.9977 - val\_loss: 2.0461 - val\_f1\_score: 0.6633  
Epoch 359/500  
28/28 [=====] - 4s 144ms/step - loss: 0.3610 -  
f1\_score: 0.9685 - val\_loss: 1.9852 - val\_f1\_score: 0.6847  
Epoch 360/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3628 -  
f1\_score: 0.9703 - val\_loss: 2.0572 - val\_f1\_score: 0.6413  
Epoch 361/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3457 -  
f1\_score: 0.9697 - val\_loss: 2.2542 - val\_f1\_score: 0.6371  
Epoch 362/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3005 -  
f1\_score: 0.9843 - val\_loss: 2.0768 - val\_f1\_score: 0.6838  
Epoch 363/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3190 -  
f1\_score: 0.9801 - val\_loss: 2.1834 - val\_f1\_score: 0.6621  
Epoch 364/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2901 -  
f1\_score: 0.9890 - val\_loss: 2.1539 - val\_f1\_score: 0.6634  
Epoch 365/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2684 -  
f1\_score: 0.9955 - val\_loss: 2.2067 - val\_f1\_score: 0.6535  
Epoch 366/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2632 -  
f1\_score: 0.9968 - val\_loss: 2.1027 - val\_f1\_score: 0.6819  
Epoch 367/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2616 -  
f1\_score: 0.9958 - val\_loss: 2.0852 - val\_f1\_score: 0.6733  
Epoch 368/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2878 -  
f1\_score: 0.9882 - val\_loss: 2.0392 - val\_f1\_score: 0.6775  
Epoch 369/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3077 -  
f1\_score: 0.9808 - val\_loss: 2.0377 - val\_f1\_score: 0.6568  
Epoch 370/500  
28/28 [=====] - 4s 144ms/step - loss: 0.3317 -  
f1\_score: 0.9747 - val\_loss: 2.4667 - val\_f1\_score: 0.6202  
Epoch 371/500  
28/28 [=====] - 4s 148ms/step - loss: 0.6210 -  
f1\_score: 0.8968 - val\_loss: 2.2715 - val\_f1\_score: 0.6042  
Epoch 372/500  
28/28 [=====] - 4s 146ms/step - loss: 0.4826 -  
f1\_score: 0.9292 - val\_loss: 2.3999 - val\_f1\_score: 0.6192  
Epoch 373/500  
28/28 [=====] - 4s 152ms/step - loss: 0.3449 -  
f1\_score: 0.9718 - val\_loss: 2.0306 - val\_f1\_score: 0.6559

Epoch 374/500  
28/28 [=====] - 4s 152ms/step - loss: 0.2889 -  
f1\_score: 0.9882 - val\_loss: 1.9652 - val\_f1\_score: 0.6657  
Epoch 375/500  
28/28 [=====] - 4s 152ms/step - loss: 0.2783 -  
f1\_score: 0.9915 - val\_loss: 1.9715 - val\_f1\_score: 0.6766  
Epoch 376/500  
28/28 [=====] - 4s 145ms/step - loss: 0.3027 -  
f1\_score: 0.9822 - val\_loss: 2.1647 - val\_f1\_score: 0.6527  
Epoch 377/500  
28/28 [=====] - 4s 146ms/step - loss: 0.4385 -  
f1\_score: 0.9418 - val\_loss: 2.1974 - val\_f1\_score: 0.6469  
Epoch 378/500  
28/28 [=====] - 4s 147ms/step - loss: 0.4079 -  
f1\_score: 0.9480 - val\_loss: 2.0079 - val\_f1\_score: 0.6649  
Epoch 379/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3890 -  
f1\_score: 0.9502 - val\_loss: 2.0350 - val\_f1\_score: 0.6112  
Epoch 380/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3784 -  
f1\_score: 0.9545 - val\_loss: 2.2040 - val\_f1\_score: 0.6476  
Epoch 381/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3008 -  
f1\_score: 0.9818 - val\_loss: 2.1599 - val\_f1\_score: 0.6616  
Epoch 382/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2852 -  
f1\_score: 0.9911 - val\_loss: 2.0639 - val\_f1\_score: 0.6599  
Epoch 383/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2809 -  
f1\_score: 0.9867 - val\_loss: 2.0929 - val\_f1\_score: 0.6554  
Epoch 384/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2632 -  
f1\_score: 0.9945 - val\_loss: 2.1131 - val\_f1\_score: 0.6407  
Epoch 385/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2714 -  
f1\_score: 0.9898 - val\_loss: 2.1045 - val\_f1\_score: 0.6418  
Epoch 386/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2957 -  
f1\_score: 0.9788 - val\_loss: 1.9729 - val\_f1\_score: 0.6697  
Epoch 387/500  
28/28 [=====] - 4s 144ms/step - loss: 0.3053 -  
f1\_score: 0.9763 - val\_loss: 2.4446 - val\_f1\_score: 0.6528  
Epoch 388/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3125 -  
f1\_score: 0.9808 - val\_loss: 2.0112 - val\_f1\_score: 0.6885  
Epoch 389/500  
28/28 [=====] - 4s 148ms/step - loss: 0.3146 -  
f1\_score: 0.9740 - val\_loss: 2.1947 - val\_f1\_score: 0.6592

Epoch 390/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2765 -  
f1\_score: 0.9869 - val\_loss: 1.9890 - val\_f1\_score: 0.6855  
Epoch 391/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2749 -  
f1\_score: 0.9917 - val\_loss: 1.8859 - val\_f1\_score: 0.7063  
Epoch 392/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3064 -  
f1\_score: 0.9762 - val\_loss: 2.0483 - val\_f1\_score: 0.6643  
Epoch 393/500  
28/28 [=====] - 4s 146ms/step - loss: 0.4651 -  
f1\_score: 0.9412 - val\_loss: 2.2115 - val\_f1\_score: 0.6361  
Epoch 394/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3888 -  
f1\_score: 0.9528 - val\_loss: 1.8967 - val\_f1\_score: 0.6898  
Epoch 395/500  
28/28 [=====] - 4s 147ms/step - loss: 0.4196 -  
f1\_score: 0.9419 - val\_loss: 2.4032 - val\_f1\_score: 0.5785  
Epoch 396/500  
28/28 [=====] - 4s 149ms/step - loss: 0.4607 -  
f1\_score: 0.9252 - val\_loss: 2.1708 - val\_f1\_score: 0.6354  
Epoch 397/500  
28/28 [=====] - 4s 149ms/step - loss: 0.3719 -  
f1\_score: 0.9615 - val\_loss: 2.2849 - val\_f1\_score: 0.6193  
Epoch 398/500  
28/28 [=====] - 4s 144ms/step - loss: 0.3603 -  
f1\_score: 0.9633 - val\_loss: 1.9828 - val\_f1\_score: 0.6888  
Epoch 399/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2863 -  
f1\_score: 0.9893 - val\_loss: 1.9339 - val\_f1\_score: 0.6708  
Epoch 400/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2601 -  
f1\_score: 0.9943 - val\_loss: 1.9711 - val\_f1\_score: 0.6959  
Epoch 401/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2534 -  
f1\_score: 0.9950 - val\_loss: 2.0943 - val\_f1\_score: 0.6767  
Epoch 402/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2464 -  
f1\_score: 0.9988 - val\_loss: 2.0995 - val\_f1\_score: 0.6601  
Epoch 403/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2423 -  
f1\_score: 0.9989 - val\_loss: 2.0153 - val\_f1\_score: 0.6928  
Epoch 404/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2415 -  
f1\_score: 0.9981 - val\_loss: 2.0004 - val\_f1\_score: 0.6926  
Epoch 405/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2377 -  
f1\_score: 0.9992 - val\_loss: 1.9344 - val\_f1\_score: 0.7055

Epoch 406/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2354 -  
f1\_score: 0.9992 - val\_loss: 1.9940 - val\_f1\_score: 0.7018  
Epoch 407/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2338 -  
f1\_score: 0.9996 - val\_loss: 1.9753 - val\_f1\_score: 0.6892  
Epoch 408/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2332 -  
f1\_score: 0.9997 - val\_loss: 1.9841 - val\_f1\_score: 0.6836  
Epoch 409/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2324 -  
f1\_score: 0.9993 - val\_loss: 1.9259 - val\_f1\_score: 0.7088  
Epoch 410/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2302 -  
f1\_score: 1.0000 - val\_loss: 2.0504 - val\_f1\_score: 0.6784  
Epoch 411/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2320 -  
f1\_score: 0.9993 - val\_loss: 1.9652 - val\_f1\_score: 0.7090  
Epoch 412/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2290 -  
f1\_score: 0.9992 - val\_loss: 2.0107 - val\_f1\_score: 0.7060  
Epoch 413/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2272 -  
f1\_score: 1.0000 - val\_loss: 2.0391 - val\_f1\_score: 0.6922  
Epoch 414/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2257 -  
f1\_score: 1.0000 - val\_loss: 2.0257 - val\_f1\_score: 0.7021  
Epoch 415/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2251 -  
f1\_score: 1.0000 - val\_loss: 2.0077 - val\_f1\_score: 0.6959  
Epoch 416/500  
28/28 [=====] - 4s 157ms/step - loss: 0.2241 -  
f1\_score: 0.9992 - val\_loss: 2.0474 - val\_f1\_score: 0.6869  
Epoch 417/500  
28/28 [=====] - 4s 151ms/step - loss: 0.2247 -  
f1\_score: 0.9996 - val\_loss: 1.9979 - val\_f1\_score: 0.7040  
Epoch 418/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2223 -  
f1\_score: 0.9993 - val\_loss: 1.9816 - val\_f1\_score: 0.6956  
Epoch 419/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2228 -  
f1\_score: 0.9991 - val\_loss: 2.0107 - val\_f1\_score: 0.7016  
Epoch 420/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2218 -  
f1\_score: 0.9993 - val\_loss: 2.0886 - val\_f1\_score: 0.6857  
Epoch 421/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2219 -  
f1\_score: 0.9985 - val\_loss: 2.1081 - val\_f1\_score: 0.7026

Epoch 422/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2191 -  
f1\_score: 0.9996 - val\_loss: 2.0368 - val\_f1\_score: 0.6786  
Epoch 423/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2189 -  
f1\_score: 0.9988 - val\_loss: 2.0304 - val\_f1\_score: 0.6921  
Epoch 424/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2180 -  
f1\_score: 1.0000 - val\_loss: 2.1142 - val\_f1\_score: 0.6732  
Epoch 425/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2167 -  
f1\_score: 0.9993 - val\_loss: 2.0103 - val\_f1\_score: 0.6886  
Epoch 426/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2146 -  
f1\_score: 1.0000 - val\_loss: 2.0765 - val\_f1\_score: 0.6868  
Epoch 427/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2140 -  
f1\_score: 1.0000 - val\_loss: 2.0681 - val\_f1\_score: 0.7013  
Epoch 428/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2133 -  
f1\_score: 1.0000 - val\_loss: 2.1017 - val\_f1\_score: 0.6831  
Epoch 429/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2129 -  
f1\_score: 0.9993 - val\_loss: 2.1295 - val\_f1\_score: 0.6815  
Epoch 430/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2129 -  
f1\_score: 0.9996 - val\_loss: 2.0223 - val\_f1\_score: 0.7008  
Epoch 431/500  
28/28 [=====] - 4s 152ms/step - loss: 0.2114 -  
f1\_score: 0.9996 - val\_loss: 2.1159 - val\_f1\_score: 0.6755  
Epoch 432/500  
28/28 [=====] - 4s 153ms/step - loss: 0.2099 -  
f1\_score: 0.9996 - val\_loss: 2.0023 - val\_f1\_score: 0.7095  
Epoch 433/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2535 -  
f1\_score: 0.9895 - val\_loss: 2.4890 - val\_f1\_score: 0.6145  
Epoch 434/500  
28/28 [=====] - 4s 147ms/step - loss: 1.1748 -  
f1\_score: 0.7806 - val\_loss: 2.4236 - val\_f1\_score: 0.5396  
Epoch 435/500  
28/28 [=====] - 4s 147ms/step - loss: 0.8556 -  
f1\_score: 0.8130 - val\_loss: 2.4337 - val\_f1\_score: 0.5723  
Epoch 436/500  
28/28 [=====] - 4s 145ms/step - loss: 0.5432 -  
f1\_score: 0.9009 - val\_loss: 2.0339 - val\_f1\_score: 0.6411  
Epoch 437/500  
28/28 [=====] - 4s 147ms/step - loss: 0.3499 -  
f1\_score: 0.9610 - val\_loss: 1.9694 - val\_f1\_score: 0.6876

Epoch 438/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2640 -  
f1\_score: 0.9886 - val\_loss: 1.8723 - val\_f1\_score: 0.7048  
Epoch 439/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2489 -  
f1\_score: 0.9947 - val\_loss: 1.8992 - val\_f1\_score: 0.7036  
Epoch 440/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2340 -  
f1\_score: 0.9988 - val\_loss: 1.9284 - val\_f1\_score: 0.7019  
Epoch 441/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2296 -  
f1\_score: 0.9983 - val\_loss: 1.8897 - val\_f1\_score: 0.7130  
Epoch 442/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2253 -  
f1\_score: 0.9996 - val\_loss: 1.9692 - val\_f1\_score: 0.6957  
Epoch 443/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2227 -  
f1\_score: 0.9992 - val\_loss: 1.9959 - val\_f1\_score: 0.7059  
Epoch 444/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2206 -  
f1\_score: 0.9993 - val\_loss: 1.9501 - val\_f1\_score: 0.7004  
Epoch 445/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2183 -  
f1\_score: 1.0000 - val\_loss: 1.9797 - val\_f1\_score: 0.6946  
Epoch 446/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2179 -  
f1\_score: 1.0000 - val\_loss: 2.0314 - val\_f1\_score: 0.6850  
Epoch 447/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2148 -  
f1\_score: 1.0000 - val\_loss: 2.0247 - val\_f1\_score: 0.6904  
Epoch 448/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2149 -  
f1\_score: 0.9993 - val\_loss: 2.0587 - val\_f1\_score: 0.6851  
Epoch 449/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2135 -  
f1\_score: 1.0000 - val\_loss: 2.0405 - val\_f1\_score: 0.6905  
Epoch 450/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2108 -  
f1\_score: 1.0000 - val\_loss: 2.0572 - val\_f1\_score: 0.6924  
Epoch 451/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2116 -  
f1\_score: 0.9993 - val\_loss: 2.0919 - val\_f1\_score: 0.6891  
Epoch 452/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2084 -  
f1\_score: 1.0000 - val\_loss: 2.0776 - val\_f1\_score: 0.6969  
Epoch 453/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2080 -  
f1\_score: 1.0000 - val\_loss: 2.0594 - val\_f1\_score: 0.6967

Epoch 454/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2073 -  
f1\_score: 0.9992 - val\_loss: 2.0992 - val\_f1\_score: 0.6944  
Epoch 455/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2069 -  
f1\_score: 0.9996 - val\_loss: 2.1464 - val\_f1\_score: 0.6898  
Epoch 456/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2052 -  
f1\_score: 1.0000 - val\_loss: 2.0861 - val\_f1\_score: 0.6939  
Epoch 457/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2033 -  
f1\_score: 1.0000 - val\_loss: 2.1207 - val\_f1\_score: 0.6879  
Epoch 458/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2031 -  
f1\_score: 1.0000 - val\_loss: 2.1122 - val\_f1\_score: 0.6968  
Epoch 459/500  
28/28 [=====] - 4s 149ms/step - loss: 0.2023 -  
f1\_score: 0.9996 - val\_loss: 2.1072 - val\_f1\_score: 0.7112  
Epoch 460/500  
28/28 [=====] - 4s 145ms/step - loss: 0.2030 -  
f1\_score: 1.0000 - val\_loss: 2.1575 - val\_f1\_score: 0.6727  
Epoch 461/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2009 -  
f1\_score: 0.9995 - val\_loss: 2.2159 - val\_f1\_score: 0.6789  
Epoch 462/500  
28/28 [=====] - 4s 152ms/step - loss: 0.2009 -  
f1\_score: 0.9993 - val\_loss: 2.0936 - val\_f1\_score: 0.6855  
Epoch 463/500  
28/28 [=====] - 4s 148ms/step - loss: 0.1998 -  
f1\_score: 0.9996 - val\_loss: 2.1006 - val\_f1\_score: 0.6903  
Epoch 464/500  
28/28 [=====] - 4s 148ms/step - loss: 0.1980 -  
f1\_score: 0.9996 - val\_loss: 2.1557 - val\_f1\_score: 0.6971  
Epoch 465/500  
28/28 [=====] - 4s 150ms/step - loss: 0.1964 -  
f1\_score: 1.0000 - val\_loss: 2.1048 - val\_f1\_score: 0.7081  
Epoch 466/500  
28/28 [=====] - 4s 144ms/step - loss: 0.1956 -  
f1\_score: 1.0000 - val\_loss: 2.0976 - val\_f1\_score: 0.7054  
Epoch 467/500  
28/28 [=====] - 4s 145ms/step - loss: 0.1956 -  
f1\_score: 0.9996 - val\_loss: 2.1316 - val\_f1\_score: 0.6973  
Epoch 468/500  
28/28 [=====] - 4s 147ms/step - loss: 0.1951 -  
f1\_score: 0.9996 - val\_loss: 2.2738 - val\_f1\_score: 0.6954  
Epoch 469/500  
28/28 [=====] - 4s 147ms/step - loss: 0.1937 -  
f1\_score: 1.0000 - val\_loss: 2.1690 - val\_f1\_score: 0.7051

Epoch 470/500  
28/28 [=====] - 4s 148ms/step - loss: 0.4864 -  
f1\_score: 0.9423 - val\_loss: 3.4248 - val\_f1\_score: 0.4533  
Epoch 471/500  
28/28 [=====] - 4s 145ms/step - loss: 1.4161 -  
f1\_score: 0.7000 - val\_loss: 2.1386 - val\_f1\_score: 0.5750  
Epoch 472/500  
28/28 [=====] - 4s 145ms/step - loss: 0.5453 -  
f1\_score: 0.8910 - val\_loss: 2.0642 - val\_f1\_score: 0.6397  
Epoch 473/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3901 -  
f1\_score: 0.9430 - val\_loss: 2.1007 - val\_f1\_score: 0.6766  
Epoch 474/500  
28/28 [=====] - 4s 154ms/step - loss: 0.3620 -  
f1\_score: 0.9525 - val\_loss: 2.1457 - val\_f1\_score: 0.6592  
Epoch 475/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2841 -  
f1\_score: 0.9746 - val\_loss: 2.1408 - val\_f1\_score: 0.6418  
Epoch 476/500  
28/28 [=====] - 4s 148ms/step - loss: 0.2711 -  
f1\_score: 0.9816 - val\_loss: 2.0404 - val\_f1\_score: 0.6733  
Epoch 477/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2555 -  
f1\_score: 0.9868 - val\_loss: 2.1725 - val\_f1\_score: 0.6268  
Epoch 478/500  
28/28 [=====] - 4s 152ms/step - loss: 0.2407 -  
f1\_score: 0.9892 - val\_loss: 1.9892 - val\_f1\_score: 0.6602  
Epoch 479/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2238 -  
f1\_score: 0.9939 - val\_loss: 2.1602 - val\_f1\_score: 0.6667  
Epoch 480/500  
28/28 [=====] - 4s 147ms/step - loss: 0.2339 -  
f1\_score: 0.9893 - val\_loss: 2.1616 - val\_f1\_score: 0.6216  
Epoch 481/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2244 -  
f1\_score: 0.9934 - val\_loss: 1.9507 - val\_f1\_score: 0.6625  
Epoch 482/500  
28/28 [=====] - 4s 150ms/step - loss: 0.2302 -  
f1\_score: 0.9929 - val\_loss: 1.9945 - val\_f1\_score: 0.6765  
Epoch 483/500  
28/28 [=====] - 4s 146ms/step - loss: 0.2399 -  
f1\_score: 0.9886 - val\_loss: 2.3103 - val\_f1\_score: 0.6466  
Epoch 484/500  
28/28 [=====] - 4s 146ms/step - loss: 0.3575 -  
f1\_score: 0.9546 - val\_loss: 2.5469 - val\_f1\_score: 0.5834  
Epoch 485/500  
28/28 [=====] - 4s 146ms/step - loss: 0.4639 -  
f1\_score: 0.9223 - val\_loss: 2.1926 - val\_f1\_score: 0.6329

```
Epoch 486/500
28/28 [=====] - 4s 147ms/step - loss: 0.3212 -
f1_score: 0.9658 - val_loss: 2.2729 - val_f1_score: 0.6336
Epoch 487/500
28/28 [=====] - 4s 151ms/step - loss: 0.2693 -
f1_score: 0.9775 - val_loss: 2.0529 - val_f1_score: 0.6577
Epoch 488/500
28/28 [=====] - 4s 150ms/step - loss: 0.2271 -
f1_score: 0.9938 - val_loss: 2.0307 - val_f1_score: 0.6336
Epoch 489/500
28/28 [=====] - 4s 145ms/step - loss: 0.2144 -
f1_score: 0.9969 - val_loss: 2.0473 - val_f1_score: 0.6794
Epoch 490/500
28/28 [=====] - 4s 147ms/step - loss: 0.2144 -
f1_score: 0.9961 - val_loss: 1.9535 - val_f1_score: 0.6845
Epoch 491/500
28/28 [=====] - 4s 147ms/step - loss: 0.2056 -
f1_score: 0.9984 - val_loss: 1.9634 - val_f1_score: 0.6784
Epoch 492/500
28/28 [=====] - 4s 147ms/step - loss: 0.2086 -
f1_score: 0.9955 - val_loss: 2.0472 - val_f1_score: 0.6751
Epoch 493/500
28/28 [=====] - 4s 147ms/step - loss: 0.2208 -
f1_score: 0.9927 - val_loss: 2.1059 - val_f1_score: 0.6347
Epoch 494/500
28/28 [=====] - 4s 144ms/step - loss: 0.2154 -
f1_score: 0.9938 - val_loss: 2.1751 - val_f1_score: 0.6696
Epoch 495/500
28/28 [=====] - 4s 146ms/step - loss: 0.1996 -
f1_score: 1.0000 - val_loss: 2.1564 - val_f1_score: 0.6722
Epoch 496/500
28/28 [=====] - 4s 148ms/step - loss: 0.1977 -
f1_score: 0.9997 - val_loss: 2.1348 - val_f1_score: 0.6751
Epoch 497/500
28/28 [=====] - 4s 146ms/step - loss: 0.1960 -
f1_score: 0.9992 - val_loss: 2.1285 - val_f1_score: 0.6502
Epoch 498/500
28/28 [=====] - 4s 146ms/step - loss: 0.1937 -
f1_score: 0.9996 - val_loss: 2.1236 - val_f1_score: 0.6691
Epoch 499/500
28/28 [=====] - 4s 150ms/step - loss: 0.1924 -
f1_score: 0.9992 - val_loss: 2.1090 - val_f1_score: 0.6774
Epoch 500/500
28/28 [=====] - 4s 145ms/step - loss: 0.1920 -
f1_score: 1.0000 - val_loss: 2.1286 - val_f1_score: 0.6739
```

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

11/11 [=====] - 2s 23ms/step

	precision	recall	f1-score	support
AXE	1.000	1.000	1.000	8
BACKPACK	0.750	1.000	0.857	6
BASKETBALL	0.889	0.800	0.842	10
BEE	1.000	0.600	0.750	10
BELT	1.000	1.000	1.000	4
BITE	0.800	0.500	0.615	8
BREAKFAST	0.600	0.500	0.545	6
CANCER	1.000	0.500	0.667	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	0.462	1.000	0.632	6
DARK	1.000	1.000	1.000	4
DEAF	0.400	0.333	0.364	6
DECIDE	0.857	1.000	0.923	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.167	0.167	0.167	6
DINNER	0.889	1.000	0.941	8
DOG	0.429	0.500	0.462	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	0.286	0.500	0.364	4
EAT	0.750	0.500	0.600	6
EDIT	0.833	0.833	0.833	6
ELEVATOR	0.400	0.500	0.444	8
FINE	0.167	0.250	0.200	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	0.800	0.667	0.727	6
GUESS	1.000	0.750	0.857	8
HALLOWEEN	0.727	1.000	0.842	8
HOSPITAL	1.000	1.000	1.000	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.750	0.750	0.750	4
KNIGHT	0.500	0.500	0.500	4
LOCK	0.667	0.500	0.571	8
LUNCH	0.714	0.625	0.667	8
MAPLE	0.600	0.750	0.667	4
MEAT	0.667	1.000	0.800	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.385	0.625	0.476	8
NOON	0.727	1.000	0.842	8

PARTY	0.750	0.750	0.750	8
PATIENT	0.286	0.333	0.308	6
RAZOR	0.500	0.250	0.333	4
RIVER	1.000	0.500	0.667	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.889	0.800	0.842	10
SINK	0.429	0.500	0.462	6
SQUEEZE	0.500	0.250	0.333	4
THEY	0.750	0.750	0.750	4
TWINS	0.417	0.625	0.500	8
WHATFOR	1.000	0.500	0.667	10
accuracy			0.698	324
macro avg	0.705	0.681	0.674	324
weighted avg	0.735	0.698	0.697	324

[91]: `reconstructed_model = tf.keras.models.load_model("2 LSTM")`

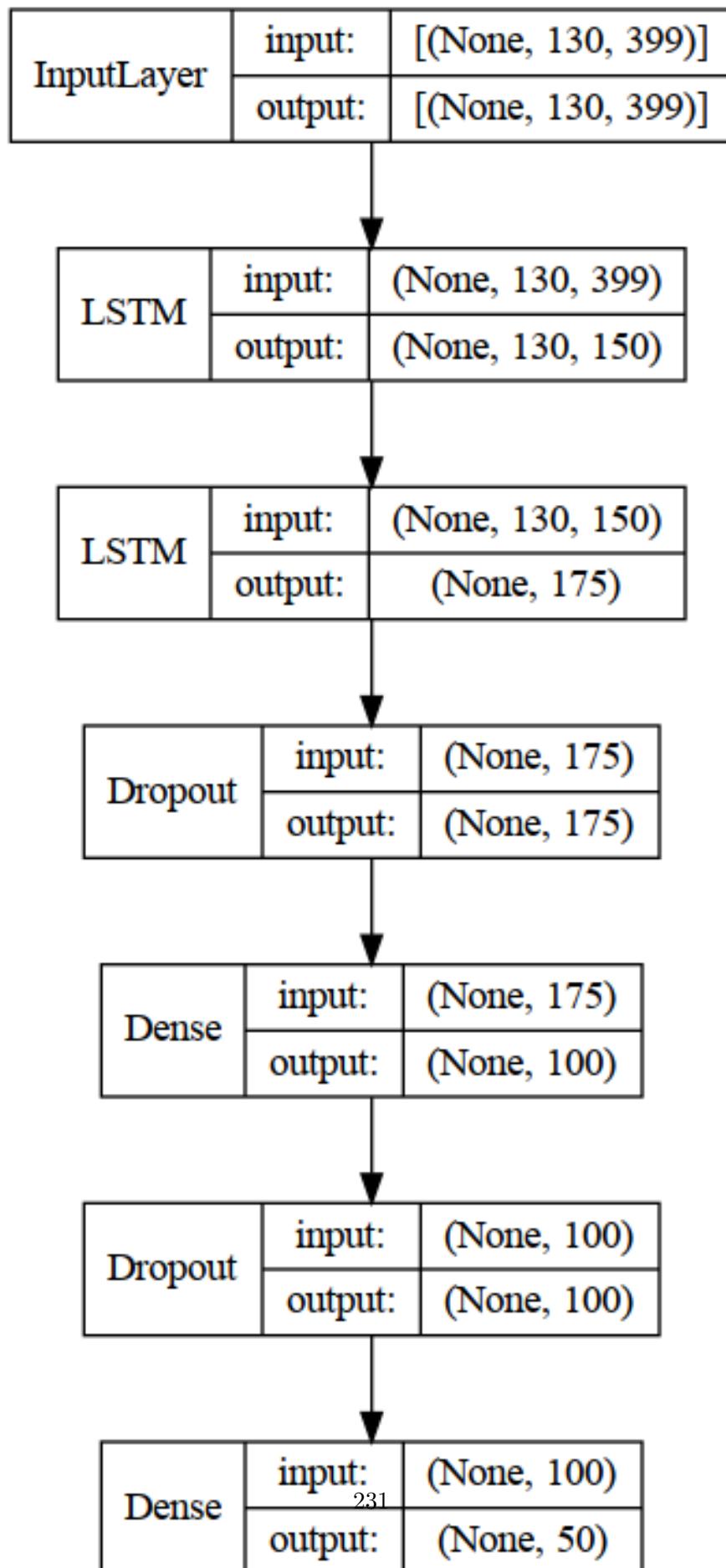
[92]: `reconstructed_model.summary()`

Model: "sequential\_2"

Layer (type)	Output Shape	Param #
<hr/>		
lstm_4 (LSTM)	(None, 130, 150)	330000
lstm_5 (LSTM)	(None, 175)	228200
dropout_4 (Dropout)	(None, 175)	0
dense_4 (Dense)	(None, 100)	17600
dropout_5 (Dropout)	(None, 100)	0
dense_5 (Dense)	(None, 50)	5050
<hr/>		
Total params: 580,850		
Trainable params: 580,850		
Non-trainable params: 0		
<hr/>		

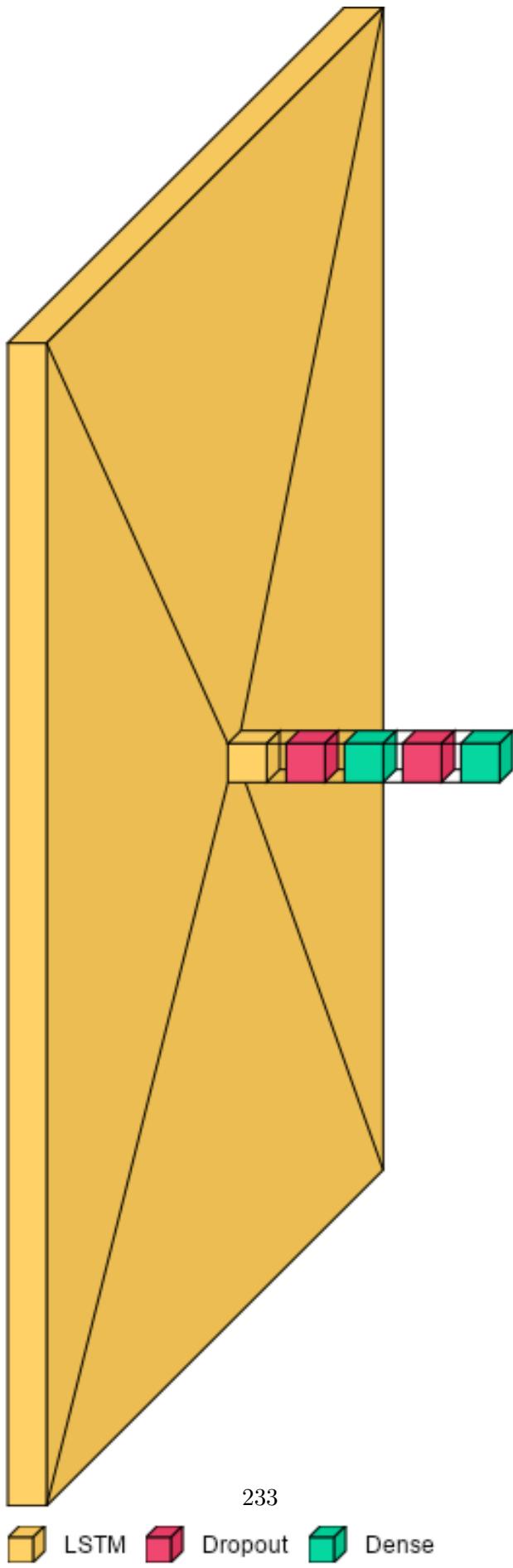
[93]: `plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)`

[93]:



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

```
[94]:
```



```
[95]: # convert the history.history dict to a pandas DataFrame:  
hist_df = pd.DataFrame(History.history)
```

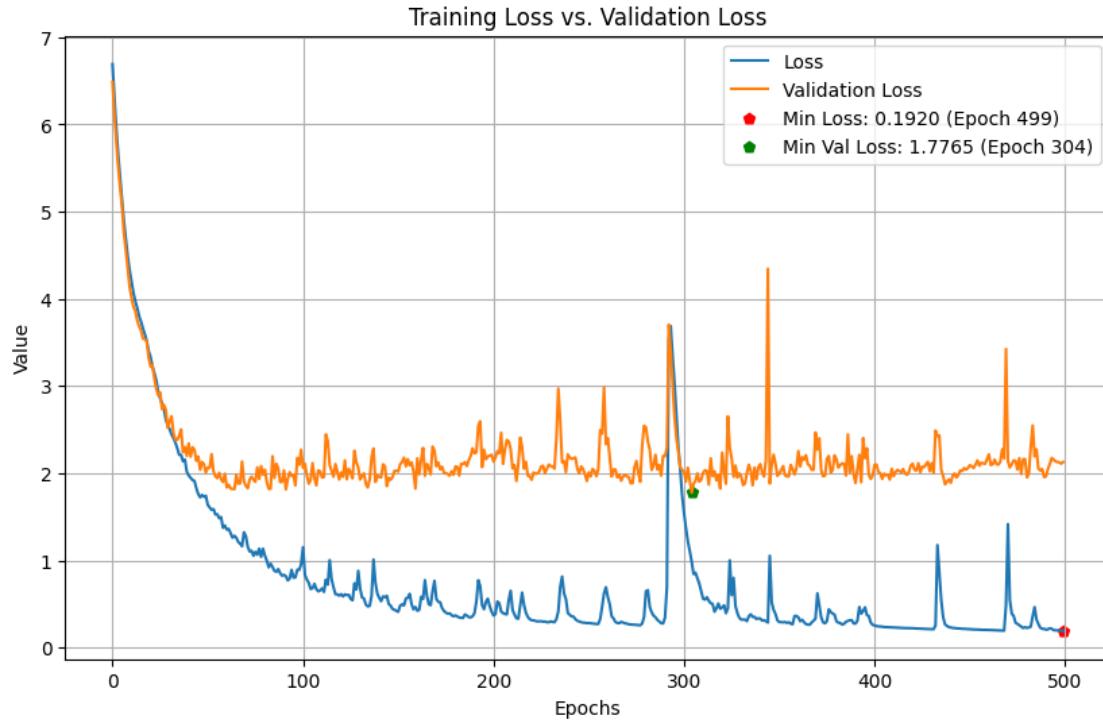
```
hist_csv_file = '2 LSTM/history.csv'  
with open(hist_csv_file, mode='w') as f:  
    hist_df.to_csv(f)
```

```
[96]: hist_df = pd.read_csv('2 LSTM/history.csv', index_col=0)  
hist_df.tail()
```

```
[96]:      loss  f1_score  val_loss  val_f1_score  
495  0.197661  0.999659  2.134759      0.675145  
496  0.196021  0.999220  2.128535      0.650186  
497  0.193725  0.999565  2.123560      0.669113  
498  0.192390  0.999185  2.109015      0.677445  
499  0.191989  1.000000  2.128645      0.673940
```

```
[97]: # 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()
```



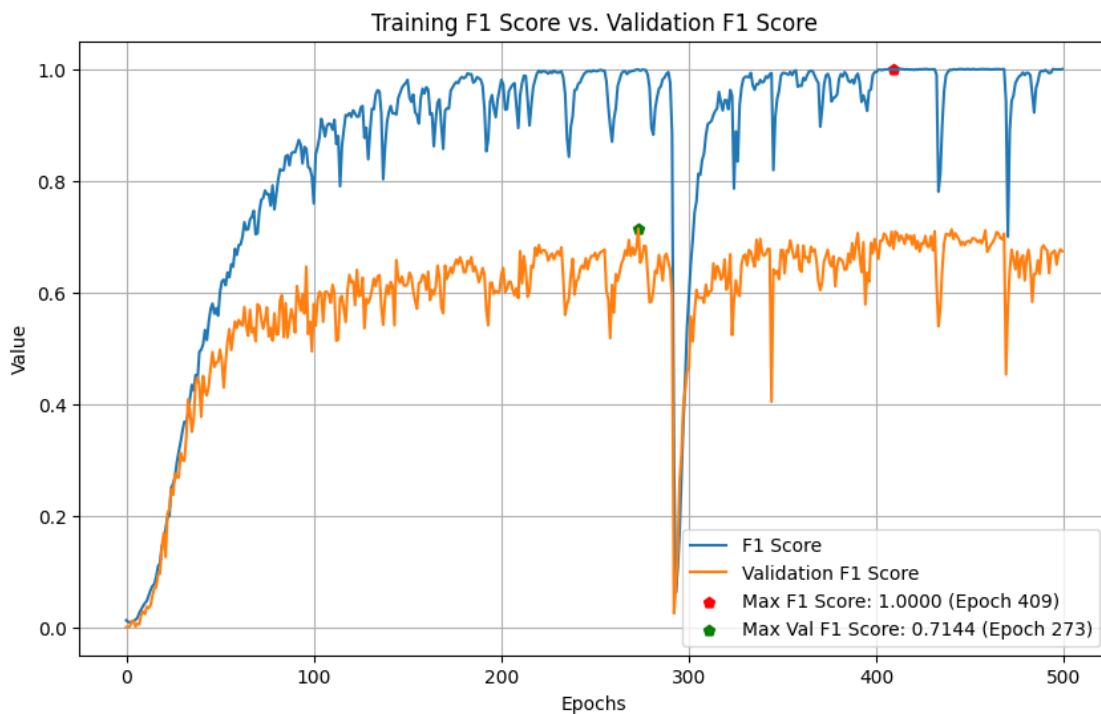
```
[98]: # Find the epoch with the highest F1 Score and Validation F1 Score  
max_f1_epoch = hist_df['f1_score'].idxmax()  
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()  
  
max_f1 = hist_df['f1_score'][max_f1_epoch]  
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]  
  
# Plotting  
epochs = 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()

```



[99]: reconstructed\_model.evaluate(Xval, Yval)

```
11/11 [=====] - 1s 24ms/step - loss: 1.8845 - f1_score: 0.7144
```

[99]: [1.8845269680023193, 0.7143672108650208]

[100]: reconstructed\_model.evaluate(Xtrain, Ytrain)

```
84/84 [=====] - 2s 25ms/step - loss: 0.2470 - f1_score: 0.9996
```

[100]: [0.24698594212532043, 0.9996124505996704]

```
[101]: 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	0.750	1.000	0.857	6
BASKETBALL	1.000	1.000	1.000	10
BEE	0.667	0.400	0.500	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.500	0.667	8
BREAKFAST	1.000	1.000	1.000	6
CANCER	0.625	0.625	0.625	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	0.455	0.833	0.588	6
DARK	1.000	1.000	1.000	4
DEAF	0.444	0.667	0.533	6
DECIDE	0.750	1.000	0.857	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	0.333	0.333	0.333	6
DINNER	1.000	1.000	1.000	8
DOG	0.444	0.667	0.533	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	0.333	0.500	0.400	4
EAT	0.750	0.500	0.600	6
EDIT	0.833	0.833	0.833	6
ELEVATOR	0.333	0.500	0.400	8
FINE	0.500	0.250	0.333	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	1.000	0.667	0.800	6
GUESS	0.714	0.625	0.667	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.500	0.667	0.571	6
HURDLE/TRIP	0.333	0.250	0.286	4
JEWELRY	0.800	1.000	0.889	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.500	0.500	0.500	8
LUNCH	0.800	0.500	0.615	8
MAPLE	0.600	0.750	0.667	4
MEAT	0.500	0.833	0.625	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	0.889	1.000	0.941	8

PARTY	0.857	0.750	0.800	8
PATIENT	0.143	0.167	0.154	6
RAZOR	1.000	0.750	0.857	4
RIVER	1.000	0.667	0.800	6
ROCKINGCHAIR	0.889	1.000	0.941	8
SHAVE	1.000	0.800	0.889	10
SINK	0.667	0.667	0.667	6
SQUEEZE	0.333	0.250	0.286	4
THEY	1.000	1.000	1.000	4
TWINS	0.500	0.750	0.600	8
WHATFOR	1.000	0.500	0.667	10
accuracy			0.722	324
macro avg	0.748	0.717	0.714	324
weighted avg	0.764	0.722	0.724	324

### 4.3 Hyperparameter Tuning 3 LSTM 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', '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(Flatten())
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_30212/3342621595.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/CSPNext/hyperband/',
    project_name='3_LSTM',
    overwrite=False)
```

2023-09-15 12:35:40.441715: 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.  
2023-09-15 12:35:40.504721: 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: 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'}
```

```
[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 23m 11s]  
val\_f1\_score: 0.6041032373905182

Best val\_f1\_score So Far: 0.6909504234790802  
Total elapsed time: 23h 44m 59s  
INFO:tensorflow:Oracle triggered exit

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

Results summary  
Results in /media/kristian/HDD/ASL\_Citizen/CSPNext/hyperband/3\_LSTM  
Showing 10 best trials  
Objective(name="val\_f1\_score", direction="max")

Trial 0599 summary  
Hyperparameters:  
dense\_activation: mish  
units\_1: 150  
regularizer\_1: 0.0016614647302908507  
units\_2: 175  
regularizer\_2: 0.0003705676850262295  
units\_3: 150  
regularizer\_3: 0.00023323687715314648  
dropout\_1: 0.0  
units\_4: 110  
dropout\_2: 0.65  
learning\_rate: 0.0002598597527871886  
tuner/epochs: 300  
tuner/initial\_epoch: 100  
tuner/bracket: 4  
tuner/round: 4  
tuner/trial\_id: 0596  
Score: 0.6909504234790802

Trial 0598 summary  
Hyperparameters:  
dense\_activation: gelu

```
units_1: 175
regularizer_1: 0.00222084508546812
units_2: 150
regularizer_2: 0.005097339455115072
units_3: 175
regularizer_3: 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: 4
tuner/round: 4
tuner/trial_id: 0593
Score: 0.6896192133426666
```

```
Trial 0427 summary
Hyperparameters:
dense_activation: selu
units_1: 125
regularizer_1: 0.0009756660584259578
units_2: 175
regularizer_2: 0.002613956776855358
units_3: 150
regularizer_3: 0.000334067220168496
dropout_1: 0.4
units_4: 100
dropout_2: 0.2
learning_rate: 0.0003401691826873532
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.6831138432025909
```

```
Trial 0593 summary
Hyperparameters:
dense_activation: gelu
units_1: 175
regularizer_1: 0.00222084508546812
units_2: 150
regularizer_2: 0.005097339455115072
units_3: 175
regularizer_3: 0.0019526565349868704
dropout_1: 0.15000000000000002
units_4: 100
```

```
dropout_2: 0.2
learning_rate: 0.00018769757435735312
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0582
Score: 0.6817665994167328
```

```
Trial 0715 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: 0.6815199553966522
```

```
Trial 0671 summary
Hyperparameters:
dense_activation: elu
units_1: 200
regularizer_1: 0.00541476837486818
units_2: 175
regularizer_2: 0.005187075299734057
units_3: 125
regularizer_3: 0.007950871082139998
dropout_1: 0.05
units_4: 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: 0665
Score: 0.6750347912311554
```

```
Trial 0426 summary
Hyperparameters:
dense_activation: selu
units_1: 175
regularizer_1: 0.0009211376149271358
units_2: 125
regularizer_2: 0.0025674422564504226
units_3: 150
regularizer_3: 0.00016478996207387034
dropout_1: 0.0
units_4: 70
dropout_2: 0.30000000000000004
learning_rate: 0.00021347610418606298
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0422
Score: 0.6698198318481445
```

```
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: 0.661438524723053
```

```
Trial 0422 summary
Hyperparameters:
dense_activation: selu
units_1: 175
regularizer_1: 0.0009211376149271358
units_2: 125
regularizer_2: 0.0025674422564504226
units_3: 150
```

```
regularizer_3: 0.00016478996207387034
dropout_1: 0.0
units_4: 70
dropout_2: 0.30000000000000004
learning_rate: 0.00021347610418606298
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0412
Score: 0.6493920087814331
```

```
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: 0.6469994187355042
```

```
[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
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
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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
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](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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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
```

```
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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.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
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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: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
```

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

```
11/11 [=====] - 5s 117ms/step - loss: 1.9652 -
f1_score: 0.6998
```

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

```
84/84 [=====] - 3s 34ms/step - loss: 0.2280 - f1_score:
0.9936
```

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

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
lstm (LSTM)	(None, 130, 150)	330000

lstm_1 (LSTM)	(None, 130, 175)	228200
lstm_2 (LSTM)	(None, 150)	195600
dropout (Dropout)	(None, 150)	0
dense (Dense)	(None, 110)	16610
dropout_1 (Dropout)	(None, 110)	0
dense_1 (Dense)	(None, 50)	5550

=====

Total params: 775,960

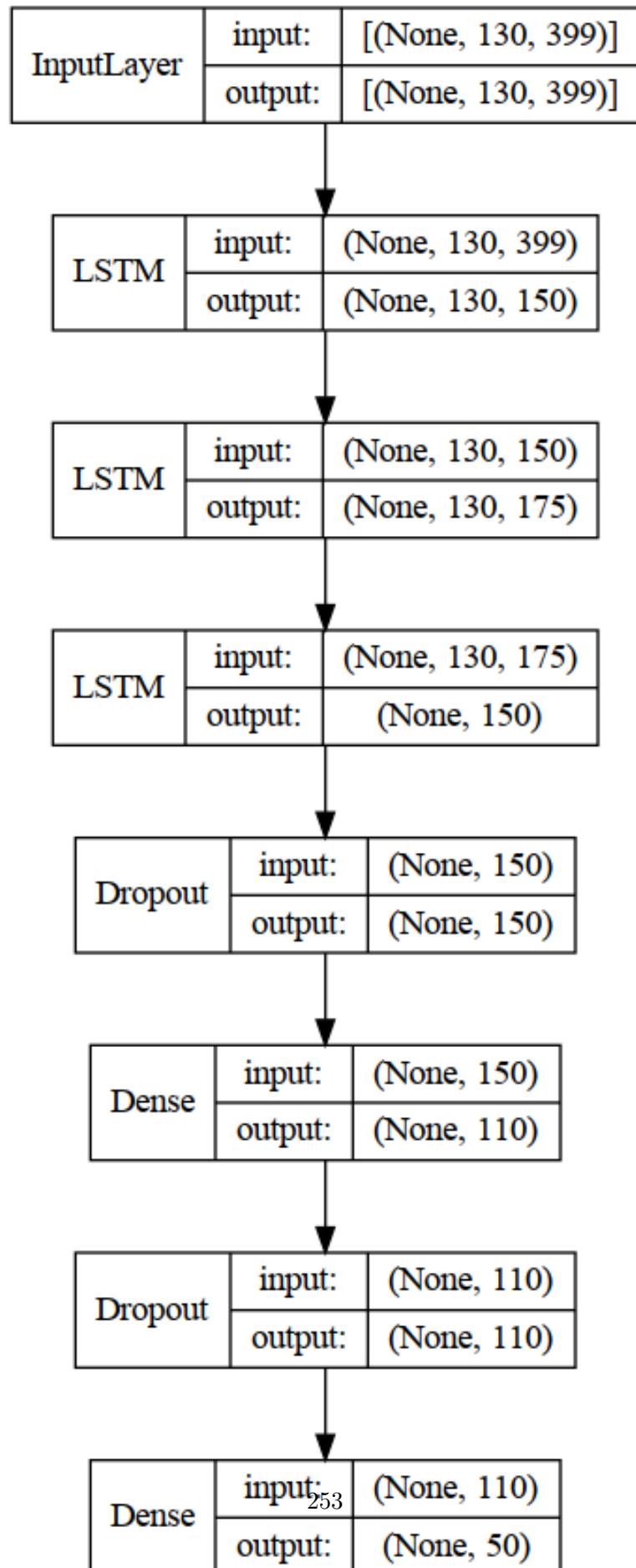
Trainable params: 775,960

Non-trainable params: 0

-----

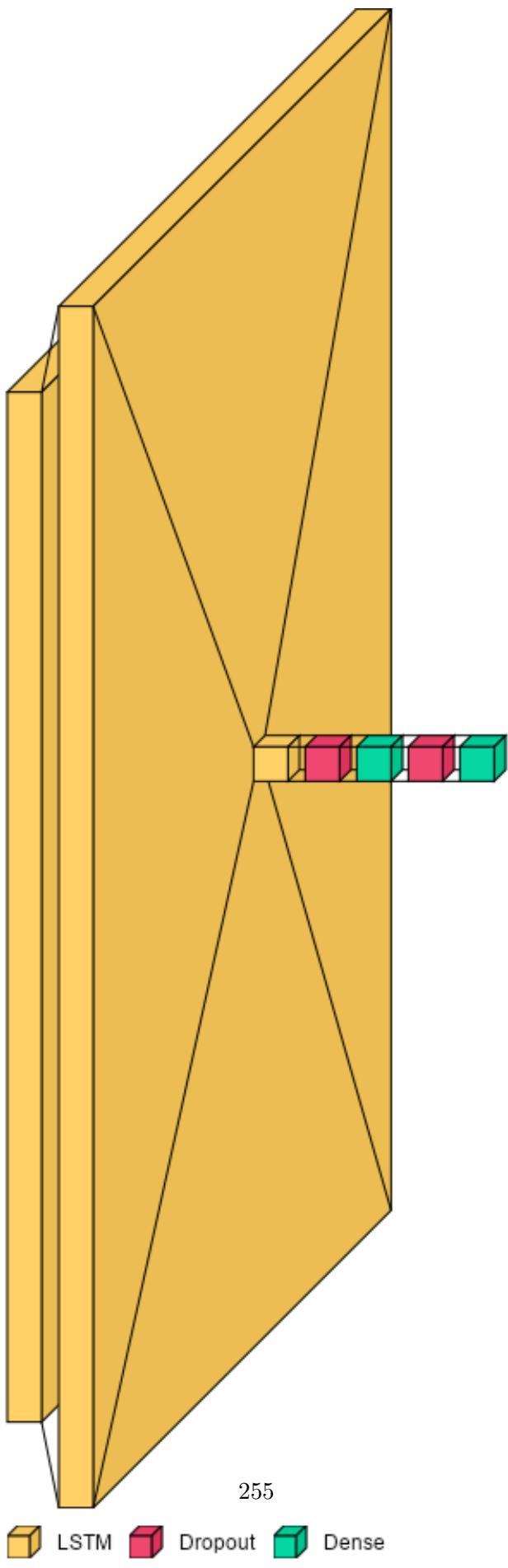
```
[130]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[130]:
```



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

```
[132]:
```



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

	precision	recall	f1-score	support
AXE	1.000	0.875	0.933	8
BACKPACK	0.750	1.000	0.857	6
BASKETBALL	0.818	0.900	0.857	10
BEE	0.833	0.500	0.625	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.875	0.933	8
BREAKFAST	0.500	0.667	0.571	6
CANCER	0.875	0.875	0.875	8
CHRISTMAS	0.833	0.833	0.833	6
CONFUSED	0.714	0.833	0.769	6
DARK	1.000	1.000	1.000	4
DEAF	0.625	0.833	0.714	6
DECIDE	0.750	1.000	0.857	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.571	0.667	0.615	6
DINNER	0.667	0.500	0.571	8
DOG	0.667	0.667	0.667	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	0.500	0.250	0.333	4
EAT	1.000	0.667	0.800	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.333	0.500	0.400	8
FINE	1.000	0.500	0.667	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	0.429	0.500	0.462	6
GUESS	1.000	0.875	0.933	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	1.000	1.000	1.000	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	0.833	0.625	0.714	8
LUNCH	1.000	0.375	0.545	8
MAPLE	0.333	0.500	0.400	4
MEAT	0.385	0.833	0.526	6
MECHANIC	0.800	1.000	0.889	4

MICROSCOPE	1.000	0.375	0.545	8
MOVIE	0.500	0.375	0.429	8
NOON	0.800	1.000	0.889	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.333	0.500	0.400	6
RAZOR	0.800	1.000	0.889	4
RIVER	0.833	0.833	0.833	6
ROCKINGCHAIR	0.545	0.750	0.632	8
SHAVE	1.000	0.800	0.889	10
SINK	0.400	0.333	0.364	6
SQUEEZE	0.000	0.000	0.000	4
THEY	1.000	0.750	0.857	4
TWINS	0.727	1.000	0.842	8
WHATFOR	0.889	0.800	0.842	10
accuracy			0.722	324
macro avg	0.736	0.706	0.700	324
weighted avg	0.757	0.722	0.719	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]: bestHP = tuner.get_best_hyperparameters(num_trials=10)[0]
```

```
[135]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='3 LSTM/',
    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: 4.8239 - f1_score:  
0.0174  
  
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 [=====] - 43s 1s/step - loss: 4.8239 - f1_score:  
0.0174 - val_loss: 4.7613 - val_f1_score: 9.6386e-04  
Epoch 2/500  
28/28 [=====] - 5s 183ms/step - loss: 4.7106 -  
f1_score: 0.0166 - val_loss: 4.6446 - val_f1_score: 7.2727e-04  
Epoch 3/500  
28/28 [=====] - 5s 184ms/step - loss: 4.6035 -  
f1_score: 0.0164 - val_loss: 4.5485 - val_f1_score: 7.2727e-04  
Epoch 4/500  
28/28 [=====] - 5s 183ms/step - loss: 4.5129 -  
f1_score: 0.0152 - val_loss: 4.4676 - val_f1_score: 6.0377e-04  
Epoch 5/500  
28/28 [=====] - ETA: 0s - loss: 4.4330 - f1_score:  
0.0154  
  
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 798ms/step - loss: 4.4330 -  
f1_score: 0.0154 - val_loss: 4.3945 - val_f1_score: 0.0013  
Epoch 6/500  
28/28 [=====] - 5s 182ms/step - loss: 4.3680 -  
f1_score: 0.0121 - val_loss: 4.3370 - val_f1_score: 6.6667e-04  
Epoch 7/500
```

```
28/28 [=====] - ETA: 0s - loss: 4.3137 - f1_score: 0.0142

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 818ms/step - loss: 4.3137 -
f1_score: 0.0142 - val_loss: 4.2826 - val_f1_score: 0.0036
Epoch 8/500
28/28 [=====] - 5s 183ms/step - loss: 4.2591 -
f1_score: 0.0193 - val_loss: 4.2367 - val_f1_score: 0.0012
Epoch 9/500
28/28 [=====] - ETA: 0s - loss: 4.2205 - f1_score: 0.0124

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 797ms/step - loss: 4.2205 -
f1_score: 0.0124 - val_loss: 4.1917 - val_f1_score: 0.0042
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 4.1543 - f1_score: 0.0249

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 793ms/step - loss: 4.1543 -
f1_score: 0.0249 - val_loss: 4.0667 - val_f1_score: 0.0071
Epoch 11/500
28/28 [=====] - ETA: 0s - loss: 4.0539 - f1_score: 0.0282
```

```
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: 4.0539 -
f1_score: 0.0282 - val_loss: 3.9551 - val_f1_score: 0.0113
```

```
Epoch 12/500
```

```
28/28 [=====] - 5s 183ms/step - loss: 3.9477 -
f1_score: 0.0289 - val_loss: 3.7876 - val_f1_score: 0.0101
```

```
Epoch 13/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.8543 - f1_score:
0.0442
```

```
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 751ms/step - loss: 3.8543 -
f1_score: 0.0442 - val_loss: 3.6621 - val_f1_score: 0.0150
```

```
Epoch 14/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.8016 - f1_score:
0.0454
```

```
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 794ms/step - loss: 3.8016 -
f1_score: 0.0454 - val_loss: 3.6690 - val_f1_score: 0.0314
```

```
Epoch 15/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.7123 - f1_score:
0.0550
```

```
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 741ms/step - loss: 3.7123 -
f1_score: 0.0550 - val_loss: 3.5005 - val_f1_score: 0.0343
Epoch 16/500
28/28 [=====] - 5s 183ms/step - loss: 3.6339 -
f1_score: 0.0688 - val_loss: 3.4893 - val_f1_score: 0.0235
Epoch 17/500
28/28 [=====] - ETA: 0s - loss: 3.5842 - f1_score:
0.0541

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 783ms/step - loss: 3.5842 -
f1_score: 0.0541 - val_loss: 3.3154 - val_f1_score: 0.0538
Epoch 18/500
28/28 [=====] - ETA: 0s - loss: 3.5041 - f1_score:
0.0772

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 779ms/step - loss: 3.5041 -
f1_score: 0.0772 - val_loss: 3.2777 - val_f1_score: 0.0609
Epoch 19/500
28/28 [=====] - 5s 183ms/step - loss: 3.4339 -
f1_score: 0.0913 - val_loss: 3.3357 - val_f1_score: 0.0533
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 3.3540 - f1_score:
0.1035

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 734ms/step - loss: 3.3540 -
f1_score: 0.1035 - val_loss: 3.0837 - val_f1_score: 0.0901
Epoch 21/500
28/28 [=====] - 5s 182ms/step - loss: 3.2652 -
f1_score: 0.1087 - val_loss: 3.0649 - val_f1_score: 0.0873
Epoch 22/500
28/28 [=====] - ETA: 0s - loss: 3.1500 - f1_score:
0.1333

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 [=====] - 59s 2s/step - loss: 3.1500 - f1_score:
0.1333 - val_loss: 2.9674 - val_f1_score: 0.1390
Epoch 23/500
28/28 [=====] - 5s 181ms/step - loss: 3.1549 -
f1_score: 0.1364 - val_loss: 3.0694 - val_f1_score: 0.0841
Epoch 24/500
28/28 [=====] - 5s 182ms/step - loss: 3.0941 -
f1_score: 0.1535 - val_loss: 2.8829 - val_f1_score: 0.1372
Epoch 25/500
28/28 [=====] - ETA: 0s - loss: 2.9547 - f1_score:
0.1674

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 787ms/step - loss: 2.9547 -
f1_score: 0.1674 - val_loss: 2.8724 - val_f1_score: 0.1454
Epoch 26/500
28/28 [=====] - ETA: 0s - loss: 2.9073 - f1_score:
0.1805
```

```
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 708ms/step - loss: 2.9073 -
```

```
f1_score: 0.1805 - val_loss: 2.8033 - val_f1_score: 0.1532
```

```
Epoch 27/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.8401 - f1_score:
```

```
0.1891
```

```
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: 2.8401 - f1_score:
```

```
0.1891 - val_loss: 2.7577 - val_f1_score: 0.1819
```

```
Epoch 28/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.7680 - f1_score:
```

```
0.2150
```

```
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 716ms/step - loss: 2.7680 -
```

```
f1_score: 0.2150 - val_loss: 2.6553 - val_f1_score: 0.1927
```

```
Epoch 29/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.7692 - f1_score:
```

```
0.2171
```

```
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 746ms/step - loss: 2.7692 -
f1_score: 0.2171 - val_loss: 2.6901 - val_f1_score: 0.2057
Epoch 30/500
28/28 [=====] - ETA: 0s - loss: 2.6641 - f1_score:
0.2365

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 767ms/step - loss: 2.6641 -
f1_score: 0.2365 - val_loss: 2.5537 - val_f1_score: 0.2253
Epoch 31/500
28/28 [=====] - 5s 183ms/step - loss: 2.6304 -
f1_score: 0.2398 - val_loss: 2.7380 - val_f1_score: 0.1414
Epoch 32/500
28/28 [=====] - 5s 182ms/step - loss: 2.5566 -
f1_score: 0.2647 - val_loss: 2.5115 - val_f1_score: 0.2157
Epoch 33/500
28/28 [=====] - ETA: 0s - loss: 2.5121 - f1_score:
0.2657

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 787ms/step - loss: 2.5121 -
f1_score: 0.2657 - val_loss: 2.4419 - val_f1_score: 0.2712
Epoch 34/500
28/28 [=====] - ETA: 0s - loss: 2.4608 - f1_score:
0.2925

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 [=====] - 31s 1s/step - loss: 2.4608 - f1_score: 0.2925 - val_loss: 2.3671 - val_f1_score: 0.2833
Epoch 35/500
28/28 [=====] - ETA: 0s - loss: 2.4141 - f1_score: 0.2985

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 716ms/step - loss: 2.4141 - f1_score: 0.2985 - val_loss: 2.5190 - val_f1_score: 0.2978
Epoch 36/500
28/28 [=====] - ETA: 0s - loss: 2.4198 - f1_score: 0.2955

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: 2.4198 - f1_score: 0.2955 - val_loss: 2.2836 - val_f1_score: 0.3006
Epoch 37/500
28/28 [=====] - 5s 183ms/step - loss: 2.2946 - f1_score: 0.3370 - val_loss: 2.4156 - val_f1_score: 0.2929
Epoch 38/500
28/28 [=====] - ETA: 0s - loss: 2.2616 - f1_score: 0.3423

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 767ms/step - loss: 2.2616 -
f1_score: 0.3423 - val_loss: 2.1982 - val_f1_score: 0.3692
Epoch 39/500
28/28 [=====] - 5s 183ms/step - loss: 2.2100 -
f1_score: 0.3507 - val_loss: 2.3341 - val_f1_score: 0.2910
Epoch 40/500
28/28 [=====] - 5s 182ms/step - loss: 2.1805 -
f1_score: 0.3746 - val_loss: 2.2777 - val_f1_score: 0.3241
Epoch 41/500
28/28 [=====] - ETA: 0s - loss: 2.1089 - f1_score:
0.3822

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 779ms/step - loss: 2.1089 -
f1_score: 0.3822 - val_loss: 2.1905 - val_f1_score: 0.3748
Epoch 42/500
28/28 [=====] - ETA: 0s - loss: 2.0342 - f1_score:
0.4235

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 816ms/step - loss: 2.0342 -
f1_score: 0.4235 - val_loss: 2.1219 - val_f1_score: 0.4148
Epoch 43/500
28/28 [=====] - 5s 182ms/step - loss: 1.9939 -
f1_score: 0.4149 - val_loss: 2.0518 - val_f1_score: 0.3881
Epoch 44/500
28/28 [=====] - 5s 183ms/step - loss: 1.9276 -
f1_score: 0.4474 - val_loss: 2.1304 - val_f1_score: 0.4133
Epoch 45/500
28/28 [=====] - 5s 186ms/step - loss: 1.9082 -
f1_score: 0.4430 - val_loss: 2.0953 - val_f1_score: 0.3956
Epoch 46/500
28/28 [=====] - ETA: 0s - loss: 1.8672 - f1_score:
0.4643
```

```
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 784ms/step - loss: 1.8672 -
f1_score: 0.4643 - val_loss: 1.9710 - val_f1_score: 0.4250
```

```
Epoch 47/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.7940 - f1_score:
0.4741
```

```
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: 1.7940 -
f1_score: 0.4741 - val_loss: 1.9134 - val_f1_score: 0.4453
```

```
Epoch 48/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.7753 - f1_score:
0.4903
```

```
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 726ms/step - loss: 1.7753 -
f1_score: 0.4903 - val_loss: 1.9412 - val_f1_score: 0.4568
```

```
Epoch 49/500
```

```
28/28 [=====] - 5s 182ms/step - loss: 1.6879 -
f1_score: 0.5302 - val_loss: 1.9211 - val_f1_score: 0.4172
```

```
Epoch 50/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.6321 - f1_score:
0.5333
```

```
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 851ms/step - loss: 1.6321 -

f1\_score: 0.5333 - val\_loss: 1.9356 - val\_f1\_score: 0.4642

Epoch 51/500

28/28 [=====] - ETA: 0s - loss: 1.6119 - f1\_score:

0.5378

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 805ms/step - loss: 1.6119 -

f1\_score: 0.5378 - val\_loss: 1.9338 - val\_f1\_score: 0.4812

Epoch 52/500

28/28 [=====] - 5s 183ms/step - loss: 1.6150 -

f1\_score: 0.5270 - val\_loss: 2.0188 - val\_f1\_score: 0.4159

Epoch 53/500

28/28 [=====] - 5s 183ms/step - loss: 1.6211 -

f1\_score: 0.5428 - val\_loss: 2.0480 - val\_f1\_score: 0.4255

Epoch 54/500

28/28 [=====] - 5s 185ms/step - loss: 1.4986 -

f1\_score: 0.5776 - val\_loss: 1.9191 - val\_f1\_score: 0.4800

Epoch 55/500

28/28 [=====] - 5s 186ms/step - loss: 1.5065 -

f1\_score: 0.5793 - val\_loss: 2.0482 - val\_f1\_score: 0.4616

Epoch 56/500

28/28 [=====] - 5s 187ms/step - loss: 1.4930 -

f1\_score: 0.5820 - val\_loss: 1.9988 - val\_f1\_score: 0.4505

Epoch 57/500

28/28 [=====] - ETA: 0s - loss: 1.4171 - f1\_score:

0.6029

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 833ms/step - loss: 1.4171 -
f1_score: 0.6029 - val_loss: 1.7735 - val_f1_score: 0.5090
Epoch 58/500
28/28 [=====] - 5s 183ms/step - loss: 1.3919 -
f1_score: 0.6222 - val_loss: 1.8237 - val_f1_score: 0.4818
Epoch 59/500
28/28 [=====] - 5s 185ms/step - loss: 1.3995 -
f1_score: 0.6086 - val_loss: 1.8955 - val_f1_score: 0.4696
Epoch 60/500
28/28 [=====] - 5s 187ms/step - loss: 1.3540 -
f1_score: 0.6254 - val_loss: 1.8882 - val_f1_score: 0.4726
Epoch 61/500
28/28 [=====] - ETA: 0s - loss: 1.3038 - f1_score:
0.6347

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 859ms/step - loss: 1.3038 -
f1_score: 0.6347 - val_loss: 1.7626 - val_f1_score: 0.5451
Epoch 62/500
28/28 [=====] - 5s 183ms/step - loss: 1.3776 -
f1_score: 0.6217 - val_loss: 1.9652 - val_f1_score: 0.4851
Epoch 63/500
28/28 [=====] - 5s 185ms/step - loss: 1.3797 -
f1_score: 0.6117 - val_loss: 1.7972 - val_f1_score: 0.5292
Epoch 64/500
28/28 [=====] - 5s 186ms/step - loss: 1.2608 -
f1_score: 0.6433 - val_loss: 1.8525 - val_f1_score: 0.5030
Epoch 65/500
28/28 [=====] - 5s 189ms/step - loss: 1.1585 -
f1_score: 0.6881 - val_loss: 1.8145 - val_f1_score: 0.4979
Epoch 66/500
28/28 [=====] - 5s 189ms/step - loss: 1.1913 -
f1_score: 0.6686 - val_loss: 1.9964 - val_f1_score: 0.4673
Epoch 67/500
28/28 [=====] - 5s 189ms/step - loss: 1.2166 -
f1_score: 0.6733 - val_loss: 1.8654 - val_f1_score: 0.5217
Epoch 68/500
28/28 [=====] - 5s 191ms/step - loss: 1.1649 -
f1_score: 0.6818 - val_loss: 1.7714 - val_f1_score: 0.5357
Epoch 69/500
28/28 [=====] - ETA: 0s - loss: 1.0558 - f1_score:
```

0.7172

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 905ms/step - loss: 1.0558 -

f1\_score: 0.7172 - val\_loss: 1.6548 - val\_f1\_score: 0.5808

Epoch 70/500

28/28 [=====] - 5s 183ms/step - loss: 0.9964 -

f1\_score: 0.7417 - val\_loss: 1.6889 - val\_f1\_score: 0.5460

Epoch 71/500

28/28 [=====] - 5s 185ms/step - loss: 1.0165 -

f1\_score: 0.7283 - val\_loss: 1.7502 - val\_f1\_score: 0.5495

Epoch 72/500

28/28 [=====] - 5s 188ms/step - loss: 0.9641 -

f1\_score: 0.7557 - val\_loss: 1.7393 - val\_f1\_score: 0.5272

Epoch 73/500

28/28 [=====] - 5s 189ms/step - loss: 0.9545 -

f1\_score: 0.7499 - val\_loss: 1.7541 - val\_f1\_score: 0.5574

Epoch 74/500

28/28 [=====] - 5s 193ms/step - loss: 0.8882 -

f1\_score: 0.7768 - val\_loss: 1.9400 - val\_f1\_score: 0.5201

Epoch 75/500

28/28 [=====] - 5s 190ms/step - loss: 0.9141 -

f1\_score: 0.7604 - val\_loss: 1.8178 - val\_f1\_score: 0.5485

Epoch 76/500

28/28 [=====] - 5s 191ms/step - loss: 0.8985 -

f1\_score: 0.7639 - val\_loss: 1.7737 - val\_f1\_score: 0.5769

Epoch 77/500

28/28 [=====] - 5s 193ms/step - loss: 0.8979 -

f1\_score: 0.7738 - val\_loss: 1.8375 - val\_f1\_score: 0.5387

Epoch 78/500

28/28 [=====] - 5s 192ms/step - loss: 0.8895 -

f1\_score: 0.7667 - val\_loss: 1.8563 - val\_f1\_score: 0.5414

Epoch 79/500

28/28 [=====] - 5s 194ms/step - loss: 0.9032 -

f1\_score: 0.7694 - val\_loss: 1.8275 - val\_f1\_score: 0.5537

Epoch 80/500

28/28 [=====] - 5s 193ms/step - loss: 0.8377 -

f1\_score: 0.7922 - val\_loss: 1.8460 - val\_f1\_score: 0.5681

Epoch 81/500

28/28 [=====] - 5s 193ms/step - loss: 0.8933 -

f1\_score: 0.7712 - val\_loss: 1.9129 - val\_f1\_score: 0.5341

```

Epoch 82/500
28/28 [=====] - 5s 193ms/step - loss: 1.3803 -
f1_score: 0.6599 - val_loss: 1.8017 - val_f1_score: 0.5328
Epoch 83/500
28/28 [=====] - 5s 193ms/step - loss: 0.9724 -
f1_score: 0.7539 - val_loss: 1.7805 - val_f1_score: 0.5693
Epoch 84/500
28/28 [=====] - 5s 193ms/step - loss: 0.8563 -
f1_score: 0.7838 - val_loss: 1.6604 - val_f1_score: 0.5657
Epoch 85/500
28/28 [=====] - 5s 193ms/step - loss: 0.7453 -
f1_score: 0.8236 - val_loss: 1.8146 - val_f1_score: 0.5673
Epoch 86/500
28/28 [=====] - 5s 194ms/step - loss: 0.7057 -
f1_score: 0.8388 - val_loss: 1.7340 - val_f1_score: 0.5654
Epoch 87/500
28/28 [=====] - 6s 200ms/step - loss: 0.6758 -
f1_score: 0.8482 - val_loss: 1.7928 - val_f1_score: 0.5553
Epoch 88/500
28/28 [=====] - 5s 195ms/step - loss: 0.6634 -
f1_score: 0.8510 - val_loss: 1.8788 - val_f1_score: 0.5411
Epoch 89/500
28/28 [=====] - ETA: 0s - loss: 0.6756 - f1_score:
0.8466

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 909ms/step - loss: 0.6756 -
f1_score: 0.8466 - val_loss: 1.7691 - val_f1_score: 0.5836
Epoch 90/500
28/28 [=====] - 5s 184ms/step - loss: 0.6809 -
f1_score: 0.8418 - val_loss: 1.6813 - val_f1_score: 0.5745
Epoch 91/500
28/28 [=====] - 5s 188ms/step - loss: 0.6753 -
f1_score: 0.8411 - val_loss: 1.7622 - val_f1_score: 0.5790
Epoch 92/500
28/28 [=====] - ETA: 0s - loss: 0.6057 - f1_score:
0.8637

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 778ms/step - loss: 0.6057 -
f1_score: 0.8637 - val_loss: 1.7478 - val_f1_score: 0.5899
Epoch 93/500
28/28 [=====] - 5s 184ms/step - loss: 0.5834 -
f1_score: 0.8724 - val_loss: 1.8933 - val_f1_score: 0.5515
Epoch 94/500
28/28 [=====] - 5s 187ms/step - loss: 0.5823 -
f1_score: 0.8743 - val_loss: 1.8281 - val_f1_score: 0.5766
Epoch 95/500
28/28 [=====] - 5s 190ms/step - loss: 0.5301 -
f1_score: 0.8992 - val_loss: 1.8223 - val_f1_score: 0.5767
Epoch 96/500
28/28 [=====] - 5s 192ms/step - loss: 1.1585 -
f1_score: 0.7253 - val_loss: 2.0529 - val_f1_score: 0.5006
Epoch 97/500
28/28 [=====] - 5s 192ms/step - loss: 0.7547 -
f1_score: 0.8127 - val_loss: 1.8933 - val_f1_score: 0.5396
Epoch 98/500
28/28 [=====] - 5s 192ms/step - loss: 0.7102 -
f1_score: 0.8276 - val_loss: 1.8422 - val_f1_score: 0.5446
Epoch 99/500
28/28 [=====] - 5s 192ms/step - loss: 0.6127 -
f1_score: 0.8670 - val_loss: 1.9116 - val_f1_score: 0.5224
Epoch 100/500
28/28 [=====] - 5s 192ms/step - loss: 0.6215 -
f1_score: 0.8727 - val_loss: 1.8333 - val_f1_score: 0.5498
Epoch 101/500
28/28 [=====] - 5s 196ms/step - loss: 0.5627 -
f1_score: 0.8777 - val_loss: 1.7885 - val_f1_score: 0.5694
Epoch 102/500
28/28 [=====] - 5s 193ms/step - loss: 0.6078 -
f1_score: 0.8639 - val_loss: 2.0063 - val_f1_score: 0.5386
Epoch 103/500
28/28 [=====] - 5s 194ms/step - loss: 0.5291 -
f1_score: 0.8915 - val_loss: 1.8334 - val_f1_score: 0.5659
Epoch 104/500
28/28 [=====] - 5s 194ms/step - loss: 0.4755 -
f1_score: 0.9083 - val_loss: 1.8893 - val_f1_score: 0.5730
Epoch 105/500
28/28 [=====] - 5s 195ms/step - loss: 0.5399 -
f1_score: 0.8939 - val_loss: 2.1536 - val_f1_score: 0.5565
Epoch 106/500
```

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28/28 [=====] - 5s 193ms/step - loss: 0.6493 -
f1_score: 0.8491 - val_loss: 2.0243 - val_f1_score: 0.5671
Epoch 107/500
28/28 [=====] - 5s 196ms/step - loss: 0.9813 -
f1_score: 0.7762 - val_loss: 1.8435 - val_f1_score: 0.5574
Epoch 108/500
28/28 [=====] - 5s 195ms/step - loss: 0.7137 -
f1_score: 0.8409 - val_loss: 1.8623 - val_f1_score: 0.5765
Epoch 109/500
28/28 [=====] - 6s 198ms/step - loss: 0.5636 -
f1_score: 0.8819 - val_loss: 2.2388 - val_f1_score: 0.5361
Epoch 110/500
28/28 [=====] - 5s 194ms/step - loss: 0.6278 -
f1_score: 0.8618 - val_loss: 1.8064 - val_f1_score: 0.5833
Epoch 111/500
28/28 [=====] - 5s 195ms/step - loss: 0.4871 -
f1_score: 0.9094 - val_loss: 1.9394 - val_f1_score: 0.5546
Epoch 112/500
28/28 [=====] - 5s 196ms/step - loss: 0.4208 -
f1_score: 0.9301 - val_loss: 1.8429 - val_f1_score: 0.5718
Epoch 113/500
28/28 [=====] - ETA: 0s - loss: 0.3856 - f1_score:
0.9400

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 924ms/step - loss: 0.3856 -
f1_score: 0.9400 - val_loss: 1.7469 - val_f1_score: 0.6055
Epoch 114/500
28/28 [=====] - 5s 186ms/step - loss: 0.3837 -
f1_score: 0.9420 - val_loss: 1.9399 - val_f1_score: 0.5647
Epoch 115/500
28/28 [=====] - ETA: 0s - loss: 0.3612 - f1_score:
0.9476

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: 0.3612 -  
f1\_score: 0.9476 - val\_loss: 1.8364 - val\_f1\_score: 0.6224  
Epoch 116/500

28/28 [=====] - 5s 184ms/step - loss: 0.4040 -  
f1\_score: 0.9358 - val\_loss: 2.0500 - val\_f1\_score: 0.5763  
Epoch 117/500

28/28 [=====] - 5s 188ms/step - loss: 0.3955 -  
f1\_score: 0.9345 - val\_loss: 2.1048 - val\_f1\_score: 0.5702  
Epoch 118/500

28/28 [=====] - 5s 189ms/step - loss: 0.4464 -  
f1\_score: 0.9195 - val\_loss: 2.0203 - val\_f1\_score: 0.5739  
Epoch 119/500

28/28 [=====] - 5s 192ms/step - loss: 0.4845 -  
f1\_score: 0.9023 - val\_loss: 2.0460 - val\_f1\_score: 0.5504  
Epoch 120/500

28/28 [=====] - 5s 192ms/step - loss: 0.4205 -  
f1\_score: 0.9224 - val\_loss: 1.9993 - val\_f1\_score: 0.5793  
Epoch 121/500

28/28 [=====] - 5s 193ms/step - loss: 0.3984 -  
f1\_score: 0.9324 - val\_loss: 2.0069 - val\_f1\_score: 0.5646  
Epoch 122/500

28/28 [=====] - 5s 194ms/step - loss: 0.4319 -  
f1\_score: 0.9197 - val\_loss: 2.1583 - val\_f1\_score: 0.5454  
Epoch 123/500

28/28 [=====] - 5s 193ms/step - loss: 0.4351 -  
f1\_score: 0.9148 - val\_loss: 2.1161 - val\_f1\_score: 0.5413  
Epoch 124/500

28/28 [=====] - 5s 194ms/step - loss: 0.4245 -  
f1\_score: 0.9202 - val\_loss: 2.0550 - val\_f1\_score: 0.5522  
Epoch 125/500

28/28 [=====] - 5s 193ms/step - loss: 0.3755 -  
f1\_score: 0.9402 - val\_loss: 2.1373 - val\_f1\_score: 0.5749  
Epoch 126/500

28/28 [=====] - 5s 194ms/step - loss: 0.4413 -  
f1\_score: 0.9182 - val\_loss: 2.2509 - val\_f1\_score: 0.5366  
Epoch 127/500

28/28 [=====] - 5s 195ms/step - loss: 0.7921 -  
f1\_score: 0.8332 - val\_loss: 2.2598 - val\_f1\_score: 0.5108  
Epoch 128/500

28/28 [=====] - 5s 195ms/step - loss: 0.5458 -  
f1\_score: 0.8900 - val\_loss: 2.2483 - val\_f1\_score: 0.5222  
Epoch 129/500

28/28 [=====] - 6s 198ms/step - loss: 0.4738 -  
f1\_score: 0.9089 - val\_loss: 2.1348 - val\_f1\_score: 0.5590  
Epoch 130/500

28/28 [=====] - 5s 196ms/step - loss: 0.4777 -

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f1_score: 0.9054 - val_loss: 2.0900 - val_f1_score: 0.5833
Epoch 131/500
28/28 [=====] - 5s 195ms/step - loss: 0.4285 -
f1_score: 0.9197 - val_loss: 2.1700 - val_f1_score: 0.5420
Epoch 132/500
28/28 [=====] - 5s 193ms/step - loss: 0.3750 -
f1_score: 0.9405 - val_loss: 2.1582 - val_f1_score: 0.5645
Epoch 133/500
28/28 [=====] - 5s 195ms/step - loss: 0.3318 -
f1_score: 0.9540 - val_loss: 2.0553 - val_f1_score: 0.5893
Epoch 134/500
28/28 [=====] - 5s 196ms/step - loss: 0.3045 -
f1_score: 0.9641 - val_loss: 2.0523 - val_f1_score: 0.5972
Epoch 135/500
28/28 [=====] - ETA: 0s - loss: 0.2746 - f1_score:
0.9701

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 853ms/step - loss: 0.2746 -
f1_score: 0.9701 - val_loss: 2.0347 - val_f1_score: 0.6238
Epoch 136/500
28/28 [=====] - 5s 185ms/step - loss: 0.3659 -
f1_score: 0.9410 - val_loss: 2.1614 - val_f1_score: 0.5963
Epoch 137/500
28/28 [=====] - 5s 188ms/step - loss: 0.3907 -
f1_score: 0.9298 - val_loss: 2.2206 - val_f1_score: 0.5656
Epoch 138/500
28/28 [=====] - 5s 191ms/step - loss: 0.3869 -
f1_score: 0.9324 - val_loss: 2.4314 - val_f1_score: 0.5517
Epoch 139/500
28/28 [=====] - 5s 192ms/step - loss: 0.4410 -
f1_score: 0.9197 - val_loss: 2.1546 - val_f1_score: 0.5657
Epoch 140/500
28/28 [=====] - 5s 194ms/step - loss: 0.3393 -
f1_score: 0.9491 - val_loss: 1.9496 - val_f1_score: 0.6117
Epoch 141/500
28/28 [=====] - 5s 193ms/step - loss: 0.2735 -
f1_score: 0.9691 - val_loss: 2.1032 - val_f1_score: 0.6028
Epoch 142/500
28/28 [=====] - 5s 195ms/step - loss: 0.2844 -
f1_score: 0.9698 - val_loss: 2.2014 - val_f1_score: 0.5759
```

Epoch 143/500  
28/28 [=====] - 5s 193ms/step - loss: 0.2797 -  
f1\_score: 0.9705 - val\_loss: 2.1546 - val\_f1\_score: 0.6054  
Epoch 144/500  
28/28 [=====] - 5s 194ms/step - loss: 0.2457 -  
f1\_score: 0.9793 - val\_loss: 2.0746 - val\_f1\_score: 0.6147  
Epoch 145/500  
28/28 [=====] - 5s 193ms/step - loss: 0.2347 -  
f1\_score: 0.9830 - val\_loss: 2.1368 - val\_f1\_score: 0.6009  
Epoch 146/500  
28/28 [=====] - 5s 194ms/step - loss: 0.2339 -  
f1\_score: 0.9839 - val\_loss: 2.2266 - val\_f1\_score: 0.6137  
Epoch 147/500  
28/28 [=====] - 5s 194ms/step - loss: 0.2416 -  
f1\_score: 0.9777 - val\_loss: 2.2240 - val\_f1\_score: 0.6032  
Epoch 148/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2255 -  
f1\_score: 0.9828 - val\_loss: 2.1390 - val\_f1\_score: 0.6176  
Epoch 149/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2245 -  
f1\_score: 0.9819 - val\_loss: 2.1520 - val\_f1\_score: 0.6233  
Epoch 150/500  
28/28 [=====] - 5s 197ms/step - loss: 0.2353 -  
f1\_score: 0.9803 - val\_loss: 2.3902 - val\_f1\_score: 0.5869  
Epoch 151/500  
28/28 [=====] - 6s 200ms/step - loss: 0.4107 -  
f1\_score: 0.9292 - val\_loss: 2.4674 - val\_f1\_score: 0.5551  
Epoch 152/500  
28/28 [=====] - 5s 197ms/step - loss: 0.5336 -  
f1\_score: 0.8935 - val\_loss: 2.2318 - val\_f1\_score: 0.5847  
Epoch 153/500  
28/28 [=====] - 5s 194ms/step - loss: 0.5724 -  
f1\_score: 0.8829 - val\_loss: 2.7957 - val\_f1\_score: 0.4783  
Epoch 154/500  
28/28 [=====] - 5s 197ms/step - loss: 0.5390 -  
f1\_score: 0.8874 - val\_loss: 2.2443 - val\_f1\_score: 0.5687  
Epoch 155/500  
28/28 [=====] - 5s 196ms/step - loss: 0.5405 -  
f1\_score: 0.8887 - val\_loss: 2.3229 - val\_f1\_score: 0.5792  
Epoch 156/500  
28/28 [=====] - 5s 195ms/step - loss: 0.3414 -  
f1\_score: 0.9424 - val\_loss: 2.0974 - val\_f1\_score: 0.5783  
Epoch 157/500  
28/28 [=====] - 5s 196ms/step - loss: 0.3723 -  
f1\_score: 0.9359 - val\_loss: 2.3171 - val\_f1\_score: 0.5711  
Epoch 158/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2844 -  
f1\_score: 0.9636 - val\_loss: 2.4261 - val\_f1\_score: 0.5364

```
Epoch 159/500
28/28 [=====] - 5s 196ms/step - loss: 0.2825 -
f1_score: 0.9650 - val_loss: 2.2748 - val_f1_score: 0.5635
Epoch 160/500
28/28 [=====] - 5s 195ms/step - loss: 0.2458 -
f1_score: 0.9771 - val_loss: 2.0576 - val_f1_score: 0.6189
Epoch 161/500
28/28 [=====] - 6s 198ms/step - loss: 0.2193 -
f1_score: 0.9861 - val_loss: 2.3090 - val_f1_score: 0.5674
Epoch 162/500
28/28 [=====] - 6s 197ms/step - loss: 0.2141 -
f1_score: 0.9877 - val_loss: 2.1637 - val_f1_score: 0.6025
Epoch 163/500
28/28 [=====] - ETA: 0s - loss: 0.5055 - f1_score:
0.9082

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 926ms/step - loss: 0.5055 -
f1_score: 0.9082 - val_loss: 1.9338 - val_f1_score: 0.6529
Epoch 164/500
28/28 [=====] - 5s 186ms/step - loss: 0.4817 -
f1_score: 0.9130 - val_loss: 2.1347 - val_f1_score: 0.5785
Epoch 165/500
28/28 [=====] - 5s 188ms/step - loss: 0.3075 -
f1_score: 0.9558 - val_loss: 2.3287 - val_f1_score: 0.5806
Epoch 166/500
28/28 [=====] - 5s 192ms/step - loss: 0.3126 -
f1_score: 0.9579 - val_loss: 2.2517 - val_f1_score: 0.6002
Epoch 167/500
28/28 [=====] - 5s 192ms/step - loss: 0.2353 -
f1_score: 0.9808 - val_loss: 2.2368 - val_f1_score: 0.6095
Epoch 168/500
28/28 [=====] - 5s 194ms/step - loss: 0.2521 -
f1_score: 0.9728 - val_loss: 2.4083 - val_f1_score: 0.5660
Epoch 169/500
28/28 [=====] - 5s 193ms/step - loss: 0.2414 -
f1_score: 0.9769 - val_loss: 2.2016 - val_f1_score: 0.5881
Epoch 170/500
28/28 [=====] - 5s 193ms/step - loss: 0.2143 -
f1_score: 0.9824 - val_loss: 2.3308 - val_f1_score: 0.5820
Epoch 171/500
```

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28/28 [=====] - 5s 194ms/step - loss: 0.2186 -
f1_score: 0.9837 - val_loss: 2.1791 - val_f1_score: 0.6189
Epoch 172/500
28/28 [=====] - 5s 195ms/step - loss: 0.2071 -
f1_score: 0.9882 - val_loss: 2.2288 - val_f1_score: 0.6092
Epoch 173/500
28/28 [=====] - 5s 195ms/step - loss: 0.1873 -
f1_score: 0.9912 - val_loss: 2.2187 - val_f1_score: 0.6126
Epoch 174/500
28/28 [=====] - 5s 196ms/step - loss: 0.1824 -
f1_score: 0.9940 - val_loss: 2.2087 - val_f1_score: 0.6244
Epoch 175/500
28/28 [=====] - 5s 195ms/step - loss: 0.1857 -
f1_score: 0.9894 - val_loss: 2.5894 - val_f1_score: 0.5866
Epoch 176/500
28/28 [=====] - 5s 195ms/step - loss: 0.2616 -
f1_score: 0.9697 - val_loss: 2.5970 - val_f1_score: 0.5810
Epoch 177/500
28/28 [=====] - 5s 195ms/step - loss: 0.2496 -
f1_score: 0.9716 - val_loss: 2.4051 - val_f1_score: 0.5999
Epoch 178/500
28/28 [=====] - 5s 195ms/step - loss: 0.2619 -
f1_score: 0.9686 - val_loss: 2.5036 - val_f1_score: 0.5792
Epoch 179/500
28/28 [=====] - 5s 194ms/step - loss: 0.5920 -
f1_score: 0.8894 - val_loss: 2.3251 - val_f1_score: 0.5668
Epoch 180/500
28/28 [=====] - 5s 195ms/step - loss: 0.4816 -
f1_score: 0.9036 - val_loss: 2.3349 - val_f1_score: 0.5723
Epoch 181/500
28/28 [=====] - 5s 196ms/step - loss: 0.3445 -
f1_score: 0.9492 - val_loss: 2.4708 - val_f1_score: 0.5653
Epoch 182/500
28/28 [=====] - 5s 197ms/step - loss: 0.3158 -
f1_score: 0.9508 - val_loss: 2.5496 - val_f1_score: 0.5625
Epoch 183/500
28/28 [=====] - 5s 195ms/step - loss: 0.2548 -
f1_score: 0.9755 - val_loss: 2.3602 - val_f1_score: 0.5863
Epoch 184/500
28/28 [=====] - 6s 200ms/step - loss: 0.2268 -
f1_score: 0.9824 - val_loss: 2.6679 - val_f1_score: 0.5593
Epoch 185/500
28/28 [=====] - 6s 197ms/step - loss: 0.2403 -
f1_score: 0.9713 - val_loss: 3.1981 - val_f1_score: 0.5155
Epoch 186/500
28/28 [=====] - 6s 200ms/step - loss: 0.5868 -
f1_score: 0.8978 - val_loss: 2.8851 - val_f1_score: 0.4943
Epoch 187/500
```

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28/28 [=====] - 6s 199ms/step - loss: 0.4973 -  
f1_score: 0.8995 - val_loss: 2.5450 - val_f1_score: 0.5351  
Epoch 188/500  
28/28 [=====] - 5s 197ms/step - loss: 0.2870 -  
f1_score: 0.9653 - val_loss: 2.3192 - val_f1_score: 0.5847  
Epoch 189/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2300 -  
f1_score: 0.9829 - val_loss: 2.3857 - val_f1_score: 0.5619  
Epoch 190/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2017 -  
f1_score: 0.9897 - val_loss: 2.4606 - val_f1_score: 0.5719  
Epoch 191/500  
28/28 [=====] - 5s 196ms/step - loss: 0.1786 -  
f1_score: 0.9944 - val_loss: 2.4312 - val_f1_score: 0.5780  
Epoch 192/500  
28/28 [=====] - 5s 197ms/step - loss: 0.1759 -  
f1_score: 0.9951 - val_loss: 2.4220 - val_f1_score: 0.6011  
Epoch 193/500  
28/28 [=====] - 5s 197ms/step - loss: 0.1778 -  
f1_score: 0.9919 - val_loss: 2.4731 - val_f1_score: 0.5785  
Epoch 194/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1728 -  
f1_score: 0.9950 - val_loss: 2.5018 - val_f1_score: 0.5809  
Epoch 195/500  
28/28 [=====] - 6s 197ms/step - loss: 0.1695 -  
f1_score: 0.9959 - val_loss: 2.5297 - val_f1_score: 0.5784  
Epoch 196/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1664 -  
f1_score: 0.9964 - val_loss: 2.4007 - val_f1_score: 0.6119  
Epoch 197/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1658 -  
f1_score: 0.9950 - val_loss: 2.5689 - val_f1_score: 0.5914  
Epoch 198/500  
28/28 [=====] - 6s 197ms/step - loss: 0.1632 -  
f1_score: 0.9977 - val_loss: 2.4655 - val_f1_score: 0.5996  
Epoch 199/500  
28/28 [=====] - 5s 197ms/step - loss: 0.1585 -  
f1_score: 0.9969 - val_loss: 2.4539 - val_f1_score: 0.6070  
Epoch 200/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1613 -  
f1_score: 0.9966 - val_loss: 2.4155 - val_f1_score: 0.6087  
Epoch 201/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1570 -  
f1_score: 0.9967 - val_loss: 2.5401 - val_f1_score: 0.6013  
Epoch 202/500  
28/28 [=====] - 5s 196ms/step - loss: 0.1545 -  
f1_score: 0.9969 - val_loss: 2.5863 - val_f1_score: 0.6030  
Epoch 203/500
```

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28/28 [=====] - 6s 199ms/step - loss: 0.1534 -  
f1_score: 0.9957 - val_loss: 2.5721 - val_f1_score: 0.6130  
Epoch 204/500  
28/28 [=====] - 6s 208ms/step - loss: 0.1543 -  
f1_score: 0.9972 - val_loss: 2.5628 - val_f1_score: 0.6050  
Epoch 205/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1511 -  
f1_score: 0.9973 - val_loss: 2.5316 - val_f1_score: 0.5997  
Epoch 206/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1511 -  
f1_score: 0.9953 - val_loss: 2.5700 - val_f1_score: 0.6077  
Epoch 207/500  
28/28 [=====] - 5s 195ms/step - loss: 0.1500 -  
f1_score: 0.9967 - val_loss: 2.5662 - val_f1_score: 0.6148  
Epoch 208/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1466 -  
f1_score: 0.9985 - val_loss: 2.5997 - val_f1_score: 0.6045  
Epoch 209/500  
28/28 [=====] - 5s 197ms/step - loss: 0.1430 -  
f1_score: 0.9991 - val_loss: 2.6127 - val_f1_score: 0.6149  
Epoch 210/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1459 -  
f1_score: 0.9983 - val_loss: 2.5992 - val_f1_score: 0.6109  
Epoch 211/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1451 -  
f1_score: 0.9968 - val_loss: 2.6255 - val_f1_score: 0.6161  
Epoch 212/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1512 -  
f1_score: 0.9954 - val_loss: 2.5690 - val_f1_score: 0.6083  
Epoch 213/500  
28/28 [=====] - 6s 198ms/step - loss: 0.8393 -  
f1_score: 0.8687 - val_loss: 3.1463 - val_f1_score: 0.4911  
Epoch 214/500  
28/28 [=====] - 6s 203ms/step - loss: 1.2021 -  
f1_score: 0.7483 - val_loss: 2.4555 - val_f1_score: 0.5269  
Epoch 215/500  
28/28 [=====] - 6s 200ms/step - loss: 0.5779 -  
f1_score: 0.8757 - val_loss: 2.1904 - val_f1_score: 0.5825  
Epoch 216/500  
28/28 [=====] - 5s 197ms/step - loss: 0.3292 -  
f1_score: 0.9464 - val_loss: 2.2004 - val_f1_score: 0.5928  
Epoch 217/500  
28/28 [=====] - 5s 197ms/step - loss: 0.2648 -  
f1_score: 0.9679 - val_loss: 2.2799 - val_f1_score: 0.5941  
Epoch 218/500  
28/28 [=====] - 6s 198ms/step - loss: 0.2573 -  
f1_score: 0.9658 - val_loss: 2.4783 - val_f1_score: 0.5598  
Epoch 219/500
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28/28 [=====] - 6s 201ms/step - loss: 0.2850 -  
f1_score: 0.9578 - val_loss: 2.3070 - val_f1_score: 0.6070  
Epoch 220/500  
28/28 [=====] - 6s 198ms/step - loss: 0.2903 -  
f1_score: 0.9599 - val_loss: 2.3227 - val_f1_score: 0.5961  
Epoch 221/500  
28/28 [=====] - 6s 199ms/step - loss: 0.2438 -  
f1_score: 0.9695 - val_loss: 2.4363 - val_f1_score: 0.5720  
Epoch 222/500  
28/28 [=====] - 6s 200ms/step - loss: 0.2340 -  
f1_score: 0.9741 - val_loss: 2.4057 - val_f1_score: 0.5746  
Epoch 223/500  
28/28 [=====] - 6s 203ms/step - loss: 0.2914 -  
f1_score: 0.9618 - val_loss: 3.0741 - val_f1_score: 0.4904  
Epoch 224/500  
28/28 [=====] - 6s 197ms/step - loss: 0.3547 -  
f1_score: 0.9389 - val_loss: 2.5087 - val_f1_score: 0.5627  
Epoch 225/500  
28/28 [=====] - 6s 201ms/step - loss: 0.4052 -  
f1_score: 0.9286 - val_loss: 2.2095 - val_f1_score: 0.5788  
Epoch 226/500  
28/28 [=====] - 6s 200ms/step - loss: 0.2413 -  
f1_score: 0.9718 - val_loss: 2.2561 - val_f1_score: 0.6021  
Epoch 227/500  
28/28 [=====] - 6s 199ms/step - loss: 0.2097 -  
f1_score: 0.9810 - val_loss: 2.3725 - val_f1_score: 0.5817  
Epoch 228/500  
28/28 [=====] - 6s 201ms/step - loss: 0.2261 -  
f1_score: 0.9760 - val_loss: 2.5182 - val_f1_score: 0.5844  
Epoch 229/500  
28/28 [=====] - 5s 196ms/step - loss: 0.2380 -  
f1_score: 0.9713 - val_loss: 2.4989 - val_f1_score: 0.5870  
Epoch 230/500  
28/28 [=====] - 6s 198ms/step - loss: 0.2832 -  
f1_score: 0.9596 - val_loss: 2.3387 - val_f1_score: 0.6128  
Epoch 231/500  
28/28 [=====] - 6s 205ms/step - loss: 0.2049 -  
f1_score: 0.9808 - val_loss: 2.4017 - val_f1_score: 0.5886  
Epoch 232/500  
28/28 [=====] - 6s 199ms/step - loss: 0.2151 -  
f1_score: 0.9772 - val_loss: 2.5978 - val_f1_score: 0.5427  
Epoch 233/500  
28/28 [=====] - 6s 198ms/step - loss: 0.2886 -  
f1_score: 0.9580 - val_loss: 2.6880 - val_f1_score: 0.5242  
Epoch 234/500  
28/28 [=====] - 6s 200ms/step - loss: 0.2491 -  
f1_score: 0.9685 - val_loss: 2.4909 - val_f1_score: 0.5635  
Epoch 235/500
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28/28 [=====] - 5s 196ms/step - loss: 0.2334 -
f1_score: 0.9782 - val_loss: 2.5462 - val_f1_score: 0.5581
Epoch 236/500
28/28 [=====] - 6s 199ms/step - loss: 0.1939 -
f1_score: 0.9868 - val_loss: 2.6644 - val_f1_score: 0.5608
Epoch 237/500
28/28 [=====] - 6s 198ms/step - loss: 0.1743 -
f1_score: 0.9917 - val_loss: 2.6316 - val_f1_score: 0.5664
Epoch 238/500
28/28 [=====] - 6s 200ms/step - loss: 0.1622 -
f1_score: 0.9964 - val_loss: 2.6633 - val_f1_score: 0.5591
Epoch 239/500
28/28 [=====] - 6s 200ms/step - loss: 0.1511 -
f1_score: 0.9981 - val_loss: 2.6656 - val_f1_score: 0.5730
Epoch 240/500
28/28 [=====] - 6s 206ms/step - loss: 0.1520 -
f1_score: 0.9970 - val_loss: 2.5687 - val_f1_score: 0.5839
Epoch 241/500
28/28 [=====] - 6s 199ms/step - loss: 0.1473 -
f1_score: 0.9981 - val_loss: 2.5608 - val_f1_score: 0.5863
Epoch 242/500
28/28 [=====] - 5s 197ms/step - loss: 0.1440 -
f1_score: 0.9977 - val_loss: 2.5370 - val_f1_score: 0.5837
Epoch 243/500
28/28 [=====] - 6s 200ms/step - loss: 0.1421 -
f1_score: 0.9987 - val_loss: 2.5740 - val_f1_score: 0.5813
Epoch 244/500
28/28 [=====] - 6s 198ms/step - loss: 0.1415 -
f1_score: 0.9963 - val_loss: 2.5151 - val_f1_score: 0.5873
Epoch 245/500
28/28 [=====] - 5s 196ms/step - loss: 0.1398 -
f1_score: 0.9988 - val_loss: 2.5595 - val_f1_score: 0.6037
Epoch 246/500
28/28 [=====] - 6s 198ms/step - loss: 0.1395 -
f1_score: 0.9982 - val_loss: 2.5999 - val_f1_score: 0.6141
Epoch 247/500
28/28 [=====] - 6s 199ms/step - loss: 0.1389 -
f1_score: 0.9977 - val_loss: 2.5892 - val_f1_score: 0.6110
Epoch 248/500
28/28 [=====] - 5s 196ms/step - loss: 0.1389 -
f1_score: 0.9979 - val_loss: 2.5737 - val_f1_score: 0.6167
Epoch 249/500
28/28 [=====] - 6s 202ms/step - loss: 0.1363 -
f1_score: 0.9991 - val_loss: 2.6350 - val_f1_score: 0.6129
Epoch 250/500
28/28 [=====] - 6s 206ms/step - loss: 0.1348 -
f1_score: 0.9985 - val_loss: 2.5549 - val_f1_score: 0.6047
Epoch 251/500
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28/28 [=====] - 6s 200ms/step - loss: 0.1366 -
f1_score: 0.9983 - val_loss: 2.6501 - val_f1_score: 0.6134
Epoch 252/500
28/28 [=====] - 6s 202ms/step - loss: 0.1311 -
f1_score: 0.9996 - val_loss: 2.6428 - val_f1_score: 0.6153
Epoch 253/500
28/28 [=====] - 6s 198ms/step - loss: 0.1309 -
f1_score: 0.9988 - val_loss: 2.6521 - val_f1_score: 0.6119
Epoch 254/500
28/28 [=====] - 6s 200ms/step - loss: 0.1311 -
f1_score: 0.9988 - val_loss: 2.6308 - val_f1_score: 0.6202
Epoch 255/500
28/28 [=====] - 6s 199ms/step - loss: 0.1321 -
f1_score: 0.9980 - val_loss: 2.6026 - val_f1_score: 0.6447
Epoch 256/500
28/28 [=====] - 6s 200ms/step - loss: 0.1297 -
f1_score: 0.9983 - val_loss: 2.6818 - val_f1_score: 0.6092
Epoch 257/500
28/28 [=====] - 6s 203ms/step - loss: 0.1278 -
f1_score: 0.9989 - val_loss: 2.6908 - val_f1_score: 0.6221
Epoch 258/500
28/28 [=====] - 6s 200ms/step - loss: 0.1282 -
f1_score: 0.9988 - val_loss: 2.7160 - val_f1_score: 0.6162
Epoch 259/500
28/28 [=====] - 6s 203ms/step - loss: 0.1269 -
f1_score: 0.9993 - val_loss: 2.7127 - val_f1_score: 0.6084
Epoch 260/500
28/28 [=====] - 6s 200ms/step - loss: 0.1238 -
f1_score: 0.9988 - val_loss: 2.7737 - val_f1_score: 0.6233
Epoch 261/500
28/28 [=====] - 6s 201ms/step - loss: 0.1239 -
f1_score: 1.0000 - val_loss: 2.7948 - val_f1_score: 0.6146
Epoch 262/500
28/28 [=====] - 6s 201ms/step - loss: 0.8554 -
f1_score: 0.8927 - val_loss: 3.4256 - val_f1_score: 0.4850
Epoch 263/500
28/28 [=====] - 6s 199ms/step - loss: 1.0782 -
f1_score: 0.7705 - val_loss: 2.4799 - val_f1_score: 0.5472
Epoch 264/500
28/28 [=====] - 6s 198ms/step - loss: 0.5854 -
f1_score: 0.8730 - val_loss: 2.5000 - val_f1_score: 0.5344
Epoch 265/500
28/28 [=====] - 6s 203ms/step - loss: 0.4116 -
f1_score: 0.9201 - val_loss: 2.5706 - val_f1_score: 0.5564
Epoch 266/500
28/28 [=====] - 6s 199ms/step - loss: 0.3322 -
f1_score: 0.9450 - val_loss: 2.3700 - val_f1_score: 0.5703
Epoch 267/500
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28/28 [=====] - 6s 200ms/step - loss: 0.2555 -
f1_score: 0.9688 - val_loss: 2.3015 - val_f1_score: 0.5977
Epoch 268/500
28/28 [=====] - 6s 198ms/step - loss: 0.2808 -
f1_score: 0.9645 - val_loss: 2.4863 - val_f1_score: 0.5746
Epoch 269/500
28/28 [=====] - 5s 196ms/step - loss: 0.2440 -
f1_score: 0.9693 - val_loss: 2.5516 - val_f1_score: 0.5573
Epoch 270/500
28/28 [=====] - 6s 198ms/step - loss: 0.4070 -
f1_score: 0.9322 - val_loss: 2.5138 - val_f1_score: 0.5659
Epoch 271/500
28/28 [=====] - 6s 198ms/step - loss: 0.4288 -
f1_score: 0.9226 - val_loss: 2.4095 - val_f1_score: 0.5757
Epoch 272/500
28/28 [=====] - 6s 197ms/step - loss: 0.3196 -
f1_score: 0.9519 - val_loss: 2.4257 - val_f1_score: 0.5828
Epoch 273/500
28/28 [=====] - 6s 198ms/step - loss: 0.2823 -
f1_score: 0.9603 - val_loss: 2.4726 - val_f1_score: 0.6090
Epoch 274/500
28/28 [=====] - 6s 200ms/step - loss: 0.2158 -
f1_score: 0.9779 - val_loss: 2.3462 - val_f1_score: 0.6024
Epoch 275/500
28/28 [=====] - 6s 200ms/step - loss: 0.1731 -
f1_score: 0.9920 - val_loss: 2.2821 - val_f1_score: 0.6125
Epoch 276/500
28/28 [=====] - 6s 200ms/step - loss: 0.1592 -
f1_score: 0.9970 - val_loss: 2.3349 - val_f1_score: 0.6110
Epoch 277/500
28/28 [=====] - 6s 199ms/step - loss: 0.1513 -
f1_score: 0.9996 - val_loss: 2.3362 - val_f1_score: 0.6146
Epoch 278/500
28/28 [=====] - 6s 198ms/step - loss: 0.1482 -
f1_score: 0.9977 - val_loss: 2.3900 - val_f1_score: 0.6203
Epoch 279/500
28/28 [=====] - 5s 196ms/step - loss: 0.1430 -
f1_score: 0.9993 - val_loss: 2.4037 - val_f1_score: 0.6155
Epoch 280/500
28/28 [=====] - 5s 196ms/step - loss: 0.1418 -
f1_score: 0.9992 - val_loss: 2.4165 - val_f1_score: 0.6299
Epoch 281/500
28/28 [=====] - 5s 196ms/step - loss: 0.1422 -
f1_score: 0.9966 - val_loss: 2.4027 - val_f1_score: 0.6386
Epoch 282/500
28/28 [=====] - 6s 198ms/step - loss: 0.1364 -
f1_score: 0.9984 - val_loss: 2.4169 - val_f1_score: 0.6338
Epoch 283/500
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28/28 [=====] - 5s 197ms/step - loss: 0.1360 -  
f1_score: 0.9985 - val_loss: 2.4506 - val_f1_score: 0.6246  
Epoch 284/500  
28/28 [=====] - 6s 202ms/step - loss: 0.1360 -  
f1_score: 0.9981 - val_loss: 2.4958 - val_f1_score: 0.6253  
Epoch 285/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1345 -  
f1_score: 0.9991 - val_loss: 2.5728 - val_f1_score: 0.6172  
Epoch 286/500  
28/28 [=====] - 6s 201ms/step - loss: 0.1334 -  
f1_score: 0.9997 - val_loss: 2.5165 - val_f1_score: 0.6256  
Epoch 287/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1328 -  
f1_score: 0.9996 - val_loss: 2.5456 - val_f1_score: 0.6312  
Epoch 288/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1313 -  
f1_score: 0.9989 - val_loss: 2.5389 - val_f1_score: 0.6345  
Epoch 289/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1282 -  
f1_score: 0.9992 - val_loss: 2.5694 - val_f1_score: 0.6326  
Epoch 290/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1323 -  
f1_score: 0.9983 - val_loss: 2.5634 - val_f1_score: 0.6380  
Epoch 291/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1275 -  
f1_score: 1.0000 - val_loss: 2.5871 - val_f1_score: 0.6313  
Epoch 292/500  
28/28 [=====] - 5s 197ms/step - loss: 0.1263 -  
f1_score: 0.9995 - val_loss: 2.5532 - val_f1_score: 0.6404  
Epoch 293/500  
28/28 [=====] - 6s 207ms/step - loss: 0.1264 -  
f1_score: 0.9993 - val_loss: 2.6272 - val_f1_score: 0.6347  
Epoch 294/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1252 -  
f1_score: 0.9992 - val_loss: 2.5794 - val_f1_score: 0.6403  
Epoch 295/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1252 -  
f1_score: 0.9988 - val_loss: 2.5867 - val_f1_score: 0.6282  
Epoch 296/500  
28/28 [=====] - 6s 197ms/step - loss: 0.1253 -  
f1_score: 0.9988 - val_loss: 2.5728 - val_f1_score: 0.6369  
Epoch 297/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1213 -  
f1_score: 0.9996 - val_loss: 2.6028 - val_f1_score: 0.6370  
Epoch 298/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1227 -  
f1_score: 0.9996 - val_loss: 2.6255 - val_f1_score: 0.6370  
Epoch 299/500
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28/28 [=====] - 6s 199ms/step - loss: 0.1221 -  
f1_score: 0.9991 - val_loss: 2.6686 - val_f1_score: 0.6115  
Epoch 300/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1215 -  
f1_score: 0.9997 - val_loss: 2.6417 - val_f1_score: 0.6320  
Epoch 301/500  
28/28 [=====] - 6s 202ms/step - loss: 0.1214 -  
f1_score: 0.9985 - val_loss: 2.6897 - val_f1_score: 0.6394  
Epoch 302/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1199 -  
f1_score: 0.9984 - val_loss: 2.6212 - val_f1_score: 0.6421  
Epoch 303/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1201 -  
f1_score: 1.0000 - val_loss: 2.6552 - val_f1_score: 0.6251  
Epoch 304/500  
28/28 [=====] - 6s 208ms/step - loss: 0.1202 -  
f1_score: 0.9983 - val_loss: 2.7305 - val_f1_score: 0.6386  
Epoch 305/500  
28/28 [=====] - 6s 209ms/step - loss: 0.1161 -  
f1_score: 0.9992 - val_loss: 2.7473 - val_f1_score: 0.6339  
Epoch 306/500  
28/28 [=====] - 6s 205ms/step - loss: 0.1172 -  
f1_score: 0.9996 - val_loss: 2.7325 - val_f1_score: 0.6346  
Epoch 307/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1170 -  
f1_score: 0.9992 - val_loss: 2.6963 - val_f1_score: 0.6356  
Epoch 308/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1186 -  
f1_score: 0.9985 - val_loss: 2.6733 - val_f1_score: 0.6395  
Epoch 309/500  
28/28 [=====] - 6s 206ms/step - loss: 0.1389 -  
f1_score: 0.9936 - val_loss: 3.3682 - val_f1_score: 0.5585  
Epoch 310/500  
28/28 [=====] - 5s 197ms/step - loss: 1.1676 -  
f1_score: 0.7716 - val_loss: 2.4040 - val_f1_score: 0.5478  
Epoch 311/500  
28/28 [=====] - 6s 198ms/step - loss: 0.7725 -  
f1_score: 0.8229 - val_loss: 2.1335 - val_f1_score: 0.6053  
Epoch 312/500  
28/28 [=====] - 6s 200ms/step - loss: 0.3732 -  
f1_score: 0.9362 - val_loss: 2.3233 - val_f1_score: 0.5769  
Epoch 313/500  
28/28 [=====] - 6s 208ms/step - loss: 0.3315 -  
f1_score: 0.9463 - val_loss: 2.4289 - val_f1_score: 0.5650  
Epoch 314/500  
28/28 [=====] - 6s 200ms/step - loss: 0.2991 -  
f1_score: 0.9470 - val_loss: 2.4152 - val_f1_score: 0.5802  
Epoch 315/500
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28/28 [=====] - 6s 201ms/step - loss: 0.3990 -  
f1_score: 0.9257 - val_loss: 2.6057 - val_f1_score: 0.5549  
Epoch 316/500  
28/28 [=====] - 6s 205ms/step - loss: 0.3863 -  
f1_score: 0.9226 - val_loss: 2.3428 - val_f1_score: 0.5989  
Epoch 317/500  
28/28 [=====] - 6s 202ms/step - loss: 0.2523 -  
f1_score: 0.9668 - val_loss: 2.2619 - val_f1_score: 0.6145  
Epoch 318/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1881 -  
f1_score: 0.9861 - val_loss: 2.2707 - val_f1_score: 0.6149  
Epoch 319/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1519 -  
f1_score: 0.9970 - val_loss: 2.1867 - val_f1_score: 0.6412  
Epoch 320/500  
28/28 [=====] - 6s 201ms/step - loss: 0.1476 -  
f1_score: 0.9966 - val_loss: 2.3063 - val_f1_score: 0.6241  
Epoch 321/500  
28/28 [=====] - 6s 200ms/step - loss: 0.1531 -  
f1_score: 0.9950 - val_loss: 2.3186 - val_f1_score: 0.6262  
Epoch 322/500  
28/28 [=====] - 6s 198ms/step - loss: 0.1402 -  
f1_score: 0.9973 - val_loss: 2.2293 - val_f1_score: 0.6377  
Epoch 323/500  
28/28 [=====] - 6s 202ms/step - loss: 0.1367 -  
f1_score: 0.9986 - val_loss: 2.3685 - val_f1_score: 0.6238  
Epoch 324/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1333 -  
f1_score: 0.9992 - val_loss: 2.3563 - val_f1_score: 0.6313  
Epoch 325/500  
28/28 [=====] - 6s 207ms/step - loss: 0.1302 -  
f1_score: 0.9978 - val_loss: 2.3787 - val_f1_score: 0.6269  
Epoch 326/500  
28/28 [=====] - 6s 199ms/step - loss: 0.1286 -  
f1_score: 0.9985 - val_loss: 2.3116 - val_f1_score: 0.6366  
Epoch 327/500  
28/28 [=====] - 6s 201ms/step - loss: 0.1503 -  
f1_score: 0.9921 - val_loss: 3.3825 - val_f1_score: 0.5464  
Epoch 328/500  
28/28 [=====] - 6s 200ms/step - loss: 0.4692 -  
f1_score: 0.9060 - val_loss: 2.9296 - val_f1_score: 0.5569  
Epoch 329/500  
28/28 [=====] - 6s 200ms/step - loss: 0.3209 -  
f1_score: 0.9437 - val_loss: 2.3719 - val_f1_score: 0.5751  
Epoch 330/500  
28/28 [=====] - 6s 199ms/step - loss: 0.2708 -  
f1_score: 0.9617 - val_loss: 2.3663 - val_f1_score: 0.5948  
Epoch 331/500
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28/28 [=====] - 6s 203ms/step - loss: 0.1909 -
f1_score: 0.9821 - val_loss: 2.3899 - val_f1_score: 0.5973
Epoch 332/500
28/28 [=====] - 6s 199ms/step - loss: 0.1662 -
f1_score: 0.9914 - val_loss: 2.5751 - val_f1_score: 0.5874
Epoch 333/500
28/28 [=====] - 6s 205ms/step - loss: 0.1441 -
f1_score: 0.9973 - val_loss: 2.4189 - val_f1_score: 0.6190
Epoch 334/500
28/28 [=====] - 6s 201ms/step - loss: 0.1374 -
f1_score: 0.9980 - val_loss: 2.4619 - val_f1_score: 0.6235
Epoch 335/500
28/28 [=====] - 6s 202ms/step - loss: 0.1539 -
f1_score: 0.9921 - val_loss: 2.2551 - val_f1_score: 0.6248
Epoch 336/500
28/28 [=====] - 6s 197ms/step - loss: 0.1349 -
f1_score: 0.9967 - val_loss: 2.5059 - val_f1_score: 0.6041
Epoch 337/500
28/28 [=====] - 5s 197ms/step - loss: 0.3756 -
f1_score: 0.9371 - val_loss: 3.0109 - val_f1_score: 0.5285
Epoch 338/500
28/28 [=====] - 5s 196ms/step - loss: 0.3302 -
f1_score: 0.9432 - val_loss: 2.5761 - val_f1_score: 0.5680
Epoch 339/500
28/28 [=====] - 6s 199ms/step - loss: 0.1932 -
f1_score: 0.9831 - val_loss: 2.8771 - val_f1_score: 0.5440
Epoch 340/500
28/28 [=====] - 5s 197ms/step - loss: 0.2818 -
f1_score: 0.9548 - val_loss: 2.7115 - val_f1_score: 0.5620
Epoch 341/500
28/28 [=====] - 6s 199ms/step - loss: 0.2978 -
f1_score: 0.9557 - val_loss: 2.6801 - val_f1_score: 0.5718
Epoch 342/500
28/28 [=====] - 6s 204ms/step - loss: 0.1938 -
f1_score: 0.9818 - val_loss: 2.3833 - val_f1_score: 0.6178
Epoch 343/500
28/28 [=====] - 6s 197ms/step - loss: 0.1679 -
f1_score: 0.9895 - val_loss: 2.3396 - val_f1_score: 0.6026
Epoch 344/500
28/28 [=====] - 6s 207ms/step - loss: 0.1394 -
f1_score: 0.9975 - val_loss: 2.2825 - val_f1_score: 0.6159
Epoch 345/500
28/28 [=====] - 6s 204ms/step - loss: 0.1318 -
f1_score: 0.9985 - val_loss: 2.2277 - val_f1_score: 0.6312
Epoch 346/500
28/28 [=====] - 6s 200ms/step - loss: 0.1270 -
f1_score: 0.9992 - val_loss: 2.2600 - val_f1_score: 0.6169
Epoch 347/500
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28/28 [=====] - 6s 206ms/step - loss: 0.1262 -
f1_score: 0.9993 - val_loss: 2.2826 - val_f1_score: 0.6321
Epoch 348/500
28/28 [=====] - 6s 198ms/step - loss: 0.1251 -
f1_score: 0.9992 - val_loss: 2.3155 - val_f1_score: 0.6088
Epoch 349/500
28/28 [=====] - 6s 201ms/step - loss: 0.1232 -
f1_score: 0.9996 - val_loss: 2.3618 - val_f1_score: 0.6206
Epoch 350/500
28/28 [=====] - 6s 204ms/step - loss: 0.1205 -
f1_score: 1.0000 - val_loss: 2.3265 - val_f1_score: 0.6313
Epoch 351/500
28/28 [=====] - 6s 200ms/step - loss: 0.1201 -
f1_score: 0.9996 - val_loss: 2.3405 - val_f1_score: 0.6383
Epoch 352/500
28/28 [=====] - 6s 198ms/step - loss: 0.1203 -
f1_score: 0.9993 - val_loss: 2.3925 - val_f1_score: 0.6314
Epoch 353/500
28/28 [=====] - 6s 198ms/step - loss: 0.1191 -
f1_score: 0.9992 - val_loss: 2.4186 - val_f1_score: 0.6128
Epoch 354/500
28/28 [=====] - 6s 201ms/step - loss: 0.1179 -
f1_score: 1.0000 - val_loss: 2.4127 - val_f1_score: 0.6175
Epoch 355/500
28/28 [=====] - 6s 202ms/step - loss: 0.1177 -
f1_score: 0.9995 - val_loss: 2.4788 - val_f1_score: 0.6306
Epoch 356/500
28/28 [=====] - 6s 199ms/step - loss: 0.1171 -
f1_score: 0.9996 - val_loss: 2.5240 - val_f1_score: 0.6268
Epoch 357/500
28/28 [=====] - 6s 204ms/step - loss: 0.1167 -
f1_score: 0.9984 - val_loss: 2.4938 - val_f1_score: 0.6420
Epoch 358/500
28/28 [=====] - 6s 211ms/step - loss: 0.1159 -
f1_score: 1.0000 - val_loss: 2.4767 - val_f1_score: 0.6402
Epoch 359/500
28/28 [=====] - 6s 200ms/step - loss: 0.1145 -
f1_score: 0.9996 - val_loss: 2.5110 - val_f1_score: 0.6295
Epoch 360/500
28/28 [=====] - 6s 201ms/step - loss: 0.1144 -
f1_score: 0.9992 - val_loss: 2.5138 - val_f1_score: 0.6237
Epoch 361/500
28/28 [=====] - 6s 198ms/step - loss: 0.1136 -
f1_score: 0.9993 - val_loss: 2.5461 - val_f1_score: 0.6322
Epoch 362/500
28/28 [=====] - 6s 197ms/step - loss: 0.1150 -
f1_score: 0.9987 - val_loss: 2.5037 - val_f1_score: 0.6168
Epoch 363/500
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28/28 [=====] - 5s 196ms/step - loss: 0.1123 -
f1_score: 0.9996 - val_loss: 2.5764 - val_f1_score: 0.6311
Epoch 364/500
28/28 [=====] - 6s 199ms/step - loss: 0.1110 -
f1_score: 0.9996 - val_loss: 2.5462 - val_f1_score: 0.6391
Epoch 365/500
28/28 [=====] - 6s 197ms/step - loss: 0.1110 -
f1_score: 0.9997 - val_loss: 2.6151 - val_f1_score: 0.6368
Epoch 366/500
28/28 [=====] - 6s 197ms/step - loss: 0.1090 -
f1_score: 1.0000 - val_loss: 2.5815 - val_f1_score: 0.6201
Epoch 367/500
28/28 [=====] - 6s 197ms/step - loss: 0.1120 -
f1_score: 0.9992 - val_loss: 2.5824 - val_f1_score: 0.6332
Epoch 368/500
28/28 [=====] - 6s 198ms/step - loss: 0.1088 -
f1_score: 0.9996 - val_loss: 2.6085 - val_f1_score: 0.6301
Epoch 369/500
28/28 [=====] - 5s 197ms/step - loss: 0.1082 -
f1_score: 0.9996 - val_loss: 2.6686 - val_f1_score: 0.6360
Epoch 370/500
28/28 [=====] - 6s 199ms/step - loss: 0.1082 -
f1_score: 1.0000 - val_loss: 2.6701 - val_f1_score: 0.6278
Epoch 371/500
28/28 [=====] - 6s 198ms/step - loss: 0.1060 -
f1_score: 1.0000 - val_loss: 2.7244 - val_f1_score: 0.6353
Epoch 372/500
28/28 [=====] - 6s 210ms/step - loss: 0.1076 -
f1_score: 1.0000 - val_loss: 2.6786 - val_f1_score: 0.6309
Epoch 373/500
28/28 [=====] - 6s 216ms/step - loss: 0.1055 -
f1_score: 1.0000 - val_loss: 2.6681 - val_f1_score: 0.6292
Epoch 374/500
28/28 [=====] - 6s 210ms/step - loss: 0.1071 -
f1_score: 0.9993 - val_loss: 2.6686 - val_f1_score: 0.6469
Epoch 375/500
28/28 [=====] - 6s 200ms/step - loss: 0.1052 -
f1_score: 0.9991 - val_loss: 2.7369 - val_f1_score: 0.6253
Epoch 376/500
28/28 [=====] - 6s 197ms/step - loss: 0.1059 -
f1_score: 0.9996 - val_loss: 2.7167 - val_f1_score: 0.6353
Epoch 377/500
28/28 [=====] - 6s 198ms/step - loss: 0.1032 -
f1_score: 1.0000 - val_loss: 2.6605 - val_f1_score: 0.6267
Epoch 378/500
28/28 [=====] - 6s 198ms/step - loss: 0.1031 -
f1_score: 0.9996 - val_loss: 2.7351 - val_f1_score: 0.6420
Epoch 379/500
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28/28 [=====] - 6s 197ms/step - loss: 0.1035 -
f1_score: 0.9997 - val_loss: 2.6277 - val_f1_score: 0.6484
Epoch 380/500
28/28 [=====] - 6s 198ms/step - loss: 0.1036 -
f1_score: 0.9996 - val_loss: 2.6780 - val_f1_score: 0.6410
Epoch 381/500
28/28 [=====] - 6s 197ms/step - loss: 0.1020 -
f1_score: 1.0000 - val_loss: 2.6801 - val_f1_score: 0.6363
Epoch 382/500
28/28 [=====] - 6s 197ms/step - loss: 0.1033 -
f1_score: 0.9997 - val_loss: 2.8239 - val_f1_score: 0.6204
Epoch 383/500
28/28 [=====] - 6s 202ms/step - loss: 0.1021 -
f1_score: 0.9997 - val_loss: 2.7291 - val_f1_score: 0.6431
Epoch 384/500
28/28 [=====] - 6s 198ms/step - loss: 0.1043 -
f1_score: 1.0000 - val_loss: 2.7840 - val_f1_score: 0.6346
Epoch 385/500
28/28 [=====] - 6s 199ms/step - loss: 0.1013 -
f1_score: 1.0000 - val_loss: 2.8838 - val_f1_score: 0.6374
Epoch 386/500
28/28 [=====] - 6s 199ms/step - loss: 0.1012 -
f1_score: 1.0000 - val_loss: 2.8131 - val_f1_score: 0.6302
Epoch 387/500
28/28 [=====] - 6s 198ms/step - loss: 0.0999 -
f1_score: 1.0000 - val_loss: 2.8137 - val_f1_score: 0.6241
Epoch 388/500
28/28 [=====] - 6s 198ms/step - loss: 0.1002 -
f1_score: 0.9993 - val_loss: 2.8151 - val_f1_score: 0.6382
Epoch 389/500
28/28 [=====] - 6s 197ms/step - loss: 0.0982 -
f1_score: 0.9996 - val_loss: 2.8276 - val_f1_score: 0.6403
Epoch 390/500
28/28 [=====] - 6s 199ms/step - loss: 0.1028 -
f1_score: 0.9984 - val_loss: 3.1298 - val_f1_score: 0.5881
Epoch 391/500
28/28 [=====] - 6s 198ms/step - loss: 2.9789 -
f1_score: 0.5425 - val_loss: 3.2998 - val_f1_score: 0.2975
Epoch 392/500
28/28 [=====] - 6s 201ms/step - loss: 1.6141 -
f1_score: 0.5650 - val_loss: 2.1472 - val_f1_score: 0.4759
Epoch 393/500
28/28 [=====] - 6s 198ms/step - loss: 0.7693 -
f1_score: 0.8103 - val_loss: 1.9364 - val_f1_score: 0.5480
Epoch 394/500
28/28 [=====] - 5s 196ms/step - loss: 0.4072 -
f1_score: 0.9185 - val_loss: 1.9925 - val_f1_score: 0.5907
Epoch 395/500
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28/28 [=====] - 5s 197ms/step - loss: 0.2624 -
f1_score: 0.9655 - val_loss: 2.0831 - val_f1_score: 0.5697
Epoch 396/500
28/28 [=====] - 6s 199ms/step - loss: 0.2838 -
f1_score: 0.9588 - val_loss: 2.2180 - val_f1_score: 0.5777
Epoch 397/500
28/28 [=====] - 6s 198ms/step - loss: 0.2353 -
f1_score: 0.9725 - val_loss: 2.3593 - val_f1_score: 0.5597
Epoch 398/500
28/28 [=====] - 6s 199ms/step - loss: 0.1995 -
f1_score: 0.9813 - val_loss: 2.3337 - val_f1_score: 0.5740
Epoch 399/500
28/28 [=====] - 6s 197ms/step - loss: 0.2342 -
f1_score: 0.9706 - val_loss: 2.3316 - val_f1_score: 0.5338
Epoch 400/500
28/28 [=====] - 6s 197ms/step - loss: 0.2250 -
f1_score: 0.9676 - val_loss: 2.4346 - val_f1_score: 0.5564
Epoch 401/500
28/28 [=====] - 6s 204ms/step - loss: 0.1840 -
f1_score: 0.9823 - val_loss: 2.3634 - val_f1_score: 0.5759
Epoch 402/500
28/28 [=====] - 6s 198ms/step - loss: 0.2240 -
f1_score: 0.9765 - val_loss: 2.4789 - val_f1_score: 0.5853
Epoch 403/500
28/28 [=====] - 6s 199ms/step - loss: 0.1825 -
f1_score: 0.9867 - val_loss: 2.5849 - val_f1_score: 0.5313
Epoch 404/500
28/28 [=====] - 5s 197ms/step - loss: 0.1639 -
f1_score: 0.9885 - val_loss: 2.5014 - val_f1_score: 0.5941
Epoch 405/500
28/28 [=====] - 6s 197ms/step - loss: 0.1360 -
f1_score: 0.9985 - val_loss: 2.4845 - val_f1_score: 0.5734
Epoch 406/500
28/28 [=====] - 6s 197ms/step - loss: 0.1397 -
f1_score: 0.9963 - val_loss: 2.5848 - val_f1_score: 0.5850
Epoch 407/500
28/28 [=====] - 6s 198ms/step - loss: 0.2295 -
f1_score: 0.9710 - val_loss: 2.5473 - val_f1_score: 0.6061
Epoch 408/500
28/28 [=====] - 6s 198ms/step - loss: 0.1663 -
f1_score: 0.9830 - val_loss: 2.4128 - val_f1_score: 0.6000
Epoch 409/500
28/28 [=====] - 6s 198ms/step - loss: 0.1863 -
f1_score: 0.9808 - val_loss: 2.7755 - val_f1_score: 0.5731
Epoch 410/500
28/28 [=====] - 6s 200ms/step - loss: 0.1946 -
f1_score: 0.9774 - val_loss: 2.5158 - val_f1_score: 0.6013
Epoch 411/500
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28/28 [=====] - 6s 200ms/step - loss: 0.1859 -
f1_score: 0.9805 - val_loss: 2.5649 - val_f1_score: 0.5894
Epoch 412/500
28/28 [=====] - 5s 197ms/step - loss: 0.2083 -
f1_score: 0.9761 - val_loss: 2.8358 - val_f1_score: 0.5444
Epoch 413/500
28/28 [=====] - 6s 197ms/step - loss: 0.2739 -
f1_score: 0.9580 - val_loss: 2.9310 - val_f1_score: 0.5402
Epoch 414/500
28/28 [=====] - 6s 199ms/step - loss: 0.2254 -
f1_score: 0.9659 - val_loss: 2.4402 - val_f1_score: 0.6019
Epoch 415/500
28/28 [=====] - 5s 197ms/step - loss: 0.2123 -
f1_score: 0.9739 - val_loss: 2.4552 - val_f1_score: 0.5951
Epoch 416/500
28/28 [=====] - 6s 199ms/step - loss: 0.2716 -
f1_score: 0.9645 - val_loss: 2.6995 - val_f1_score: 0.5929
Epoch 417/500
28/28 [=====] - 6s 199ms/step - loss: 0.3096 -
f1_score: 0.9528 - val_loss: 2.2819 - val_f1_score: 0.6036
Epoch 418/500
28/28 [=====] - 5s 197ms/step - loss: 0.1847 -
f1_score: 0.9785 - val_loss: 2.5804 - val_f1_score: 0.5666
Epoch 419/500
28/28 [=====] - 6s 198ms/step - loss: 0.2124 -
f1_score: 0.9747 - val_loss: 2.4506 - val_f1_score: 0.5646
Epoch 420/500
28/28 [=====] - 6s 203ms/step - loss: 0.1747 -
f1_score: 0.9875 - val_loss: 2.4499 - val_f1_score: 0.5812
Epoch 421/500
28/28 [=====] - 6s 199ms/step - loss: 0.1358 -
f1_score: 0.9967 - val_loss: 2.2436 - val_f1_score: 0.6342
Epoch 422/500
28/28 [=====] - 6s 198ms/step - loss: 0.1249 -
f1_score: 0.9986 - val_loss: 2.3718 - val_f1_score: 0.6180
Epoch 423/500
28/28 [=====] - 5s 197ms/step - loss: 0.1306 -
f1_score: 0.9961 - val_loss: 2.6699 - val_f1_score: 0.5624
Epoch 424/500
28/28 [=====] - 5s 197ms/step - loss: 0.1273 -
f1_score: 0.9970 - val_loss: 2.4673 - val_f1_score: 0.5986
Epoch 425/500
28/28 [=====] - 6s 197ms/step - loss: 0.1183 -
f1_score: 1.0000 - val_loss: 2.4319 - val_f1_score: 0.5970
Epoch 426/500
28/28 [=====] - 6s 199ms/step - loss: 0.1150 -
f1_score: 0.9992 - val_loss: 2.3986 - val_f1_score: 0.6124
Epoch 427/500
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28/28 [=====] - 6s 198ms/step - loss: 0.1137 -
f1_score: 0.9996 - val_loss: 2.3843 - val_f1_score: 0.6135
Epoch 428/500
28/28 [=====] - 6s 197ms/step - loss: 0.1131 -
f1_score: 0.9996 - val_loss: 2.5011 - val_f1_score: 0.6013
Epoch 429/500
28/28 [=====] - 6s 200ms/step - loss: 0.1117 -
f1_score: 1.0000 - val_loss: 2.4671 - val_f1_score: 0.6044
Epoch 430/500
28/28 [=====] - 6s 201ms/step - loss: 0.1109 -
f1_score: 0.9996 - val_loss: 2.5005 - val_f1_score: 0.6080
Epoch 431/500
28/28 [=====] - 6s 199ms/step - loss: 0.1102 -
f1_score: 0.9996 - val_loss: 2.4854 - val_f1_score: 0.6187
Epoch 432/500
28/28 [=====] - 6s 199ms/step - loss: 0.1109 -
f1_score: 0.9987 - val_loss: 2.4467 - val_f1_score: 0.6161
Epoch 433/500
28/28 [=====] - 6s 198ms/step - loss: 0.1074 -
f1_score: 1.0000 - val_loss: 2.5112 - val_f1_score: 0.6148
Epoch 434/500
28/28 [=====] - 5s 196ms/step - loss: 0.1093 -
f1_score: 0.9992 - val_loss: 2.5264 - val_f1_score: 0.6133
Epoch 435/500
28/28 [=====] - 5s 197ms/step - loss: 0.1093 -
f1_score: 0.9997 - val_loss: 2.5777 - val_f1_score: 0.5971
Epoch 436/500
28/28 [=====] - 6s 197ms/step - loss: 0.1069 -
f1_score: 1.0000 - val_loss: 2.5895 - val_f1_score: 0.6153
Epoch 437/500
28/28 [=====] - 6s 205ms/step - loss: 0.1064 -
f1_score: 1.0000 - val_loss: 2.5674 - val_f1_score: 0.6109
Epoch 438/500
28/28 [=====] - 6s 203ms/step - loss: 0.1082 -
f1_score: 0.9988 - val_loss: 2.5489 - val_f1_score: 0.6163
Epoch 439/500
28/28 [=====] - 6s 207ms/step - loss: 0.1064 -
f1_score: 0.9996 - val_loss: 2.5649 - val_f1_score: 0.6135
Epoch 440/500
28/28 [=====] - 6s 203ms/step - loss: 0.1050 -
f1_score: 1.0000 - val_loss: 2.6311 - val_f1_score: 0.6177
Epoch 441/500
28/28 [=====] - 6s 207ms/step - loss: 0.1040 -
f1_score: 1.0000 - val_loss: 2.6437 - val_f1_score: 0.6149
Epoch 442/500
28/28 [=====] - 6s 200ms/step - loss: 0.1030 -
f1_score: 1.0000 - val_loss: 2.6354 - val_f1_score: 0.6204
Epoch 443/500
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28/28 [=====] - 6s 203ms/step - loss: 0.1049 -
f1_score: 0.9996 - val_loss: 2.7105 - val_f1_score: 0.6162
Epoch 444/500
28/28 [=====] - 6s 198ms/step - loss: 0.1034 -
f1_score: 0.9996 - val_loss: 2.5738 - val_f1_score: 0.6252
Epoch 445/500
28/28 [=====] - 6s 199ms/step - loss: 0.1031 -
f1_score: 0.9996 - val_loss: 2.6596 - val_f1_score: 0.6106
Epoch 446/500
28/28 [=====] - 6s 199ms/step - loss: 0.1007 -
f1_score: 1.0000 - val_loss: 2.6599 - val_f1_score: 0.6302
Epoch 447/500
28/28 [=====] - 6s 200ms/step - loss: 0.1018 -
f1_score: 1.0000 - val_loss: 2.7103 - val_f1_score: 0.6262
Epoch 448/500
28/28 [=====] - 6s 198ms/step - loss: 0.1023 -
f1_score: 1.0000 - val_loss: 2.6990 - val_f1_score: 0.6301
Epoch 449/500
28/28 [=====] - 6s 198ms/step - loss: 0.0993 -
f1_score: 1.0000 - val_loss: 2.7287 - val_f1_score: 0.6246
Epoch 450/500
28/28 [=====] - 5s 197ms/step - loss: 0.1003 -
f1_score: 0.9996 - val_loss: 2.7394 - val_f1_score: 0.6335
Epoch 451/500
28/28 [=====] - 6s 198ms/step - loss: 0.1007 -
f1_score: 1.0000 - val_loss: 2.7774 - val_f1_score: 0.6311
Epoch 452/500
28/28 [=====] - 6s 198ms/step - loss: 0.0996 -
f1_score: 1.0000 - val_loss: 2.7924 - val_f1_score: 0.6283
Epoch 453/500
28/28 [=====] - 5s 197ms/step - loss: 0.1007 -
f1_score: 0.9992 - val_loss: 2.7211 - val_f1_score: 0.6322
Epoch 454/500
28/28 [=====] - 6s 197ms/step - loss: 0.0993 -
f1_score: 0.9992 - val_loss: 2.7805 - val_f1_score: 0.6325
Epoch 455/500
28/28 [=====] - 6s 202ms/step - loss: 0.0983 -
f1_score: 1.0000 - val_loss: 2.8436 - val_f1_score: 0.6161
Epoch 456/500
28/28 [=====] - 6s 205ms/step - loss: 0.0978 -
f1_score: 1.0000 - val_loss: 2.8650 - val_f1_score: 0.6242
Epoch 457/500
28/28 [=====] - 5s 196ms/step - loss: 0.0974 -
f1_score: 1.0000 - val_loss: 2.8450 - val_f1_score: 0.6216
Epoch 458/500
28/28 [=====] - 5s 196ms/step - loss: 0.0955 -
f1_score: 1.0000 - val_loss: 2.9181 - val_f1_score: 0.6244
Epoch 459/500
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28/28 [=====] - 6s 198ms/step - loss: 0.0967 -
f1_score: 0.9996 - val_loss: 2.9187 - val_f1_score: 0.6276
Epoch 460/500
28/28 [=====] - 5s 196ms/step - loss: 0.0957 -
f1_score: 1.0000 - val_loss: 2.9524 - val_f1_score: 0.6175
Epoch 461/500
28/28 [=====] - 6s 197ms/step - loss: 0.0956 -
f1_score: 1.0000 - val_loss: 2.8715 - val_f1_score: 0.6271
Epoch 462/500
28/28 [=====] - 5s 196ms/step - loss: 0.0965 -
f1_score: 1.0000 - val_loss: 2.9176 - val_f1_score: 0.6161
Epoch 463/500
28/28 [=====] - 5s 195ms/step - loss: 0.0954 -
f1_score: 0.9996 - val_loss: 3.0978 - val_f1_score: 0.6129
Epoch 464/500
28/28 [=====] - 5s 197ms/step - loss: 0.0963 -
f1_score: 0.9996 - val_loss: 2.9742 - val_f1_score: 0.6267
Epoch 465/500
28/28 [=====] - 6s 197ms/step - loss: 0.0946 -
f1_score: 0.9996 - val_loss: 2.9611 - val_f1_score: 0.6175
Epoch 466/500
28/28 [=====] - 6s 197ms/step - loss: 0.0951 -
f1_score: 0.9996 - val_loss: 3.1161 - val_f1_score: 0.6037
Epoch 467/500
28/28 [=====] - 6s 197ms/step - loss: 0.0950 -
f1_score: 1.0000 - val_loss: 3.0695 - val_f1_score: 0.6144
Epoch 468/500
28/28 [=====] - 5s 197ms/step - loss: 0.0926 -
f1_score: 1.0000 - val_loss: 3.0003 - val_f1_score: 0.6255
Epoch 469/500
28/28 [=====] - 6s 199ms/step - loss: 0.0934 -
f1_score: 1.0000 - val_loss: 2.9823 - val_f1_score: 0.6307
Epoch 470/500
28/28 [=====] - 6s 198ms/step - loss: 0.0919 -
f1_score: 0.9996 - val_loss: 2.9559 - val_f1_score: 0.6267
Epoch 471/500
28/28 [=====] - 6s 197ms/step - loss: 0.0984 -
f1_score: 0.9970 - val_loss: 3.2410 - val_f1_score: 0.5979
Epoch 472/500
28/28 [=====] - 6s 199ms/step - loss: 2.0921 -
f1_score: 0.6741 - val_loss: 2.3014 - val_f1_score: 0.4414
Epoch 473/500
28/28 [=====] - 5s 196ms/step - loss: 0.9715 -
f1_score: 0.7560 - val_loss: 1.8664 - val_f1_score: 0.5781
Epoch 474/500
28/28 [=====] - 6s 201ms/step - loss: 0.4791 -
f1_score: 0.9050 - val_loss: 1.7886 - val_f1_score: 0.6106
Epoch 475/500
```

```
28/28 [=====] - 6s 197ms/step - loss: 0.4047 -
f1_score: 0.9154 - val_loss: 1.9493 - val_f1_score: 0.5952
Epoch 476/500
28/28 [=====] - 5s 196ms/step - loss: 0.2973 -
f1_score: 0.9499 - val_loss: 2.0582 - val_f1_score: 0.5840
Epoch 477/500
28/28 [=====] - 5s 197ms/step - loss: 0.1841 -
f1_score: 0.9817 - val_loss: 2.3259 - val_f1_score: 0.5840
Epoch 478/500
28/28 [=====] - 6s 198ms/step - loss: 0.2040 -
f1_score: 0.9791 - val_loss: 2.3708 - val_f1_score: 0.5776
Epoch 479/500
28/28 [=====] - 5s 196ms/step - loss: 0.1713 -
f1_score: 0.9835 - val_loss: 2.3932 - val_f1_score: 0.5850
Epoch 480/500
28/28 [=====] - 5s 196ms/step - loss: 0.1741 -
f1_score: 0.9833 - val_loss: 2.2900 - val_f1_score: 0.5890
Epoch 481/500
28/28 [=====] - 6s 198ms/step - loss: 0.1672 -
f1_score: 0.9878 - val_loss: 2.3133 - val_f1_score: 0.5815
Epoch 482/500
28/28 [=====] - 6s 199ms/step - loss: 0.1606 -
f1_score: 0.9899 - val_loss: 2.3303 - val_f1_score: 0.6110
Epoch 483/500
28/28 [=====] - 6s 201ms/step - loss: 0.1512 -
f1_score: 0.9923 - val_loss: 2.2911 - val_f1_score: 0.5911
Epoch 484/500
28/28 [=====] - 6s 197ms/step - loss: 0.1569 -
f1_score: 0.9865 - val_loss: 2.4059 - val_f1_score: 0.5974
Epoch 485/500
28/28 [=====] - 6s 198ms/step - loss: 0.1856 -
f1_score: 0.9803 - val_loss: 2.7280 - val_f1_score: 0.5558
Epoch 486/500
28/28 [=====] - 6s 198ms/step - loss: 0.2253 -
f1_score: 0.9684 - val_loss: 2.4114 - val_f1_score: 0.6018
Epoch 487/500
28/28 [=====] - 5s 195ms/step - loss: 0.1852 -
f1_score: 0.9770 - val_loss: 2.2935 - val_f1_score: 0.6023
Epoch 488/500
28/28 [=====] - 6s 197ms/step - loss: 0.1433 -
f1_score: 0.9890 - val_loss: 2.4404 - val_f1_score: 0.5720
Epoch 489/500
28/28 [=====] - 6s 197ms/step - loss: 0.1228 -
f1_score: 0.9969 - val_loss: 2.4788 - val_f1_score: 0.5912
Epoch 490/500
28/28 [=====] - 6s 199ms/step - loss: 0.1143 -
f1_score: 0.9982 - val_loss: 2.4079 - val_f1_score: 0.6033
Epoch 491/500
```

```

28/28 [=====] - 5s 196ms/step - loss: 0.1102 -
f1_score: 1.0000 - val_loss: 2.4162 - val_f1_score: 0.6025
Epoch 492/500
28/28 [=====] - 6s 198ms/step - loss: 0.1088 -
f1_score: 1.0000 - val_loss: 2.4298 - val_f1_score: 0.6055
Epoch 493/500
28/28 [=====] - 6s 199ms/step - loss: 0.1064 -
f1_score: 0.9997 - val_loss: 2.4205 - val_f1_score: 0.6018
Epoch 494/500
28/28 [=====] - 6s 199ms/step - loss: 0.1065 -
f1_score: 0.9996 - val_loss: 2.4254 - val_f1_score: 0.6109
Epoch 495/500
28/28 [=====] - 5s 196ms/step - loss: 0.1060 -
f1_score: 1.0000 - val_loss: 2.4545 - val_f1_score: 0.6136
Epoch 496/500
28/28 [=====] - 6s 197ms/step - loss: 0.1035 -
f1_score: 1.0000 - val_loss: 2.4243 - val_f1_score: 0.6154
Epoch 497/500
28/28 [=====] - 6s 198ms/step - loss: 0.1034 -
f1_score: 1.0000 - val_loss: 2.4557 - val_f1_score: 0.6245
Epoch 498/500
28/28 [=====] - 5s 197ms/step - loss: 0.1028 -
f1_score: 1.0000 - val_loss: 2.5262 - val_f1_score: 0.6194
Epoch 499/500
28/28 [=====] - 6s 197ms/step - loss: 0.1017 -
f1_score: 1.0000 - val_loss: 2.5048 - val_f1_score: 0.6203
Epoch 500/500
28/28 [=====] - 5s 197ms/step - loss: 0.1014 -
f1_score: 1.0000 - val_loss: 2.5211 - val_f1_score: 0.6223

```

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

	precision	recall	f1-score	support
AXE	0.778	0.875	0.824	8
BACKPACK	0.571	0.667	0.615	6
BASKETBALL	0.769	1.000	0.870	10
BEE	0.600	0.300	0.400	10
BELT	0.667	1.000	0.800	4
BITE	0.571	0.500	0.533	8
BREAKFAST	0.333	0.500	0.400	6
CANCER	0.600	0.750	0.667	8
CHRISTMAS	0.750	1.000	0.857	6

CONFUSED	0.500	0.833	0.625	6
DARK	1.000	1.000	1.000	4
DEAF	0.375	0.500	0.429	6
DECIDE	1.000	0.667	0.800	6
DEMAND	0.889	1.000	0.941	8
DEVELOP	0.500	0.667	0.571	6
DINNER	1.000	0.625	0.769	8
DOG	0.571	0.667	0.615	6
DOWNSIZE	0.778	0.875	0.824	8
DRAG	0.400	0.500	0.444	4
EAT	1.000	0.667	0.800	6
EDIT	0.571	0.667	0.615	6
ELEVATOR	0.417	0.625	0.500	8
FINE	0.400	0.500	0.444	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	0.429	0.500	0.462	6
GUESS	1.000	0.750	0.857	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	0.000	0.000	0.000	4
LOCK	1.000	0.250	0.400	8
LUNCH	1.000	0.375	0.545	8
MAPLE	0.500	1.000	0.667	4
MEAT	0.667	1.000	0.800	6
MECHANIC	0.500	1.000	0.667	4
MICROSCOPE	1.000	0.250	0.400	8
MOVIE	0.667	0.500	0.571	8
NOON	0.857	0.750	0.800	8
PARTY	1.000	0.625	0.769	8
PATIENT	0.500	0.833	0.625	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.571	0.667	0.615	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	0.250	0.250	0.250	4
THEY	1.000	0.750	0.857	4
TWINS	0.625	0.625	0.625	8
WHATFOR	0.833	0.500	0.625	10
accuracy			0.651	324
macro avg	0.660	0.644	0.622	324
weighted avg	0.692	0.651	0.640	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 = '3 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)

```

[139]: `hist_df = pd.read_csv('3 LSTM/history.csv', index_col=0)`  
`hist_df.tail()`

	loss	f1_score	val_loss	val_f1_score
495	0.103536	1.0	2.424316	0.615422
496	0.103385	1.0	2.455749	0.624529
497	0.102776	1.0	2.526179	0.619446
498	0.101666	1.0	2.504849	0.620275
499	0.101413	1.0	2.521060	0.622308

[140]: # 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]

```

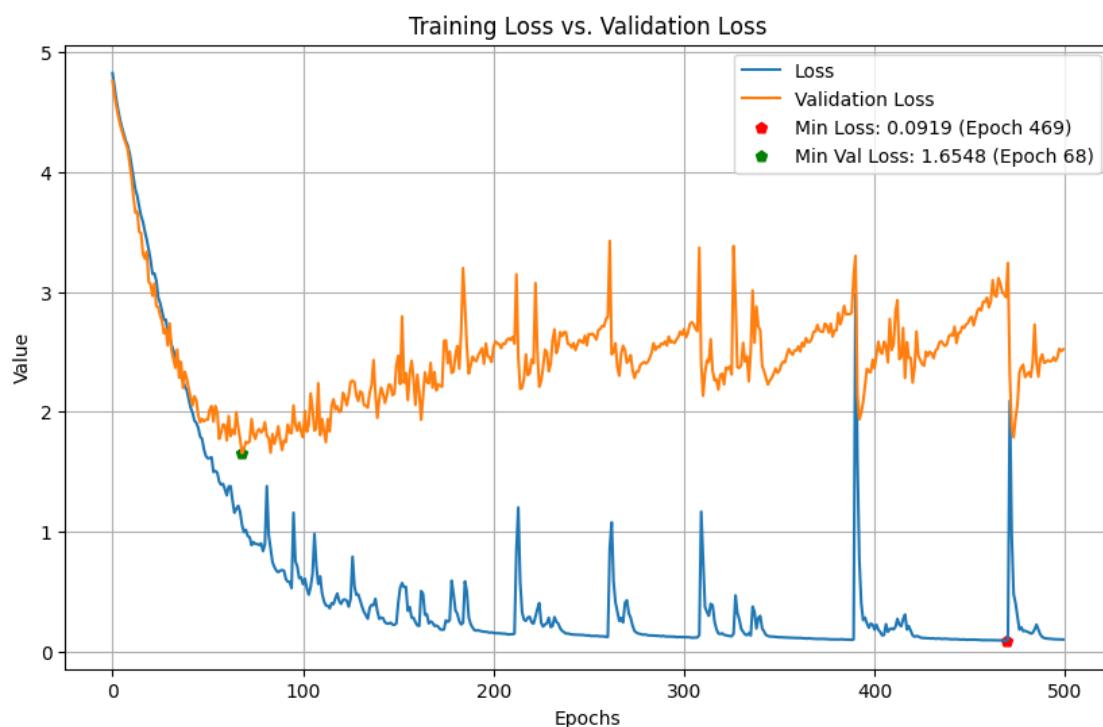
# Plotting  
`epochs = range(0, 500)`  
`plt.figure(figsize=(10, 6))`  
`plt.plot(epochs, hist_df.loss, label='Loss')`  
`plt.plot(epochs, hist_df.val_loss, label='Validation Loss')`  
`plt.scatter(min_loss_epoch,`  
 `min_loss,`  
 `c='red',`  
 `marker='p',`

```

        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()

```



```

[141]: # 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

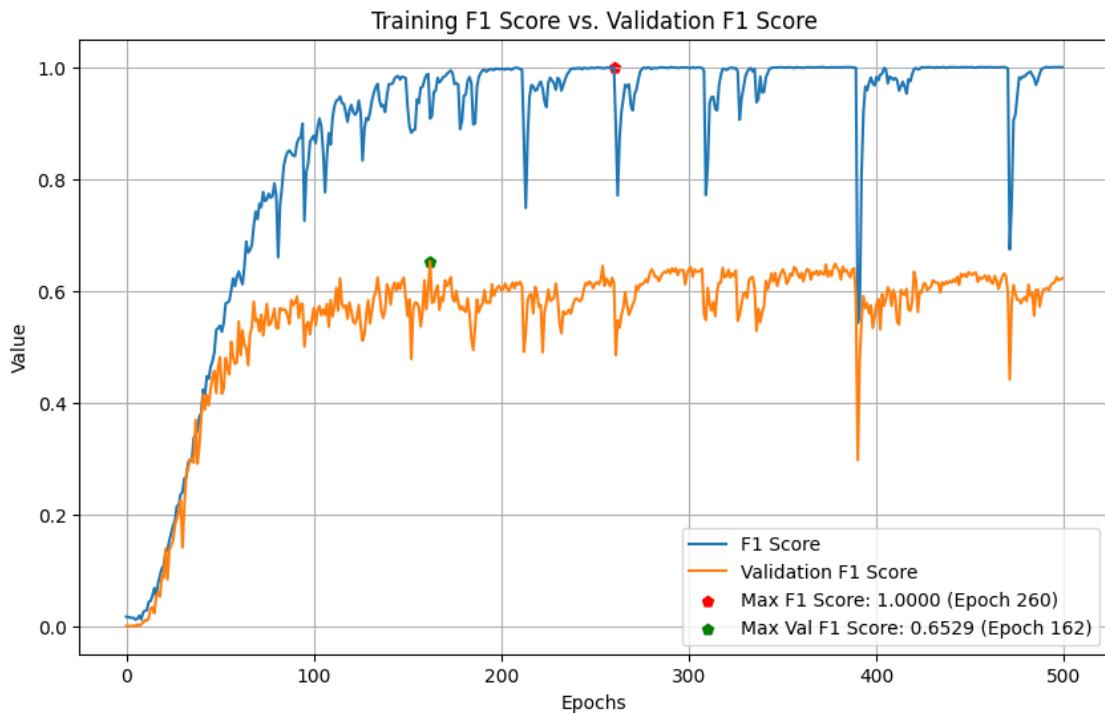
```

```

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("3 LSTM")
```

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

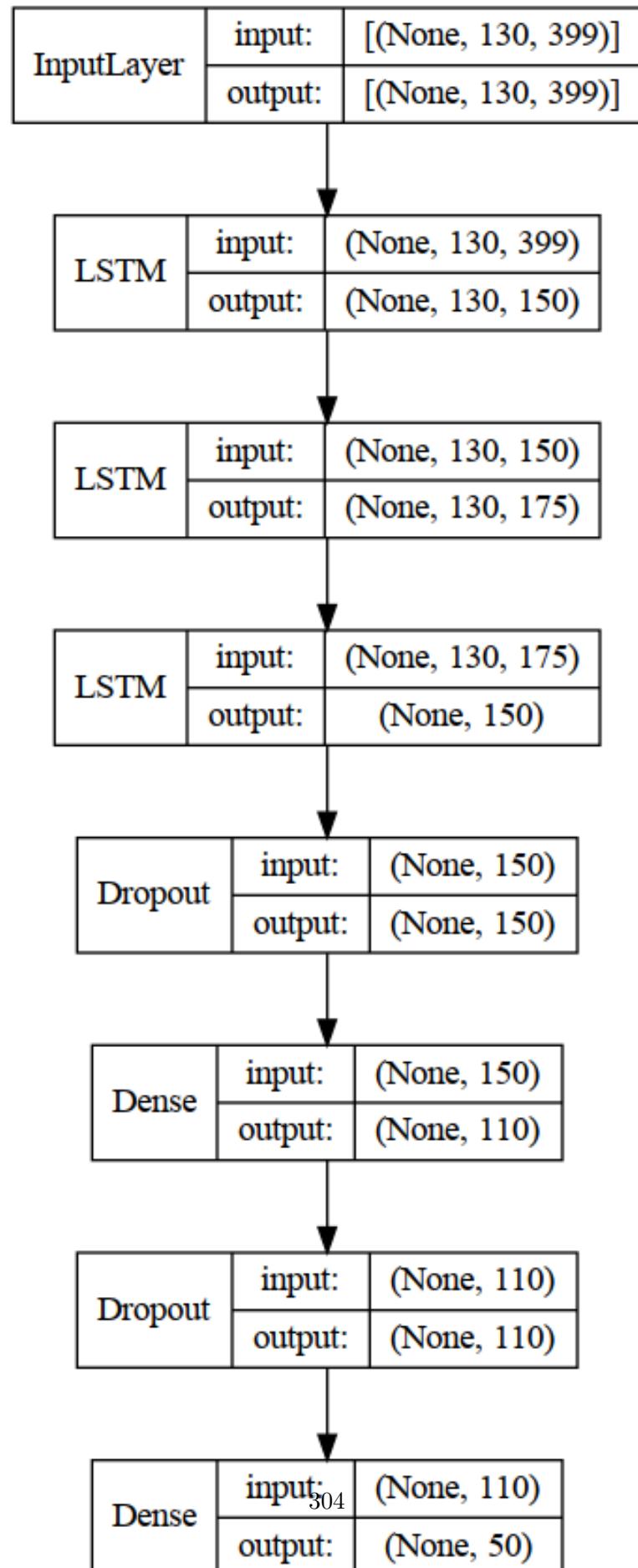
Model: "sequential\_1"

Layer (type)	Output Shape	Param #
<hr/>		
lstm_3 (LSTM)	(None, 130, 150)	330000
lstm_4 (LSTM)	(None, 130, 175)	228200
lstm_5 (LSTM)	(None, 150)	195600
dropout_2 (Dropout)	(None, 150)	0
dense_2 (Dense)	(None, 110)	16610
dropout_3 (Dropout)	(None, 110)	0
dense_3 (Dense)	(None, 50)	5550
<hr/>		
Total params: 775,960		
Trainable params: 775,960		
Non-trainable params: 0		

---

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

```
[144]:
```



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

11/11 [=====] - 2s 32ms/step - loss: 1.9338 - f1_score: 0.6529
```

[145]: [1.9338433742523193, 0.6529363989830017]

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

84/84 [=====] - 3s 34ms/step - loss: 0.3059 - f1_score: 0.9486
```

[146]: [0.3058566749095917, 0.9486328363418579]

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

	precision	recall	f1-score	support
AXE	1.000	1.000	1.000	8
BACKPACK	0.800	0.667	0.727	6
BASKETBALL	0.769	1.000	0.870	10
BEE	0.800	0.400	0.533	10
BELT	1.000	1.000	1.000	4
BITE	0.625	0.625	0.625	8
BREAKFAST	0.667	0.667	0.667	6
CANCER	0.583	0.875	0.700	8
CHRISTMAS	0.833	0.833	0.833	6
CONFUSED	0.500	0.667	0.571	6
DARK	1.000	1.000	1.000	4
DEAF	0.500	0.667	0.571	6
DECIDE	1.000	1.000	1.000	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.500	0.500	0.500	6
DINNER	0.875	0.875	0.875	8
DOG	0.333	0.500	0.400	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	0.500	0.500	0.500	4
EAT	0.625	0.833	0.714	6
EDIT	0.667	1.000	0.800	6
ELEVATOR	0.625	0.625	0.625	8
FINE	0.400	0.500	0.444	4

FLOAT	0.667	0.500	0.571	4
FOREIGNER	0.600	0.500	0.545	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	0.000	0.000	0.000	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	1.000	0.250	0.400	4
LOCK	0.500	0.250	0.333	8
LUNCH	0.714	0.625	0.667	8
MAPLE	0.400	0.500	0.444	4
MEAT	0.286	1.000	0.444	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.375	0.545	8
MOVIE	1.000	0.375	0.545	8
NOON	1.000	1.000	1.000	8
PARTY	0.615	1.000	0.762	8
PATIENT	0.500	0.167	0.250	6
RAZOR	0.333	0.500	0.400	4
RIVER	0.571	0.667	0.615	6
ROCKINGCHAIR	0.429	0.750	0.545	8
SHAVE	0.700	0.700	0.700	10
SINK	0.500	0.167	0.250	6
SQUEEZE	0.333	0.250	0.286	4
THEY	0.750	0.750	0.750	4
TWINS	0.714	0.625	0.667	8
WHATFOR	0.875	0.700	0.778	10
accuracy			0.679	324
macro avg	0.702	0.661	0.653	324
weighted avg	0.721	0.679	0.672	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))
```

#### 4.4 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='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, 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_1960703/3060645919.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/CSPNext/hyperband/',
project_name='1_1D_CNN',
overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/1_1D_CNN/tuner0.json
```

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

```
Search space summary
Default search space size: 8
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, 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 09m 42s]
val_f1_score: 0.29337821900844574
```

```
Best val_f1_score So Far: 0.44099260866642
Total elapsed time: 07h 52m 41s
INFO:tensorflow:Oracle triggered exit
```

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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/1_1D_CNN
Showing 10 best trials
Objective(name="val_f1_score", direction="max")
```

```
Trial 0670 summary
Hyperparameters:
dense_activation: selu
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: 0667
Score: 0.44099260866642
```

```
Trial 0671 summary
Hyperparameters:
dense_activation: elu
filters_1: 50
kernel_1: 10
pool_1: 7
dropout_1: 0.25
units_2: 120
dropout_2: 0.8
learning_rate: 0.001273875001513303
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0669
```

Score: 0.4313937574625015

Trial 0599 summary  
Hyperparameters:  
dense\_activation: elu  
filters\_1: 75  
kernel\_1: 4  
pool\_1: 8  
dropout\_1: 0.05  
units\_2: 110  
dropout\_2: 0.6000000000000001  
learning\_rate: 0.002112765859059582  
tuner/epochs: 300  
tuner/initial\_epoch: 100  
tuner/bracket: 4  
tuner/round: 4  
tuner/trial\_id: 0593  
Score: 0.4285096377134323

Trial 0714 summary  
Hyperparameters:  
dense\_activation: selu  
filters\_1: 175  
kernel\_1: 4  
pool\_1: 10  
dropout\_1: 0.75  
units\_2: 90  
dropout\_2: 0.25  
learning\_rate: 0.0003005119239919036  
tuner/epochs: 300  
tuner/initial\_epoch: 100  
tuner/bracket: 1  
tuner/round: 1  
tuner/trial\_id: 0709  
Score: 0.4271707981824875

Trial 0427 summary  
Hyperparameters:  
dense\_activation: mish  
filters\_1: 150  
kernel\_1: 2  
pool\_1: 6  
dropout\_1: 0.55  
units\_2: 110  
dropout\_2: 0.45  
learning\_rate: 0.0017199099695109801  
tuner/epochs: 300  
tuner/initial\_epoch: 100

```
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.4213039427995682
```

```
Trial 0422 summary
Hyperparameters:
dense_activation: selu
filters_1: 50
kernel_1: 5
pool_1: 9
dropout_1: 0.35000000000000003
units_2: 80
dropout_2: 0.4
learning_rate: 0.0012341315610031297
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0416
Score: 0.41656494140625
```

```
Trial 0723 summary
Hyperparameters:
dense_activation: gelu
filters_1: 150
kernel_1: 2
pool_1: 9
dropout_1: 0.15000000000000002
units_2: 110
dropout_2: 0.1
learning_rate: 0.0008719241758525561
tuner/epochs: 300
tuner/initial_epoch: 0
tuner/bracket: 0
tuner/round: 0
Score: 0.416300505399704
```

```
Trial 0667 summary
Hyperparameters:
dense_activation: selu
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: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0658
Score: 0.41369301080703735
```

```
Trial 0669 summary
Hyperparameters:
dense_activation: elu
filters_1: 50
kernel_1: 10
pool_1: 7
dropout_1: 0.25
units_2: 120
dropout_2: 0.8
learning_rate: 0.001273875001513303
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 3
tuner/round: 2
tuner/trial_id: 0662
Score: 0.40710021555423737
```

```
Trial 0594 summary
Hyperparameters:
dense_activation: gelu
filters_1: 175
kernel_1: 2
pool_1: 6
dropout_1: 0.1
units_2: 100
dropout_2: 0.3000000000000004
learning_rate: 0.0016212150201753844
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0580
Score: 0.4042707681655884
```

```
[125]: best_model = tuner.get_best_models(num_models=1)[0]
```

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

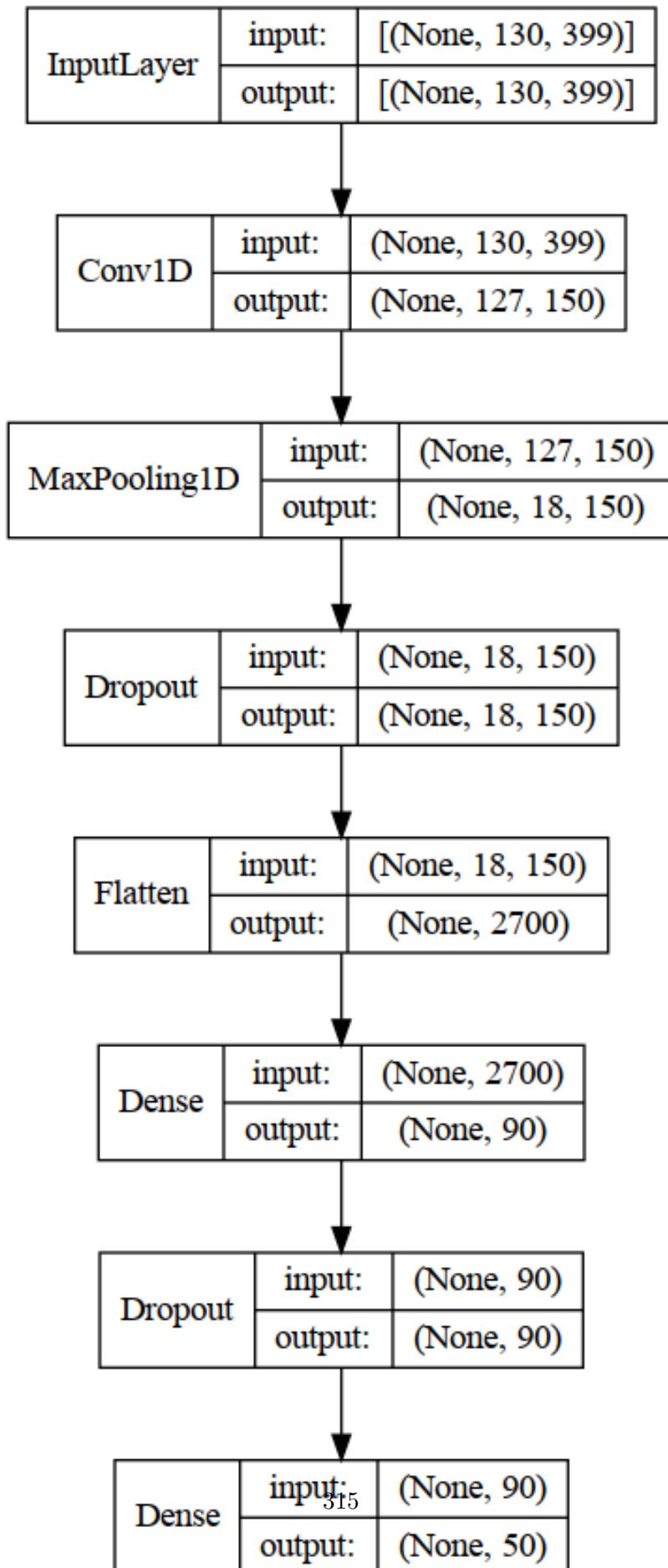
```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
--------------	--------------	---------

```
=====
conv1d (Conv1D)           (None, 127, 150)      239550
max_pooling1d (MaxPooling1D) (None, 18, 150)      0
)
dropout (Dropout)         (None, 18, 150)      0
flatten (Flatten)         (None, 2700)        0
dense (Dense)             (None, 90)          243090
dropout_1 (Dropout)       (None, 90)          0
dense_1 (Dense)           (None, 50)          4550
=====
Total params: 487,190
Trainable params: 487,190
Non-trainable params: 0
```

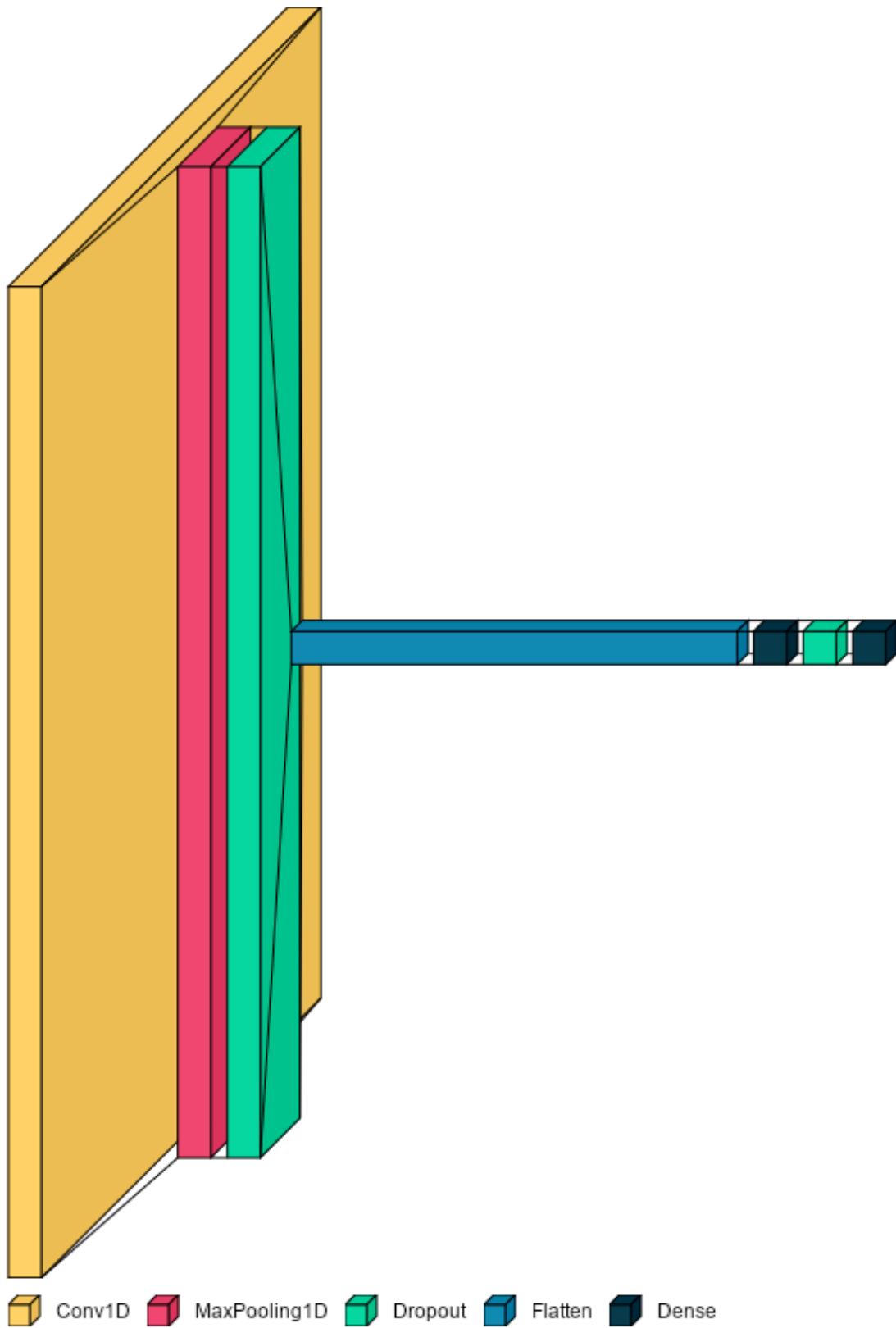
```
[127]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[127]:
```



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

```
[128]:
```



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

11/11 [=====] - 1s 20ms/step - loss: 2.2785 - f1_score: 0.4443
```

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

84/84 [=====] - 1s 11ms/step - loss: 0.4082 - f1_score: 0.9491
```

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

	precision	recall	f1-score	support
AXE	0.750	0.375	0.500	8
BACKPACK	0.500	0.500	0.500	6
BASKETBALL	0.667	0.600	0.632	10
BEE	0.400	0.200	0.267	10
BELT	1.000	1.000	1.000	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.750	0.500	0.600	6
CANCER	0.833	0.625	0.714	8
CHRISTMAS	0.250	0.167	0.200	6
CONFUSED	0.000	0.000	0.000	6
DARK	0.667	0.500	0.571	4
DEAF	0.333	0.333	0.333	6
DECIDE	0.667	0.667	0.667	6
DEMAND	0.375	0.375	0.375	8
DEVELOP	0.111	0.167	0.133	6
DINNER	0.714	0.625	0.667	8
DOG	0.750	0.500	0.600	6
DOWNSIZE	1.000	0.750	0.857	8
DRAG	0.182	0.500	0.267	4
EAT	1.000	0.500	0.667	6
EDIT	0.375	0.500	0.429	6
ELEVATOR	0.250	0.500	0.333	8
FINE	0.375	0.750	0.500	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	0.444	0.667	0.533	6
GUESS	0.833	0.625	0.714	8
HALLOWEEN	0.571	1.000	0.727	8
HOSPITAL	0.143	0.167	0.154	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.333	0.500	0.400	4

KNIGHT	0.500	0.500	0.500	4
LOCK	0.333	0.250	0.286	8
LUNCH	0.800	0.500	0.615	8
MAPLE	0.333	0.500	0.400	4
MEAT	0.750	1.000	0.857	6
MECHANIC	0.250	0.250	0.250	4
MICROSCOPE	0.750	0.375	0.500	8
MOVIE	0.444	0.500	0.471	8
NOON	0.583	0.875	0.700	8
PARTY	1.000	0.250	0.400	8
PATIENT	0.143	0.167	0.154	6
RAZOR	0.000	0.000	0.000	4
RIVER	1.000	0.500	0.667	6
ROCKINGCHAIR	0.533	1.000	0.696	8
SHAVE	0.400	0.400	0.400	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.500	0.500	0.500	4
TWINS	0.217	0.625	0.323	8
WHATFOR	0.714	0.500	0.588	10
accuracy			0.466	324
macro avg	0.484	0.456	0.444	324
weighted avg	0.507	0.466	0.459	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]: bestHP = tuner.get\_best\_hyperparameters(num\_trials=10)[0]

[124]: model\_checkpoint\_callback = tf.keras.callbacks.ModelCheckpoint(
 filepath='1\_1DCNN/',
 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...

2023-09-14 23:47:46.387531: W tensorflow/core/framework/cpu\_allocator\_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.

2023-09-14 23:47:56.648097: W tensorflow/core/common\_runtime/bfc\_allocator.cc:479] Allocator (GPU\_0\_bfc) ran out of memory trying to allocate 529.50MiB (rounded to 555216640)requested by op \_EagerConst

If the cause is memory fragmentation maybe the environment variable 'TF\_GPU\_ALLOCATOR=cuda\_malloc\_async' will improve the situation.

Current allocation summary follows.

Current allocation summary follows.

2023-09-14 23:47:56.648134: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1033] BFCAllocator dump for GPU\_0\_bfc

2023-09-14 23:47:56.648142: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (256): Total Chunks: 47, Chunks in use: 47. 11.8KiB allocated for chunks. 11.8KiB in use in bin. 2.5KiB client-requested in use in bin.

2023-09-14 23:47:56.648146: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (512): Total Chunks: 8, Chunks in use: 8. 5.0KiB allocated for chunks. 5.0KiB in use in bin. 3.8KiB client-requested in use in bin.

2023-09-14 23:47:56.648150: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (1024): Total Chunks: 1, Chunks in use: 1. 1.2KiB allocated for chunks. 1.2KiB in use in bin. 1.0KiB client-requested in use in bin.

2023-09-14 23:47:56.648154: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (2048): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648158: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (4096): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648161: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (8192): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648165: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (16384): Total Chunks: 4, Chunks in use: 4. 83.8KiB allocated for chunks. 83.8KiB in use in bin. 70.3KiB client-requested in use in bin.

2023-09-14 23:47:56.648169: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (32768): Total Chunks: 2, Chunks in use: 0. 90.8KiB allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648173: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (65536): Total Chunks: 1, Chunks in use: 1. 105.8KiB allocated for chunks. 105.8KiB in use in bin. 63.3KiB client-requested in use in bin.

2023-09-14 23:47:56.648177: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (131072): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648180: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (262144): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648184: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (524288): Total Chunks: 9, Chunks in use: 7. 7.78MiB allocated for chunks. 6.03MiB in use in bin. 6.03MiB client-requested in use in bin.

2023-09-14 23:47:56.648187: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (1048576): Total Chunks: 3, Chunks in use: 2. 4.50MiB allocated for chunks. 2.68MiB in use in bin. 1.84MiB client-requested in use in bin.

2023-09-14 23:47:56.648191: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (2097152): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648194: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (4194304): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648197: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (8388608): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

2023-09-14 23:47:56.648200: I tensorflow/core/common\_runtime/bfc\_allocator.cc:1040] Bin (16777216): Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.

```
2023-09-14 23:47:56.648210: I tensorflow/core/common_runtime/bfc_allocator.cc:1040] Bin (33554432):      Total Chunks: 1, Chunks in use: 0. 33.42MiB allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.
2023-09-14 23:47:56.648215: I tensorflow/core/common_runtime/bfc_allocator.cc:1040] Bin (67108864):      Total Chunks: 1, Chunks in use: 1. 64.11MiB allocated for chunks. 64.11MiB in use in bin. 64.11MiB client-requested in use in bin.
2023-09-14 23:47:56.648218: I tensorflow/core/common_runtime/bfc_allocator.cc:1040] Bin (134217728):      Total Chunks: 0, Chunks in use: 0. 0B allocated for chunks. 0B in use in bin. 0B client-requested in use in bin.
2023-09-14 23:47:56.648223: I tensorflow/core/common_runtime/bfc_allocator.cc:1040] Bin (268435456):      Total Chunks: 2, Chunks in use: 1. 919.90MiB allocated for chunks. 529.50MiB in use in bin. 529.50MiB client-requested in use in bin.
2023-09-14 23:47:56.648228: I tensorflow/core/common_runtime/bfc_allocator.cc:1056] Bin for 529.50MiB was 256.00MiB, Chunk State:
2023-09-14 23:47:56.648237: I tensorflow/core/common_runtime/bfc_allocator.cc:1062] Size: 390.40MiB | Requested Size: 21.43MiB | in_use: 0 | bin_num: 20, prev: Size: 64.11MiB | Requested Size: 64.11MiB | in_use: 1 | bin_num: -1
2023-09-14 23:47:56.648240: I tensorflow/core/common_runtime/bfc_allocator.cc:1069] Next region of size 1073741824
2023-09-14 23:47:56.648245: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4670000000 of size 555216640 next 27
2023-09-14 23:47:56.648248: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469117ef00 of size 972032 next 36
2023-09-14 23:47:56.648251: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469126c400 of size 18176 next 39
2023-09-14 23:47:56.648254: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691270b00 of size 256 next 40
2023-09-14 23:47:56.648256: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691270c00 of size 256 next 41
2023-09-14 23:47:56.648258: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691270d00 of size 256 next 42
2023-09-14 23:47:56.648261: I tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691270e00 of size 256 next 43
2023-09-14 23:47:56.648264: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691270f00 of
size 256 next 44
2023-09-14 23:47:56.648266: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271000 of
size 256 next 45
2023-09-14 23:47:56.648268: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271100 of
size 256 next 46
2023-09-14 23:47:56.648271: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271200 of
size 256 next 47
2023-09-14 23:47:56.648273: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271300 of
size 256 next 48
2023-09-14 23:47:56.648276: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271400 of
size 256 next 49
2023-09-14 23:47:56.648278: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691271500 of
size 256 next 50
2023-09-14 23:47:56.648281: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4691271600 of
size 1915392 next 75
2023-09-14 23:47:56.648284: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4691445000 of
size 957696 next 83
2023-09-14 23:47:56.648287: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f469152ed00 of
size 972032 next 82
2023-09-14 23:47:56.648289: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469161c200 of
size 972032 next 76
2023-09-14 23:47:56.648292: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4691709700 of
size 35038976 next 71
2023-09-14 23:47:56.648295: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693873e00 of
size 256 next 57
2023-09-14 23:47:56.648298: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693873f00 of
size 256 next 56
2023-09-14 23:47:56.648300: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874000 of
size 256 next 81
2023-09-14 23:47:56.648303: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874100 of
size 256 next 68
2023-09-14 23:47:56.648305: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874200 of
size 256 next 69
2023-09-14 23:47:56.648308: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874300 of
size 256 next 78
2023-09-14 23:47:56.648310: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874400 of
size 256 next 63
2023-09-14 23:47:56.648313: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874500 of
size 256 next 86
2023-09-14 23:47:56.648315: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874600 of
size 768 next 79
2023-09-14 23:47:56.648319: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874900 of
size 256 next 61
2023-09-14 23:47:56.648321: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874a00 of
size 256 next 84
2023-09-14 23:47:56.648324: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874b00 of
size 256 next 51
2023-09-14 23:47:56.648326: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874c00 of
size 256 next 58
2023-09-14 23:47:56.648329: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874d00 of
size 256 next 73
2023-09-14 23:47:56.648331: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693874e00 of
size 256 next 87
2023-09-14 23:47:56.648333: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4693874f00 of
size 35328 next 70
2023-09-14 23:47:56.648336: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469387d900 of
size 18176 next 18
2023-09-14 23:47:56.648338: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4693882000 of
size 57600 next 89
2023-09-14 23:47:56.648341: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693890100 of
size 256 next 14
2023-09-14 23:47:56.648343: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4693890200 of
size 863488 next 59
2023-09-14 23:47:56.648346: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693962f00 of
size 256 next 54
2023-09-14 23:47:56.648348: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f4693963000 of
size 108288 next 52
2023-09-14 23:47:56.648351: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469397d700 of
size 256 next 55
2023-09-14 23:47:56.648353: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f469397d800 of
size 67223552 next 74
2023-09-14 23:47:56.648356: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] Free at 7f4697999800 of
size 409364480 next 18446744073709551615
2023-09-14 23:47:56.648359: I
tensorflow/core/common_runtime/bfc_allocator.cc:1069] Next region of size
2097152
2023-09-14 23:47:56.648362: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00000 of
size 256 next 1
2023-09-14 23:47:56.648365: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00100 of
size 1280 next 2
2023-09-14 23:47:56.648367: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00600 of
size 256 next 3
2023-09-14 23:47:56.648370: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00700 of
size 256 next 4
2023-09-14 23:47:56.648372: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00800 of
size 256 next 6
2023-09-14 23:47:56.648374: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00900 of
size 768 next 7
2023-09-14 23:47:56.648377: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00c00 of
size 256 next 5
2023-09-14 23:47:56.648380: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00d00 of
size 256 next 8
2023-09-14 23:47:56.648383: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc00e00 of
size 512 next 12
2023-09-14 23:47:56.648385: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01000 of
size 256 next 13
2023-09-14 23:47:56.648388: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01100 of
size 256 next 11
2023-09-14 23:47:56.648390: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01200 of
size 256 next 16
2023-09-14 23:47:56.648393: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01300 of
size 256 next 17
2023-09-14 23:47:56.648395: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01400 of
size 256 next 64
2023-09-14 23:47:56.648398: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01500 of
size 512 next 21
2023-09-14 23:47:56.648400: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01700 of
size 256 next 22
2023-09-14 23:47:56.648403: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01800 of
size 256 next 23
2023-09-14 23:47:56.648405: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01900 of
size 256 next 24
2023-09-14 23:47:56.648408: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01a00 of
size 256 next 25
2023-09-14 23:47:56.648411: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01b00 of
size 256 next 29
2023-09-14 23:47:56.648413: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01c00 of
size 256 next 30
2023-09-14 23:47:56.648415: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01d00 of
size 256 next 31
2023-09-14 23:47:56.648418: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01e00 of
size 256 next 32
2023-09-14 23:47:56.648420: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc01f00 of
size 768 next 34
2023-09-14 23:47:56.648422: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc02200 of
size 768 next 35
2023-09-14 23:47:56.648425: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc02500 of
size 512 next 37
2023-09-14 23:47:56.648427: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc02700 of
size 512 next 38
2023-09-14 23:47:56.648430: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc02900 of
size 31232 next 19
2023-09-14 23:47:56.648432: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc0a300 of
size 18176 next 20
2023-09-14 23:47:56.648435: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc0ea00 of
size 535296 next 28
2023-09-14 23:47:56.648438: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480cc91500 of
size 1501952 next 18446744073709551615
2023-09-14 23:47:56.648441: I
tensorflow/core/common_runtime/bfc_allocator.cc:1069] Next region of size
4194304
2023-09-14 23:47:56.648443: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480d200000 of
size 957696 next 10
2023-09-14 23:47:56.648446: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480d2e9d00 of
size 972032 next 15
2023-09-14 23:47:56.648449: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480d3d7200 of
size 957696 next 33
2023-09-14 23:47:56.648452: I
tensorflow/core/common_runtime/bfc_allocator.cc:1089] InUse at 7f480d4c0f00 of
size 1306880 next 18446744073709551615
2023-09-14 23:47:56.648454: I
tensorflow/core/common_runtime/bfc_allocator.cc:1094]           Summary of in-use
Chunks by size:
2023-09-14 23:47:56.648458: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 47 Chunks of size 256
totalling 11.8KiB
2023-09-14 23:47:56.648462: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 4 Chunks of size 512
totalling 2.0KiB
2023-09-14 23:47:56.648465: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 4 Chunks of size 768
totalling 3.0KiB
2023-09-14 23:47:56.648468: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 1280
totalling 1.2KiB
2023-09-14 23:47:56.648471: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 3 Chunks of size 18176
totalling 53.2KiB
2023-09-14 23:47:56.648476: I
```

```
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 31232
totalling 30.5KiB
2023-09-14 23:47:56.648479: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 108288
totalling 105.8KiB
2023-09-14 23:47:56.648482: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 535296
totalling 522.8KiB
2023-09-14 23:47:56.648485: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 3 Chunks of size 957696
totalling 2.74MiB
2023-09-14 23:47:56.648488: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 3 Chunks of size 972032
totalling 2.78MiB
2023-09-14 23:47:56.648491: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 1306880
totalling 1.25MiB
2023-09-14 23:47:56.648494: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 1501952
totalling 1.43MiB
2023-09-14 23:47:56.648497: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 67223552
totalling 64.11MiB
2023-09-14 23:47:56.648500: I
tensorflow/core/common_runtime/bfc_allocator.cc:1097] 1 Chunks of size 555216640
totalling 529.50MiB
2023-09-14 23:47:56.648503: I
tensorflow/core/common_runtime/bfc_allocator.cc:1101] Sum Total of in-use
chunks: 602.52MiB
2023-09-14 23:47:56.648506: I
tensorflow/core/common_runtime/bfc_allocator.cc:1103]
total_region_allocated_bytes_: 1080033280 memory_limit_: 1473839104 available
bytes: 393805824 curr_region_allocation_bytes_: 1073741824
2023-09-14 23:47:56.648512: I
tensorflow/core/common_runtime/bfc_allocator.cc:1109] Stats:
Limit: 1473839104
InUse: 631785984
MaxInUse: 711906816
NumAllocs: 1148697
MaxAllocSize: 555216640
Reserved: 0
PeakReserved: 0
LargestFreeBlock: 0

2023-09-14 23:47:56.648520: W
tensorflow/core/common_runtime/bfc_allocator.cc:491] ****
*****
```

```

-----
InternalError                                     Traceback (most recent call last)
Cell In[126], line 3
    1 print("[INFO] training the best model...")
    2 model = tuner.hypermodel.build(bestHP)
--> 3 History = model.fit(x=Xtrain, y=Ytrain, validation_data= (Xval,Yval), batch_size=96, epochs=500, verbose=1)

File ~/miniconda3/lib/python3.10/site-packages/keras/utils traceback_utils.py:
  ↵70, in filter_traceback.<locals>.error_handler(*args, **kwargs)
    67     filtered_tb = _process_traceback_frames(e.__traceback__)
    68     # To get the full stack trace, call:
    69     # `tf.debugging.disable_traceback_filtering()`
--> 70     raise e.with_traceback(filtered_tb) from None
    71 finally:
    72     del filtered_tb

File ~/miniconda3/lib/python3.10/site-packages/tensorflow/python/framework/
  ↵constant_op.py:102, in convert_to_eager_tensor(value, ctx, dtype)
    100     dtype = dtypes.as_dtype(dtype).as_datatype_enum
    101 ctx.ensure_initialized()
--> 102 return ops.EagerTensor(value, ctx.device_name, dtype)

InternalError: Failed copying input tensor from /job:localhost/replica:0/task:0/device:CPU:0 to /job:localhost/replica:0/task:0/device:GPU:0 in order to run _EagerConst: Dst tensor is not initialized.

```

```

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

```

	precision	recall	f1-score	support
AXE	0.058	0.375	0.100	8
BACKPACK	0.000	0.000	0.000	6
BASKETBALL	0.000	0.000	0.000	10
BEE	0.023	0.100	0.038	10
BELT	0.000	0.000	0.000	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.000	0.000	0.000	6
CANCER	0.000	0.000	0.000	8
CHRISTMAS	0.000	0.000	0.000	6
CONFUSED	0.000	0.000	0.000	6

DARK	0.000	0.000	0.000	4
DEAF	0.000	0.000	0.000	6
DECIDE	0.000	0.000	0.000	6
DEMAND	0.000	0.000	0.000	8
DEVELOP	0.000	0.000	0.000	6
DINNER	0.016	0.375	0.030	8
DOG	0.000	0.000	0.000	6
DOWNSIZE	0.000	0.000	0.000	8
DRAG	0.000	0.000	0.000	4
EAT	0.000	0.000	0.000	6
EDIT	0.000	0.000	0.000	6
ELEVATOR	0.000	0.000	0.000	8
FINE	0.000	0.000	0.000	4
FLOAT	0.000	0.000	0.000	4
FOREIGNER	0.000	0.000	0.000	6
GUESS	0.000	0.000	0.000	8
HALLOWEEN	0.000	0.000	0.000	8
HOSPITAL	0.000	0.000	0.000	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.000	0.000	0.000	4
KNIGHT	0.000	0.000	0.000	4
LOCK	0.000	0.000	0.000	8
LUNCH	0.000	0.000	0.000	8
MAPLE	0.000	0.000	0.000	4
MEAT	0.000	0.000	0.000	6
MECHANIC	0.000	0.000	0.000	4
MICROSCOPE	0.000	0.000	0.000	8
MOVIE	0.000	0.000	0.000	8
NOON	0.000	0.000	0.000	8
PARTY	0.000	0.000	0.000	8
PATIENT	0.000	0.000	0.000	6
RAZOR	0.000	0.000	0.000	4
RIVER	0.000	0.000	0.000	6
ROCKINGCHAIR	0.000	0.000	0.000	8
SHAVE	0.000	0.000	0.000	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.000	0.000	0.000	4
TWINS	0.000	0.000	0.000	8
WHATFOR	0.000	0.000	0.000	10
accuracy			0.022	324
macro avg	0.002	0.017	0.003	324
weighted avg	0.003	0.022	0.004	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 1DCNN/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

```
[128]: hist_df = pd.read_csv('1 1DCNN/history.csv', index_col=0)
hist_df.tail()
```

	loss	f1_score	val_loss	val_f1_score
495	0.436177	0.859061	3.552348	0.390553
496	0.493882	0.839884	3.623430	0.410118
497	0.486451	0.835061	3.719245	0.396905
498	0.439246	0.850907	3.524067	0.391212
499	0.479134	0.842514	3.654266	0.368043

```
[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]

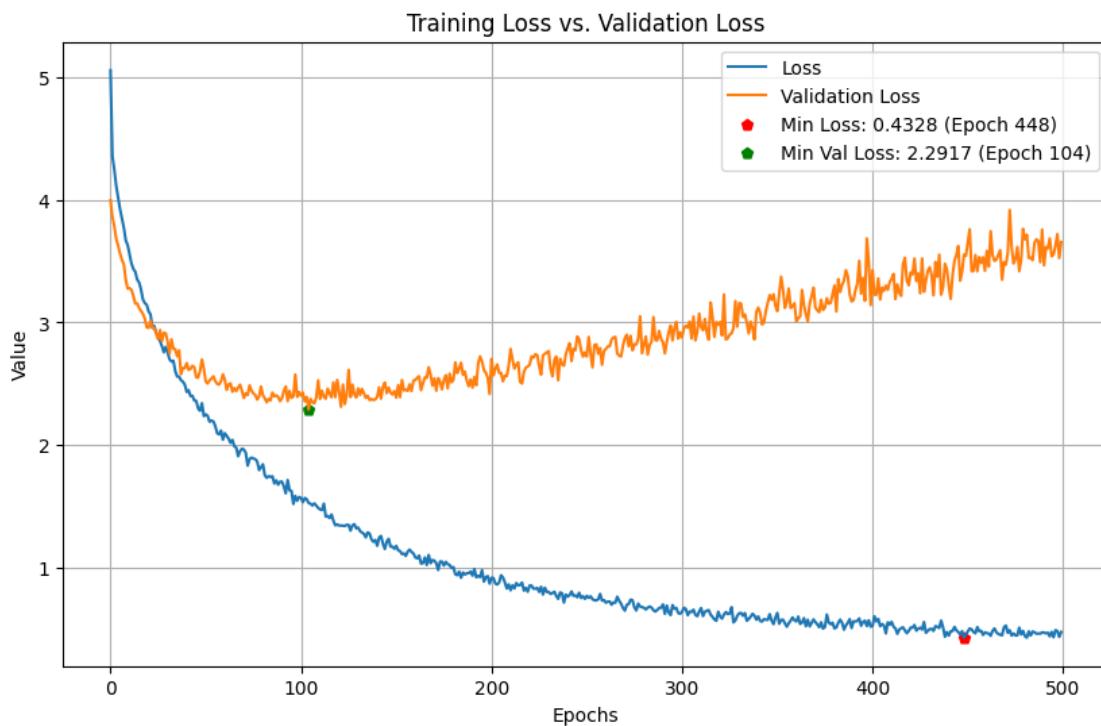
# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (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)

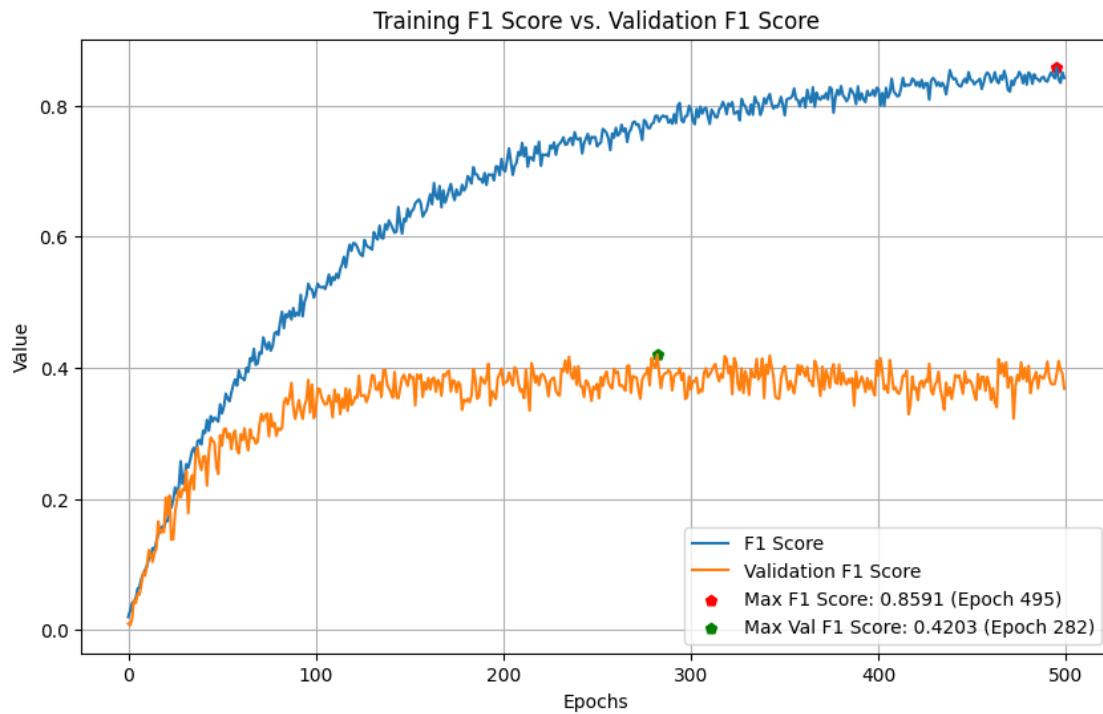
```

```

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()

```



```
[120]: reconstructed_model = tf.keras.models.load_model("1 1DCNN")
```

```
2023-09-15 12:33:12.994407: 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.
```

```
2023-09-15 12:33:13.072810: 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
```

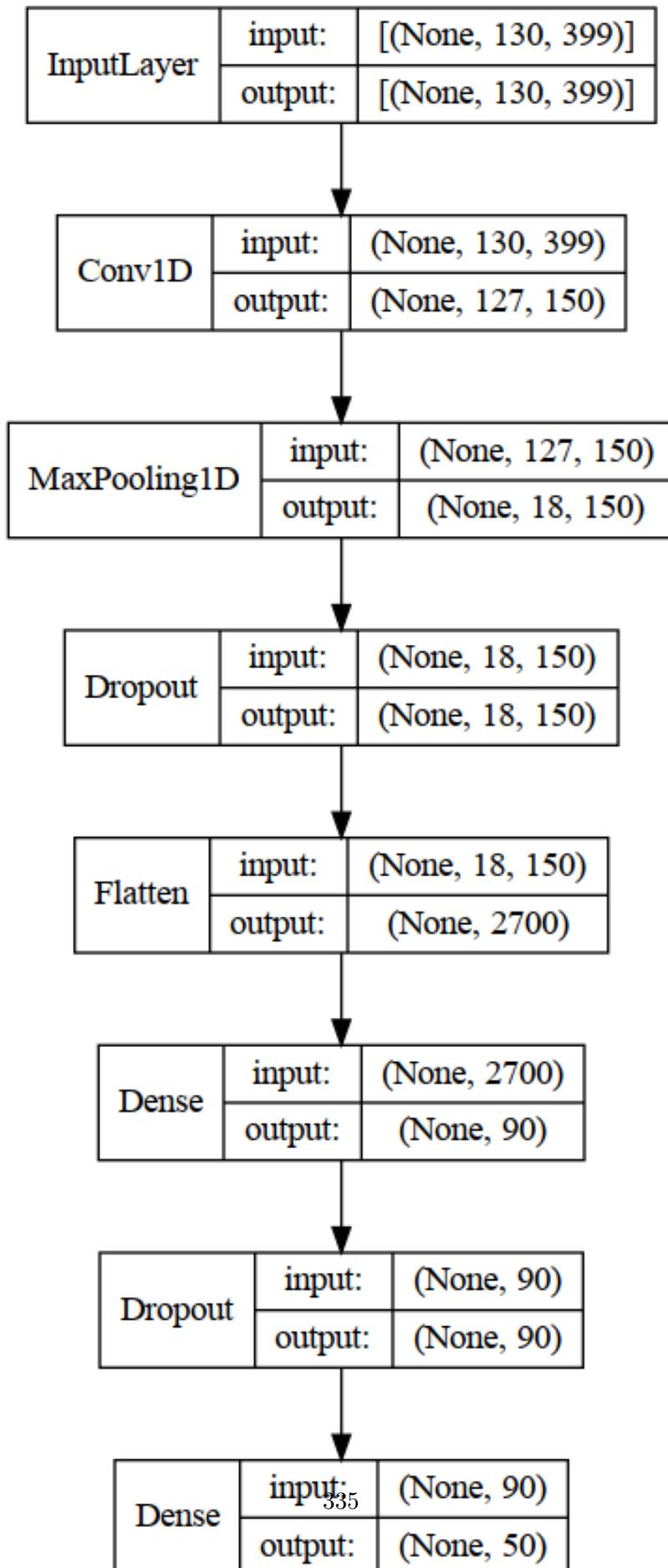
```
[132]: reconstructed_model.summary()
```

```
Model: "sequential"
```

Layer (type)	Output Shape	Param #
conv1d (Conv1D)	(None, 127, 150)	239550
max_pooling1d (MaxPooling1D )	(None, 18, 150)	0
dropout (Dropout)	(None, 18, 150)	0
flatten (Flatten)	(None, 2700)	0
dense (Dense)	(None, 90)	243090
dropout_1 (Dropout)	(None, 90)	0
dense_1 (Dense)	(None, 50)	4550
<hr/>		
Total params: 487,190		
Trainable params: 487,190		
Non-trainable params: 0		

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

```
[133]:
```



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

```
11/11 [=====] - 0s 12ms/step - loss: 2.7388 - f1_score: 0.4203
```

```
[134]: [2.7387735843658447, 0.42028117179870605]
```

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

```
2023-09-14 23:50:01.566405: W tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.
```

```
2023-09-14 23:50:02.082902: W tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.
```

```
84/84 [=====] - 1s 9ms/step - loss: 0.0302 - f1_score: 0.9996
```

```
[135]: [0.030212510377168655, 0.999569833278656]
```

```
[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 [=====] - 0s 7ms/step
```

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

AXE	1.000	0.750	0.857	8
BACKPACK	0.500	0.667	0.571	6
BASKETBALL	0.667	1.000	0.800	10
BEE	0.222	0.200	0.211	10
BELT	0.800	1.000	0.889	4
BITE	0.500	0.125	0.200	8
BREAKFAST	0.000	0.000	0.000	6
CANCER	0.462	0.750	0.571	8
CHRISTMAS	0.200	0.333	0.250	6
CONFUSED	1.000	0.333	0.500	6
DARK	0.667	0.500	0.571	4
DEAF	0.333	0.167	0.222	6
DECIDE	0.400	0.333	0.364	6
DEMAND	0.500	0.125	0.200	8
DEVELOP	0.100	0.167	0.125	6
DINNER	1.000	0.375	0.545	8
DOG	0.167	0.167	0.167	6

DOWNSIZE	0.714	0.625	0.667	8
DRAG	0.000	0.000	0.000	4
EAT	0.667	0.667	0.667	6
EDIT	0.444	0.667	0.533	6
ELEVATOR	0.000	0.000	0.000	8
FINE	0.429	0.750	0.545	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.444	0.667	0.533	6
GUESS	0.571	0.500	0.533	8
HALLOWEEN	0.667	1.000	0.800	8
HOSPITAL	0.222	0.333	0.267	6
HURDLE/TRIP	0.200	0.250	0.222	4
JEWELRY	0.333	0.500	0.400	4
KNIGHT	0.333	0.500	0.400	4
LOCK	0.200	0.125	0.154	8
LUNCH	0.400	0.250	0.308	8
MAPLE	0.375	0.750	0.500	4
MEAT	0.500	1.000	0.667	6
MECHANIC	0.500	0.500	0.500	4
MICROSCOPE	1.000	0.375	0.545	8
MOVIE	0.308	0.500	0.381	8
NOON	0.667	0.750	0.706	8
PARTY	0.000	0.000	0.000	8
PATIENT	0.500	0.167	0.250	6
RAZOR	0.500	0.250	0.333	4
RIVER	1.000	0.667	0.800	6
ROCKINGCHAIR	0.700	0.875	0.778	8
SHAVE	0.455	0.500	0.476	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.333	0.250	0.286	4
THEY	0.333	0.500	0.400	4
TWINS	0.200	0.500	0.286	8
WHATFOR	0.800	0.400	0.533	10
accuracy			0.448	324
macro avg	0.456	0.446	0.420	324
weighted avg	0.471	0.448	0.426	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))

```

## 4.5 Hyperparameter Tuning 2 1D CNN 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', '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_1970154/1773258914.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/CSPNext/hyperband/',
    project_name='2_1D_CNN',
    overwrite=False)
```

```
2023-09-14 23:53:50.493984: 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.
```

```
2023-09-14 23:53:50.574420: I tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device  
/job:localhost/replica:0/task:0/device:GPU:0 with 1405 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: 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 07m 03s]  
val\_f1\_score: 0.28673285245895386

Best val\_f1\_score So Far: 0.625692218542099  
Total elapsed time: 10h 18m 46s  
INFO:tensorflow:Oracle triggered exit

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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/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: 0.625692218542099

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: 0666
Score: 0.6207140684127808

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: 0.6191738843917847
```

```
Trial 0598 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: 0593  
Score: 0.6104321777820587
```

```
Trial 0701 summary  
Hyperparameters:  
dense_activation: elu  
filters_1: 50  
kernel_1: 8  
pool_1: 9  
filters_2: 200  
kernel_2: 4  
pool_2: 3  
dropout_1: 0.2
```

```
units_2: 100
dropout_2: 0.55
learning_rate: 0.00020843099526886985
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0694
Score: 0.5944094359874725
```

```
Trial 0599 summary
Hyperparameters:
dense_activation: elu
filters_1: 125
kernel_1: 8
pool_1: 6
filters_2: 100
kernel_2: 2
pool_2: 4
dropout_1: 0.25
units_2: 90
dropout_2: 0.6000000000000001
learning_rate: 0.0015014961907760683
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0594
Score: 0.5852055847644806
```

```
Trial 0593 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: 0.3500000000000003
units_2: 90
dropout_2: 0.65
learning_rate: 0.0018808082162961115
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0590
```

Score: 0.5789733231067657

Trial 0670 summary  
Hyperparameters:  
dense\_activation: relu  
filters\_1: 175  
kernel\_1: 2  
pool\_1: 4  
filters\_2: 175  
kernel\_2: 4  
pool\_2: 5  
dropout\_1: 0.65  
units\_2: 120  
dropout\_2: 0.0  
learning\_rate: 0.0006767358590353206  
tuner/epochs: 300  
tuner/initial\_epoch: 100  
tuner/bracket: 3  
tuner/round: 3  
tuner/trial\_id: 0664  
Score: 0.567707896232605

Trial 0664 summary  
Hyperparameters:  
dense\_activation: relu  
filters\_1: 175  
kernel\_1: 2  
pool\_1: 4  
filters\_2: 175  
kernel\_2: 4  
pool\_2: 5  
dropout\_1: 0.65  
units\_2: 120  
dropout\_2: 0.0  
learning\_rate: 0.0006767358590353206  
tuner/epochs: 100  
tuner/initial\_epoch: 34  
tuner/bracket: 3  
tuner/round: 2  
tuner/trial\_id: 0653  
Score: 0.5561619997024536

Trial 0426 summary  
Hyperparameters:  
dense\_activation: selu  
filters\_1: 50  
kernel\_1: 5  
pool\_1: 4

```
filters_2: 150
kernel_2: 3
pool_2: 5
dropout_1: 0.65
units_2: 90
dropout_2: 0.15000000000000002
learning_rate: 0.0015228263940738605
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0422
Score: 0.5491477847099304
```

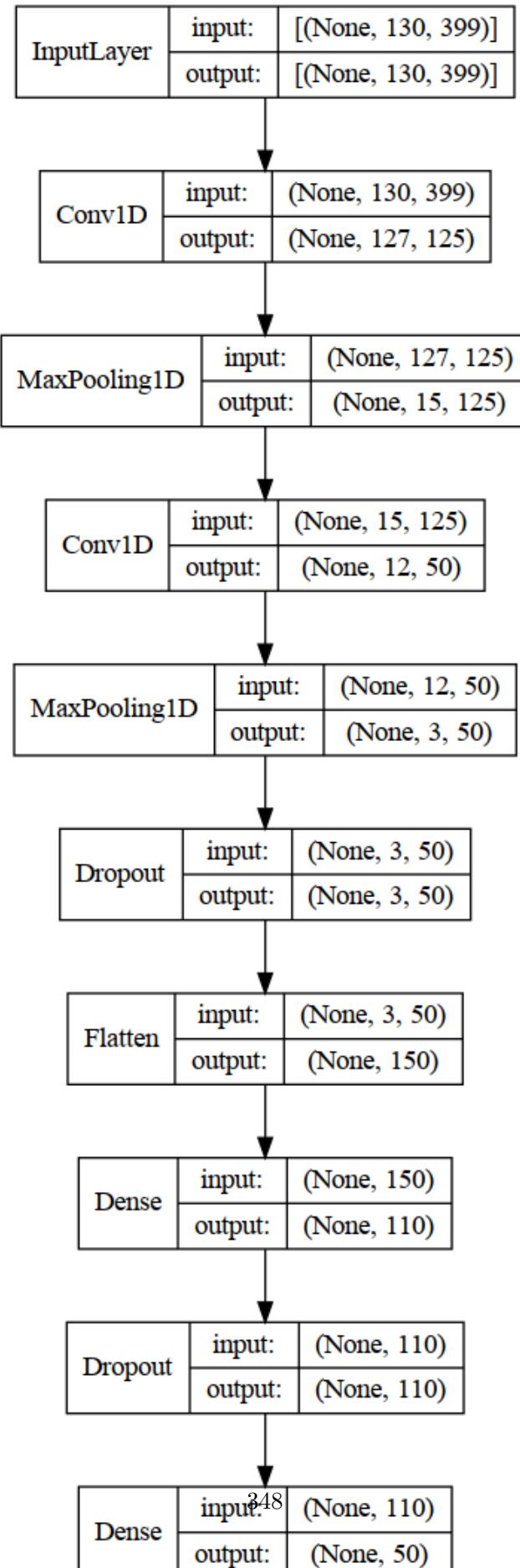
```
[125]: best_model = tuner.get_best_models(num_models=1)[0]
```

```
[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
-----
```

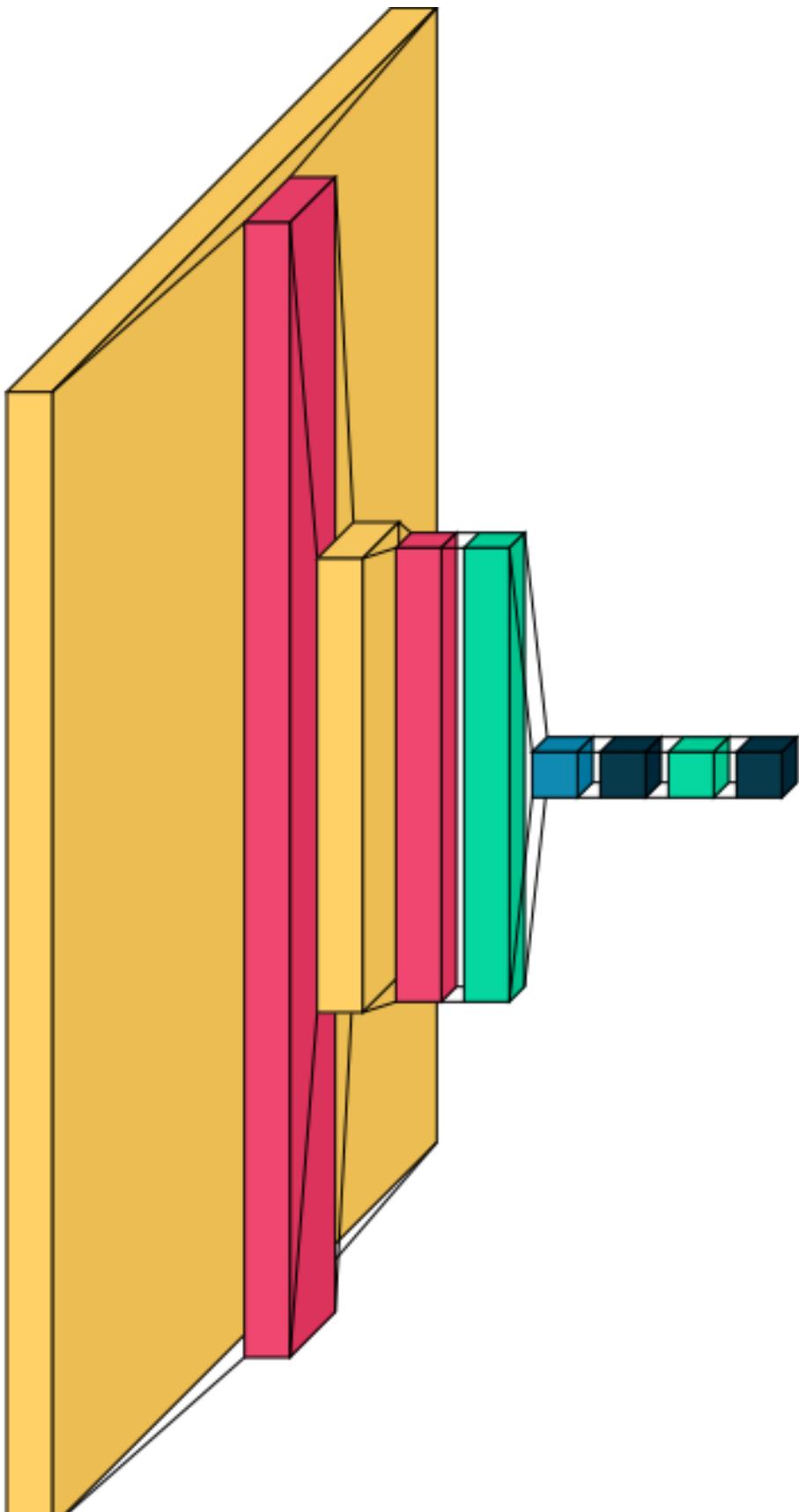
```
[127]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[127]:
```



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

```
[128]:
```



Conv1D



MaxPooling1D

350



Dropout



Flatten



Dense

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

11/11 [=====] - 1s 43ms/step - loss: 1.3178 - f1_score: 0.6397
```

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

84/84 [=====] - 1s 12ms/step - loss: 0.2394 - f1_score: 0.9693
```

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

	precision	recall	f1-score	support
AXE	0.889	1.000	0.941	8
BACKPACK	0.545	1.000	0.706	6
BASKETBALL	0.833	1.000	0.909	10
BEE	0.000	0.000	0.000	10
BELT	0.667	1.000	0.800	4
BITE	1.000	0.500	0.667	8
BREAKFAST	0.500	0.333	0.400	6
CANCER	1.000	0.750	0.857	8
CHRISTMAS	0.750	1.000	0.857	6
CONFUSED	1.000	1.000	1.000	6
DARK	1.000	1.000	1.000	4
DEAF	0.286	0.333	0.308	6
DECIDE	1.000	0.333	0.500	6
DEMAND	1.000	0.375	0.545	8
DEVELOP	0.333	0.333	0.333	6
DINNER	1.000	1.000	1.000	8
DOG	0.375	0.500	0.429	6
DOWNSIZE	0.667	0.750	0.706	8
DRAG	0.667	0.500	0.571	4
EAT	0.800	0.667	0.727	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.556	0.625	0.588	8
FINE	0.500	0.500	0.500	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.667	0.750	0.706	8
HALLOWEEN	0.800	1.000	0.889	8

HOSPITAL	1.000	0.500	0.667	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.400	0.500	0.444	4
LOCK	0.833	0.625	0.714	8
LUNCH	0.500	0.250	0.333	8
MAPLE	0.800	1.000	0.889	4
MEAT	0.444	0.667	0.533	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.333	0.625	0.435	8
NOON	0.889	1.000	0.941	8
PARTY	0.857	0.750	0.800	8
PATIENT	0.000	0.000	0.000	6
RAZOR	0.000	0.000	0.000	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.545	0.600	0.571	10
SINK	0.286	0.333	0.308	6
SQUEEZE	1.000	0.500	0.667	4
THEY	0.571	1.000	0.727	4
TWINS	0.545	0.750	0.632	8
WHATFOR	0.800	0.800	0.800	10
accuracy			0.660	324
macro avg	0.674	0.652	0.640	324
weighted avg	0.682	0.660	0.649	324

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

```
[133]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2_1DCNN/',
    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
27/28 [=====>..] - ETA: 0s - loss: 3.9573 - f1_score: 0.0144

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 [=====] - 14s 403ms/step - loss: 3.9568 - f1_score: 0.0144 - val_loss: 3.9148 - val_f1_score: 0.0101
Epoch 2/500
28/28 [=====] - 1s 48ms/step - loss: 3.9107 - f1_score: 0.0225 - val_loss: 3.9039 - val_f1_score: 0.0070
Epoch 3/500
28/28 [=====] - ETA: 0s - loss: 3.9138 - f1_score: 0.0199

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 224ms/step - loss: 3.9138 - f1_score: 0.0199 - val_loss: 3.8966 - val_f1_score: 0.0178
Epoch 4/500
28/28 [=====] - 1s 47ms/step - loss: 3.8939 - f1_score: 0.0216 - val_loss: 3.8843 - val_f1_score: 0.0136
Epoch 5/500
28/28 [=====] - 1s 47ms/step - loss: 3.8778 - f1_score: 0.0296 - val_loss: 3.8610 - val_f1_score: 0.0164
Epoch 6/500
27/28 [=====>..] - ETA: 0s - loss: 3.8532 - f1_score: 0.0307

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: 3.8523 - f1_score: 0.0309 - val_loss: 3.8332 - val_f1_score: 0.0274
Epoch 7/500
28/28 [=====] - 1s 48ms/step - loss: 3.8266 - f1_score: 0.0351 - val_loss: 3.7954 - val_f1_score: 0.0268
```

```
Epoch 8/500
27/28 [=====>..] - ETA: 0s - loss: 3.7816 - f1_score: 0.0423

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 187ms/step - loss: 3.7810 - f1_score: 0.0429 - val_loss: 3.7417 - val_f1_score: 0.0302
Epoch 9/500
27/28 [=====>..] - ETA: 0s - loss: 3.7556 - f1_score: 0.0383

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 215ms/step - loss: 3.7531 - f1_score: 0.0403 - val_loss: 3.6772 - val_f1_score: 0.0600
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 3.7065 - f1_score: 0.0520

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 223ms/step - loss: 3.7065 - f1_score: 0.0520 - val_loss: 3.6289 - val_f1_score: 0.0684
Epoch 11/500
28/28 [=====] - 1s 46ms/step - loss: 3.6498 - f1_score: 0.0548 - val_loss: 3.5674 - val_f1_score: 0.0597
Epoch 12/500
28/28 [=====] - ETA: 0s - loss: 3.5860 - f1_score: 0.0648

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
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INFO:tensorflow:Assets written to: 2 1DCNN/assets
28/28 [=====] - 6s 203ms/step - loss: 3.5860 -
f1_score: 0.0648 - val_loss: 3.4853 - val_f1_score: 0.0969
Epoch 13/500
28/28 [=====] - 1s 52ms/step - loss: 3.5363 - f1_score:
0.0715 - val_loss: 3.4204 - val_f1_score: 0.0955
Epoch 14/500
28/28 [=====] - ETA: 0s - loss: 3.4926 - f1_score:
0.0672

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 203ms/step - loss: 3.4926 -
f1_score: 0.0672 - val_loss: 3.3826 - val_f1_score: 0.1001
Epoch 15/500
27/28 [=====>..] - ETA: 0s - loss: 3.4252 - f1_score:
0.0799

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 196ms/step - loss: 3.4271 -
f1_score: 0.0794 - val_loss: 3.2903 - val_f1_score: 0.1016
Epoch 16/500
28/28 [=====] - ETA: 0s - loss: 3.3797 - f1_score:
0.0929

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: 3.3797 -
f1_score: 0.0929 - val_loss: 3.2254 - val_f1_score: 0.1137
Epoch 17/500
28/28 [=====] - 1s 47ms/step - loss: 3.3096 - f1_score:
0.1040 - val_loss: 3.1700 - val_f1_score: 0.1073
Epoch 18/500
28/28 [=====] - 1s 48ms/step - loss: 3.2708 - f1_score:
```

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0.0912 - val_loss: 3.0934 - val_f1_score: 0.1135
Epoch 19/500
28/28 [=====] - 1s 49ms/step - loss: 3.2187 - f1_score: 0.1084 - val_loss: 3.0557 - val_f1_score: 0.1115
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 3.1547 - f1_score: 0.1159

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 211ms/step - loss: 3.1547 -
f1_score: 0.1159 - val_loss: 3.0046 - val_f1_score: 0.1413
Epoch 21/500
28/28 [=====] - 1s 46ms/step - loss: 3.1147 - f1_score: 0.1364 - val_loss: 2.9526 - val_f1_score: 0.1186
Epoch 22/500
28/28 [=====] - 1s 45ms/step - loss: 3.0634 - f1_score: 0.1429 - val_loss: 2.9130 - val_f1_score: 0.1226
Epoch 23/500
27/28 [=====>..] - ETA: 0s - loss: 3.0310 - f1_score: 0.1361

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 196ms/step - loss: 3.0375 -
f1_score: 0.1335 - val_loss: 2.8533 - val_f1_score: 0.1488
Epoch 24/500
27/28 [=====>..] - ETA: 0s - loss: 3.0019 - f1_score: 0.1498

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 187ms/step - loss: 2.9989 -
f1_score: 0.1500 - val_loss: 2.8227 - val_f1_score: 0.1544
Epoch 25/500
```

```
27/28 [=====>..] - ETA: 0s - loss: 2.9791 - f1_score: 0.1496
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 220ms/step - loss: 2.9776 - f1_score: 0.1503 - val_loss: 2.7896 - val_f1_score: 0.1679
Epoch 26/500
27/28 [=====>..] - ETA: 0s - loss: 2.9444 - f1_score: 0.1506
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 [=====] - 13s 489ms/step - loss: 2.9369 - f1_score: 0.1532 - val_loss: 2.7445 - val_f1_score: 0.1874
Epoch 27/500
28/28 [=====] - ETA: 0s - loss: 2.8928 - f1_score: 0.1605
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: 2.8928 - f1_score: 0.1605 - val_loss: 2.7166 - val_f1_score: 0.1965
Epoch 28/500
27/28 [=====>..] - ETA: 0s - loss: 2.8892 - f1_score: 0.1642
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 185ms/step - loss: 2.8912 - f1_score: 0.1632 - val_loss: 2.6914 - val_f1_score: 0.1968
Epoch 29/500
```

```
28/28 [=====] - 1s 44ms/step - loss: 2.8214 - f1_score: 0.1873 - val_loss: 2.6665 - val_f1_score: 0.1956
Epoch 30/500
27/28 [=====>..] - ETA: 0s - loss: 2.8029 - f1_score: 0.1913

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: 2.7986 -
f1_score: 0.1906 - val_loss: 2.6240 - val_f1_score: 0.2153
Epoch 31/500
27/28 [=====>..] - ETA: 0s - loss: 2.7823 - f1_score: 0.1853

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 190ms/step - loss: 2.7839 -
f1_score: 0.1855 - val_loss: 2.6089 - val_f1_score: 0.2252
Epoch 32/500
28/28 [=====] - 1s 45ms/step - loss: 2.7419 - f1_score: 0.1931 - val_loss: 2.5889 - val_f1_score: 0.2054
Epoch 33/500
27/28 [=====>..] - ETA: 0s - loss: 2.6978 - f1_score: 0.2030

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 217ms/step - loss: 2.6954 -
f1_score: 0.2048 - val_loss: 2.5316 - val_f1_score: 0.2400
Epoch 34/500
28/28 [=====] - ETA: 0s - loss: 2.6871 - f1_score: 0.2209

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 [=====] - 8s 283ms/step - loss: 2.6871 -
f1_score: 0.2209 - val_loss: 2.5557 - val_f1_score: 0.2700
Epoch 35/500
27/28 [=====>..] - ETA: 0s - loss: 2.6726 - f1_score:
0.2139

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: 2.6695 -
f1_score: 0.2140 - val_loss: 2.5055 - val_f1_score: 0.2728
Epoch 36/500
28/28 [=====] - 1s 52ms/step - loss: 2.6422 - f1_score:
0.2334 - val_loss: 2.4574 - val_f1_score: 0.2549
Epoch 37/500
28/28 [=====] - 1s 49ms/step - loss: 2.5862 - f1_score:
0.2340 - val_loss: 2.4647 - val_f1_score: 0.2390
Epoch 38/500
27/28 [=====>..] - ETA: 0s - loss: 2.5744 - f1_score:
0.2344

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 247ms/step - loss: 2.5707 -
f1_score: 0.2341 - val_loss: 2.4144 - val_f1_score: 0.2790
Epoch 39/500
27/28 [=====>..] - ETA: 0s - loss: 2.5614 - f1_score:
0.2497

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 [=====] - 12s 436ms/step - loss: 2.5590 -
f1_score: 0.2480 - val_loss: 2.4068 - val_f1_score: 0.3079
Epoch 40/500
```

```
28/28 [=====] - 1s 49ms/step - loss: 2.5482 - f1_score: 0.2422 - val_loss: 2.3715 - val_f1_score: 0.2987
Epoch 41/500
28/28 [=====] - ETA: 0s - loss: 2.4928 - f1_score: 0.2511

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 239ms/step - loss: 2.4928 - f1_score: 0.2511 - val_loss: 2.3604 - val_f1_score: 0.3234
Epoch 42/500
28/28 [=====] - 1s 47ms/step - loss: 2.4871 - f1_score: 0.2630 - val_loss: 2.3493 - val_f1_score: 0.2971
Epoch 43/500
27/28 [=====>..] - ETA: 0s - loss: 2.4502 - f1_score: 0.2733

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: 2.4496 - f1_score: 0.2743 - val_loss: 2.3165 - val_f1_score: 0.3281
Epoch 44/500
27/28 [=====>..] - ETA: 0s - loss: 2.4601 - f1_score: 0.2633

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: 2.4659 - f1_score: 0.2631 - val_loss: 2.3294 - val_f1_score: 0.3361
Epoch 45/500
28/28 [=====] - 1s 49ms/step - loss: 2.4197 - f1_score: 0.2836 - val_loss: 2.2973 - val_f1_score: 0.3323
Epoch 46/500
27/28 [=====>..] - ETA: 0s - loss: 2.4042 - f1_score: 0.2794
```

```
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: 2.4024 -
f1_score: 0.2804 - val_loss: 2.2575 - val_f1_score: 0.3403
Epoch 47/500
27/28 [=====>..] - ETA: 0s - loss: 2.3478 - f1_score:
0.2993

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 202ms/step - loss: 2.3466 -
f1_score: 0.2992 - val_loss: 2.2505 - val_f1_score: 0.3521
Epoch 48/500
28/28 [=====] - 1s 45ms/step - loss: 2.3631 - f1_score:
0.2834 - val_loss: 2.2498 - val_f1_score: 0.3388
Epoch 49/500
27/28 [=====>..] - ETA: 0s - loss: 2.3604 - f1_score:
0.2904

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: 2.3631 -
f1_score: 0.2904 - val_loss: 2.2289 - val_f1_score: 0.3620
Epoch 50/500
27/28 [=====>..] - ETA: 0s - loss: 2.3448 - f1_score:
0.3060

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 219ms/step - loss: 2.3370 -
f1_score: 0.3087 - val_loss: 2.1963 - val_f1_score: 0.3660
```

```
Epoch 51/500
28/28 [=====] - ETA: 0s - loss: 2.3077 - f1_score: 0.3207
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: 2.3077 - f1_score: 0.3207 - val_loss: 2.2043 - val_f1_score: 0.3762
Epoch 52/500
28/28 [=====] - ETA: 0s - loss: 2.2735 - f1_score: 0.3140
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: 2.2735 - f1_score: 0.3140 - val_loss: 2.1570 - val_f1_score: 0.4046
Epoch 53/500
28/28 [=====] - 1s 48ms/step - loss: 2.2864 - f1_score: 0.3051 - val_loss: 2.1649 - val_f1_score: 0.3949
Epoch 54/500
28/28 [=====] - 1s 46ms/step - loss: 2.2122 - f1_score: 0.3413 - val_loss: 2.1615 - val_f1_score: 0.3632
Epoch 55/500
27/28 [=====>..] - ETA: 0s - loss: 2.1874 - f1_score: 0.3290
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 239ms/step - loss: 2.1934 - f1_score: 0.3291 - val_loss: 2.1020 - val_f1_score: 0.4204
Epoch 56/500
28/28 [=====] - 1s 52ms/step - loss: 2.2051 - f1_score: 0.3333 - val_loss: 2.1036 - val_f1_score: 0.3827
Epoch 57/500
28/28 [=====] - 1s 46ms/step - loss: 2.1633 - f1_score: 0.3460 - val_loss: 2.0851 - val_f1_score: 0.3958
```

```
Epoch 58/500
28/28 [=====] - 1s 48ms/step - loss: 2.1321 - f1_score: 0.3645 - val_loss: 2.0623 - val_f1_score: 0.4140
Epoch 59/500
28/28 [=====] - 1s 47ms/step - loss: 2.1367 - f1_score: 0.3588 - val_loss: 2.0790 - val_f1_score: 0.4058
Epoch 60/500
28/28 [=====] - 1s 50ms/step - loss: 2.1335 - f1_score: 0.3569 - val_loss: 2.0518 - val_f1_score: 0.4175
Epoch 61/500
27/28 [=====>..] - ETA: 0s - loss: 2.1291 - f1_score: 0.3521

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 204ms/step - loss: 2.1242 - f1_score: 0.3538 - val_loss: 2.0338 - val_f1_score: 0.4259
Epoch 62/500
27/28 [=====>..] - ETA: 0s - loss: 2.0655 - f1_score: 0.3874

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: 2.0632 - f1_score: 0.3842 - val_loss: 1.9965 - val_f1_score: 0.4363
Epoch 63/500
28/28 [=====] - 1s 46ms/step - loss: 2.0725 - f1_score: 0.3798 - val_loss: 1.9848 - val_f1_score: 0.4157
Epoch 64/500
28/28 [=====] - 1s 46ms/step - loss: 2.0787 - f1_score: 0.3671 - val_loss: 1.9986 - val_f1_score: 0.4113
Epoch 65/500
28/28 [=====] - 1s 49ms/step - loss: 2.0194 - f1_score: 0.3947 - val_loss: 1.9793 - val_f1_score: 0.4217
Epoch 66/500
28/28 [=====] - 1s 46ms/step - loss: 2.0383 - f1_score: 0.3767 - val_loss: 1.9734 - val_f1_score: 0.4209
Epoch 67/500
28/28 [=====] - 1s 46ms/step - loss: 2.0221 - f1_score: 0.3810 - val_loss: 1.9502 - val_f1_score: 0.4226
```

```
Epoch 68/500
27/28 [=====>..] - ETA: 0s - loss: 1.9808 - f1_score: 0.3913

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: 1.9857 - f1_score: 0.3916 - val_loss: 1.9420 - val_f1_score: 0.4506
Epoch 69/500
27/28 [=====>..] - ETA: 0s - loss: 1.9876 - f1_score: 0.3832

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: 1.9861 - f1_score: 0.3845 - val_loss: 1.9136 - val_f1_score: 0.4554
Epoch 70/500
28/28 [=====] - ETA: 0s - loss: 1.9604 - f1_score: 0.3920

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 227ms/step - loss: 1.9604 - f1_score: 0.3920 - val_loss: 1.9195 - val_f1_score: 0.4662
Epoch 71/500
28/28 [=====] - 1s 46ms/step - loss: 1.9184 - f1_score: 0.4045 - val_loss: 1.8886 - val_f1_score: 0.4566
Epoch 72/500
28/28 [=====] - 1s 46ms/step - loss: 1.9376 - f1_score: 0.4185 - val_loss: 1.9248 - val_f1_score: 0.4232
Epoch 73/500
28/28 [=====] - 1s 46ms/step - loss: 1.9033 - f1_score: 0.4185 - val_loss: 1.8882 - val_f1_score: 0.4534
Epoch 74/500
28/28 [=====] - 1s 53ms/step - loss: 1.8843 - f1_score: 0.4179 - val_loss: 1.8577 - val_f1_score: 0.4550
```

```
Epoch 75/500
28/28 [=====] - 1s 46ms/step - loss: 1.8924 - f1_score: 0.4259 - val_loss: 1.8856 - val_f1_score: 0.4369
Epoch 76/500
28/28 [=====] - 1s 47ms/step - loss: 1.8825 - f1_score: 0.4338 - val_loss: 1.8679 - val_f1_score: 0.4602
Epoch 77/500
28/28 [=====] - 1s 46ms/step - loss: 1.8387 - f1_score: 0.4392 - val_loss: 1.8574 - val_f1_score: 0.4561
Epoch 78/500
27/28 [=====>..] - ETA: 0s - loss: 1.8513 - f1_score: 0.4275

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 231ms/step - loss: 1.8460 - f1_score: 0.4296 - val_loss: 1.8278 - val_f1_score: 0.4813
Epoch 79/500
27/28 [=====>..] - ETA: 0s - loss: 1.8297 - f1_score: 0.4388

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 205ms/step - loss: 1.8266 - f1_score: 0.4385 - val_loss: 1.8149 - val_f1_score: 0.4863
Epoch 80/500
28/28 [=====] - 1s 47ms/step - loss: 1.8122 - f1_score: 0.4471 - val_loss: 1.8151 - val_f1_score: 0.4853
Epoch 81/500
28/28 [=====] - 1s 45ms/step - loss: 1.7995 - f1_score: 0.4360 - val_loss: 1.7962 - val_f1_score: 0.4861
Epoch 82/500
28/28 [=====] - 1s 49ms/step - loss: 1.7811 - f1_score: 0.4401 - val_loss: 1.7748 - val_f1_score: 0.4562
Epoch 83/500
28/28 [=====] - 1s 45ms/step - loss: 1.7811 - f1_score: 0.4593 - val_loss: 1.7929 - val_f1_score: 0.4617
Epoch 84/500
28/28 [=====] - 1s 46ms/step - loss: 1.7591 - f1_score: 0.4580 - val_loss: 1.7772 - val_f1_score: 0.4776
```

```
Epoch 85/500
28/28 [=====] - 1s 46ms/step - loss: 1.7338 - f1_score: 0.4540 - val_loss: 1.7917 - val_f1_score: 0.4546
Epoch 86/500
28/28 [=====] - 1s 49ms/step - loss: 1.7491 - f1_score: 0.4538 - val_loss: 1.7495 - val_f1_score: 0.4517
Epoch 87/500
28/28 [=====] - 1s 46ms/step - loss: 1.7210 - f1_score: 0.4623 - val_loss: 1.7591 - val_f1_score: 0.4827
Epoch 88/500
28/28 [=====] - 1s 46ms/step - loss: 1.7169 - f1_score: 0.4709 - val_loss: 1.7587 - val_f1_score: 0.4719
Epoch 89/500
27/28 [=====>..] - ETA: 0s - loss: 1.6864 - f1_score: 0.4817

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 214ms/step - loss: 1.6872 - f1_score: 0.4791 - val_loss: 1.7123 - val_f1_score: 0.4981
Epoch 90/500
28/28 [=====] - 1s 49ms/step - loss: 1.7035 - f1_score: 0.4869 - val_loss: 1.7438 - val_f1_score: 0.4690
Epoch 91/500
28/28 [=====] - 1s 49ms/step - loss: 1.6724 - f1_score: 0.4897 - val_loss: 1.7488 - val_f1_score: 0.4888
Epoch 92/500
28/28 [=====] - 1s 50ms/step - loss: 1.6598 - f1_score: 0.4863 - val_loss: 1.7476 - val_f1_score: 0.4705
Epoch 93/500
28/28 [=====] - 2s 57ms/step - loss: 1.6543 - f1_score: 0.4745 - val_loss: 1.7089 - val_f1_score: 0.4794
Epoch 94/500
28/28 [=====] - 1s 48ms/step - loss: 1.5975 - f1_score: 0.4923 - val_loss: 1.7026 - val_f1_score: 0.4740
Epoch 95/500
28/28 [=====] - 1s 48ms/step - loss: 1.6408 - f1_score: 0.4816 - val_loss: 1.7068 - val_f1_score: 0.4727
Epoch 96/500
27/28 [=====>..] - ETA: 0s - loss: 1.5971 - f1_score: 0.5056

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 222ms/step - loss: 1.5995 - f1_score: 0.5019 - val_loss: 1.6943 - val_f1_score: 0.5108
Epoch 97/500
28/28 [=====] - 1s 53ms/step - loss: 1.6015 - f1_score: 0.5034 - val_loss: 1.6833 - val_f1_score: 0.4965
Epoch 98/500
28/28 [=====] - 2s 73ms/step - loss: 1.5994 - f1_score: 0.4954 - val_loss: 1.6802 - val_f1_score: 0.4848
Epoch 99/500
28/28 [=====] - 2s 63ms/step - loss: 1.5614 - f1_score: 0.5244 - val_loss: 1.6842 - val_f1_score: 0.4897
Epoch 100/500
28/28 [=====] - 2s 60ms/step - loss: 1.5702 - f1_score: 0.5148 - val_loss: 1.6550 - val_f1_score: 0.4832
Epoch 101/500
27/28 [=====>..] - ETA: 0s - loss: 1.5188 - f1_score: 0.5230
```

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: 1.5202 - f1_score: 0.5217 - val_loss: 1.6345 - val_f1_score: 0.5177
Epoch 102/500
28/28 [=====] - 1s 47ms/step - loss: 1.5528 - f1_score: 0.5186 - val_loss: 1.7120 - val_f1_score: 0.4672
Epoch 103/500
28/28 [=====] - 1s 47ms/step - loss: 1.5475 - f1_score: 0.5286 - val_loss: 1.6337 - val_f1_score: 0.5016
Epoch 104/500
28/28 [=====] - 1s 54ms/step - loss: 1.4986 - f1_score: 0.5370 - val_loss: 1.6470 - val_f1_score: 0.4966
Epoch 105/500
28/28 [=====] - 1s 46ms/step - loss: 1.5221 - f1_score: 0.5265 - val_loss: 1.6110 - val_f1_score: 0.5079
Epoch 106/500
28/28 [=====] - 1s 47ms/step - loss: 1.5016 - f1_score: 0.5417 - val_loss: 1.6199 - val_f1_score: 0.5103
Epoch 107/500
28/28 [=====] - 1s 48ms/step - loss: 1.4970 - f1_score:
```

```
0.5458 - val_loss: 1.6076 - val_f1_score: 0.5063
Epoch 108/500
28/28 [=====] - 1s 53ms/step - loss: 1.4966 - f1_score: 0.5366 - val_loss: 1.6531 - val_f1_score: 0.4841
Epoch 109/500
28/28 [=====] - 1s 49ms/step - loss: 1.4864 - f1_score: 0.5439 - val_loss: 1.6186 - val_f1_score: 0.4850
Epoch 110/500
28/28 [=====] - 1s 49ms/step - loss: 1.4572 - f1_score: 0.5533 - val_loss: 1.6012 - val_f1_score: 0.5001
Epoch 111/500
28/28 [=====] - 1s 53ms/step - loss: 1.4859 - f1_score: 0.5420 - val_loss: 1.5900 - val_f1_score: 0.4998
Epoch 112/500
28/28 [=====] - 1s 49ms/step - loss: 1.4561 - f1_score: 0.5446 - val_loss: 1.5893 - val_f1_score: 0.5065
Epoch 113/500
27/28 [=====>..] - ETA: 0s - loss: 1.4379 - f1_score: 0.5541

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 247ms/step - loss: 1.4416 - f1_score: 0.5531 - val_loss: 1.5724 - val_f1_score: 0.5244
Epoch 114/500
28/28 [=====] - 1s 51ms/step - loss: 1.4503 - f1_score: 0.5441 - val_loss: 1.5790 - val_f1_score: 0.5107
Epoch 115/500
28/28 [=====] - 1s 48ms/step - loss: 1.4184 - f1_score: 0.5480 - val_loss: 1.5644 - val_f1_score: 0.5105
Epoch 116/500
28/28 [=====] - 1s 50ms/step - loss: 1.4265 - f1_score: 0.5576 - val_loss: 1.5568 - val_f1_score: 0.5153
Epoch 117/500
28/28 [=====] - 1s 47ms/step - loss: 1.4257 - f1_score: 0.5536 - val_loss: 1.5519 - val_f1_score: 0.5160
Epoch 118/500
28/28 [=====] - 1s 54ms/step - loss: 1.3942 - f1_score: 0.5582 - val_loss: 1.5562 - val_f1_score: 0.5126
Epoch 119/500
28/28 [=====] - 1s 50ms/step - loss: 1.3690 - f1_score: 0.5649 - val_loss: 1.5552 - val_f1_score: 0.5103
Epoch 120/500
28/28 [=====] - ETA: 0s - loss: 1.3858 - f1_score:
```

0.5697

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: 1.3858 -  
f1\_score: 0.5697 - val\_loss: 1.5870 - val\_f1\_score: 0.5268  
Epoch 121/500  
27/28 [=====>..] - ETA: 0s - loss: 1.3949 - f1\_score:  
0.5703

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 223ms/step - loss: 1.3913 -  
f1\_score: 0.5709 - val\_loss: 1.5477 - val\_f1\_score: 0.5318  
Epoch 122/500  
27/28 [=====>..] - ETA: 0s - loss: 1.3540 - f1\_score:  
0.5804

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 245ms/step - loss: 1.3611 -  
f1\_score: 0.5785 - val\_loss: 1.5141 - val\_f1\_score: 0.5384  
Epoch 123/500  
28/28 [=====] - 1s 48ms/step - loss: 1.3526 - f1\_score:  
0.5714 - val\_loss: 1.5640 - val\_f1\_score: 0.5093  
Epoch 124/500  
28/28 [=====] - 1s 48ms/step - loss: 1.3513 - f1\_score:  
0.5727 - val\_loss: 1.5017 - val\_f1\_score: 0.5350  
Epoch 125/500  
28/28 [=====] - 2s 56ms/step - loss: 1.3204 - f1\_score:  
0.5784 - val\_loss: 1.5570 - val\_f1\_score: 0.5038  
Epoch 126/500  
28/28 [=====] - 1s 51ms/step - loss: 1.3200 - f1\_score:  
0.5886 - val\_loss: 1.5379 - val\_f1\_score: 0.5070  
Epoch 127/500  
28/28 [=====] - 1s 49ms/step - loss: 1.3096 - f1\_score:

```
0.5910 - val_loss: 1.5394 - val_f1_score: 0.5150
Epoch 128/500
28/28 [=====] - 1s 47ms/step - loss: 1.3130 - f1_score: 0.5783 - val_loss: 1.5374 - val_f1_score: 0.5113
Epoch 129/500
28/28 [=====] - 2s 58ms/step - loss: 1.3213 - f1_score: 0.5891 - val_loss: 1.5173 - val_f1_score: 0.5161
Epoch 130/500
28/28 [=====] - 1s 49ms/step - loss: 1.2940 - f1_score: 0.5895 - val_loss: 1.5092 - val_f1_score: 0.5227
Epoch 131/500
28/28 [=====] - 1s 48ms/step - loss: 1.3023 - f1_score: 0.5872 - val_loss: 1.5715 - val_f1_score: 0.4994
Epoch 132/500
28/28 [=====] - ETA: 0s - loss: 1.2794 - f1_score: 0.5949
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 [=====] - 10s 357ms/step - loss: 1.2794 - f1_score: 0.5949 - val_loss: 1.4702 - val_f1_score: 0.5489
Epoch 133/500
28/28 [=====] - 1s 51ms/step - loss: 1.2835 - f1_score: 0.6034 - val_loss: 1.5055 - val_f1_score: 0.5307
Epoch 134/500
28/28 [=====] - 1s 47ms/step - loss: 1.2631 - f1_score: 0.6030 - val_loss: 1.5070 - val_f1_score: 0.5279
Epoch 135/500
28/28 [=====] - 1s 49ms/step - loss: 1.2685 - f1_score: 0.6055 - val_loss: 1.4804 - val_f1_score: 0.5418
Epoch 136/500
28/28 [=====] - 1s 50ms/step - loss: 1.2548 - f1_score: 0.5997 - val_loss: 1.5123 - val_f1_score: 0.5284
Epoch 137/500
28/28 [=====] - 2s 58ms/step - loss: 1.2330 - f1_score: 0.6095 - val_loss: 1.5021 - val_f1_score: 0.5269
Epoch 138/500
28/28 [=====] - 2s 54ms/step - loss: 1.2330 - f1_score: 0.6165 - val_loss: 1.4487 - val_f1_score: 0.5487
Epoch 139/500
28/28 [=====] - 1s 49ms/step - loss: 1.2193 - f1_score: 0.6263 - val_loss: 1.4502 - val_f1_score: 0.5442
Epoch 140/500
28/28 [=====] - 2s 55ms/step - loss: 1.2267 - f1_score:
```

```
0.5994 - val_loss: 1.5108 - val_f1_score: 0.5246
Epoch 141/500
27/28 [=====>..] - ETA: 0s - loss: 1.1906 - f1_score:
0.6340

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 185ms/step - loss: 1.1934 -
f1_score: 0.6338 - val_loss: 1.4543 - val_f1_score: 0.5523
Epoch 142/500
28/28 [=====] - 1s 49ms/step - loss: 1.1993 - f1_score:
0.6247 - val_loss: 1.4895 - val_f1_score: 0.5459
Epoch 143/500
28/28 [=====] - 1s 48ms/step - loss: 1.2032 - f1_score:
0.6294 - val_loss: 1.4519 - val_f1_score: 0.5424
Epoch 144/500
28/28 [=====] - 1s 48ms/step - loss: 1.2030 - f1_score:
0.6182 - val_loss: 1.4432 - val_f1_score: 0.5422
Epoch 145/500
28/28 [=====] - 1s 52ms/step - loss: 1.1856 - f1_score:
0.6258 - val_loss: 1.4500 - val_f1_score: 0.5513
Epoch 146/500
28/28 [=====] - 1s 51ms/step - loss: 1.2017 - f1_score:
0.6170 - val_loss: 1.4411 - val_f1_score: 0.5269
Epoch 147/500
28/28 [=====] - 1s 48ms/step - loss: 1.1939 - f1_score:
0.6246 - val_loss: 1.4747 - val_f1_score: 0.5121
Epoch 148/500
28/28 [=====] - 1s 53ms/step - loss: 1.1687 - f1_score:
0.6412 - val_loss: 1.4265 - val_f1_score: 0.5490
Epoch 149/500
28/28 [=====] - 1s 49ms/step - loss: 1.1597 - f1_score:
0.6317 - val_loss: 1.4520 - val_f1_score: 0.5430
Epoch 150/500
27/28 [=====>..] - ETA: 0s - loss: 1.1475 - f1_score:
0.6388

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 [=====] - 8s 286ms/step - loss: 1.1480 -  
f1_score: 0.6398 - val_loss: 1.4353 - val_f1_score: 0.5817  
Epoch 151/500  
28/28 [=====] - 2s 56ms/step - loss: 1.1383 - f1_score:  
0.6323 - val_loss: 1.4529 - val_f1_score: 0.5529  
Epoch 152/500  
28/28 [=====] - 1s 48ms/step - loss: 1.1310 - f1_score:  
0.6400 - val_loss: 1.4451 - val_f1_score: 0.5408  
Epoch 153/500  
28/28 [=====] - 1s 48ms/step - loss: 1.1552 - f1_score:  
0.6377 - val_loss: 1.4362 - val_f1_score: 0.5558  
Epoch 154/500  
28/28 [=====] - 1s 53ms/step - loss: 1.1260 - f1_score:  
0.6329 - val_loss: 1.4229 - val_f1_score: 0.5477  
Epoch 155/500  
28/28 [=====] - 1s 49ms/step - loss: 1.1355 - f1_score:  
0.6452 - val_loss: 1.4226 - val_f1_score: 0.5521  
Epoch 156/500  
28/28 [=====] - 1s 50ms/step - loss: 1.1311 - f1_score:  
0.6329 - val_loss: 1.4224 - val_f1_score: 0.5547  
Epoch 157/500  
28/28 [=====] - 1s 49ms/step - loss: 1.1144 - f1_score:  
0.6379 - val_loss: 1.4260 - val_f1_score: 0.5768  
Epoch 158/500  
28/28 [=====] - 1s 53ms/step - loss: 1.1234 - f1_score:  
0.6513 - val_loss: 1.4239 - val_f1_score: 0.5649  
Epoch 159/500  
28/28 [=====] - 2s 54ms/step - loss: 1.0823 - f1_score:  
0.6512 - val_loss: 1.4135 - val_f1_score: 0.5708  
Epoch 160/500  
28/28 [=====] - 1s 54ms/step - loss: 1.0831 - f1_score:  
0.6555 - val_loss: 1.4354 - val_f1_score: 0.5410  
Epoch 161/500  
28/28 [=====] - 2s 54ms/step - loss: 1.0587 - f1_score:  
0.6737 - val_loss: 1.4177 - val_f1_score: 0.5502  
Epoch 162/500  
28/28 [=====] - 1s 49ms/step - loss: 1.0845 - f1_score:  
0.6521 - val_loss: 1.3913 - val_f1_score: 0.5590  
Epoch 163/500  
28/28 [=====] - 1s 49ms/step - loss: 1.0669 - f1_score:  
0.6649 - val_loss: 1.4013 - val_f1_score: 0.5495  
Epoch 164/500  
28/28 [=====] - 1s 48ms/step - loss: 1.0708 - f1_score:  
0.6517 - val_loss: 1.4242 - val_f1_score: 0.5428  
Epoch 165/500  
28/28 [=====] - 2s 57ms/step - loss: 1.0749 - f1_score:  
0.6584 - val_loss: 1.4066 - val_f1_score: 0.5583  
Epoch 166/500
```

```
28/28 [=====] - 1s 50ms/step - loss: 1.0472 - f1_score: 0.6676 - val_loss: 1.3873 - val_f1_score: 0.5682
Epoch 167/500
28/28 [=====] - 1s 54ms/step - loss: 1.0879 - f1_score: 0.6566 - val_loss: 1.3856 - val_f1_score: 0.5719
Epoch 168/500
28/28 [=====] - 2s 58ms/step - loss: 1.0689 - f1_score: 0.6674 - val_loss: 1.3777 - val_f1_score: 0.5700
Epoch 169/500
28/28 [=====] - 1s 53ms/step - loss: 1.0341 - f1_score: 0.6767 - val_loss: 1.3529 - val_f1_score: 0.5707
Epoch 170/500
28/28 [=====] - 1s 51ms/step - loss: 1.0268 - f1_score: 0.6828 - val_loss: 1.4462 - val_f1_score: 0.5429
Epoch 171/500
28/28 [=====] - 2s 56ms/step - loss: 1.0403 - f1_score: 0.6604 - val_loss: 1.3912 - val_f1_score: 0.5730
Epoch 172/500
28/28 [=====] - 2s 55ms/step - loss: 1.0139 - f1_score: 0.6806 - val_loss: 1.3770 - val_f1_score: 0.5673
Epoch 173/500
28/28 [=====] - 1s 51ms/step - loss: 1.0081 - f1_score: 0.6839 - val_loss: 1.4432 - val_f1_score: 0.5463
Epoch 174/500
28/28 [=====] - 2s 55ms/step - loss: 1.0093 - f1_score: 0.6829 - val_loss: 1.3639 - val_f1_score: 0.5648
Epoch 175/500
28/28 [=====] - 2s 58ms/step - loss: 0.9985 - f1_score: 0.6746 - val_loss: 1.3669 - val_f1_score: 0.5769
Epoch 176/500
28/28 [=====] - 1s 49ms/step - loss: 0.9960 - f1_score: 0.6842 - val_loss: 1.3763 - val_f1_score: 0.5718
Epoch 177/500
28/28 [=====] - 1s 49ms/step - loss: 1.0162 - f1_score: 0.6721 - val_loss: 1.3933 - val_f1_score: 0.5807
Epoch 178/500
28/28 [=====] - 2s 55ms/step - loss: 0.9969 - f1_score: 0.6753 - val_loss: 1.4121 - val_f1_score: 0.5544
Epoch 179/500
28/28 [=====] - 2s 58ms/step - loss: 0.9848 - f1_score: 0.6868 - val_loss: 1.3734 - val_f1_score: 0.5816
Epoch 180/500
28/28 [=====] - ETA: 0s - loss: 0.9869 - f1_score: 0.6842
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.
```

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INFO:tensorflow:Assets written to: 2 1DCNN/assets
INFO:tensorflow:Assets written to: 2 1DCNN/assets
28/28 [=====] - 8s 303ms/step - loss: 0.9869 - f1_score: 0.6842 - val_loss: 1.3910 - val_f1_score: 0.5916
Epoch 181/500
28/28 [=====] - 1s 49ms/step - loss: 1.0003 - f1_score: 0.6736 - val_loss: 1.3738 - val_f1_score: 0.5807
Epoch 182/500
28/28 [=====] - 1s 47ms/step - loss: 0.9810 - f1_score: 0.6870 - val_loss: 1.4029 - val_f1_score: 0.5680
Epoch 183/500
28/28 [=====] - 1s 48ms/step - loss: 0.9875 - f1_score: 0.6810 - val_loss: 1.3609 - val_f1_score: 0.5791
Epoch 184/500
28/28 [=====] - 1s 53ms/step - loss: 0.9992 - f1_score: 0.6830 - val_loss: 1.3501 - val_f1_score: 0.5831
Epoch 185/500
28/28 [=====] - 1s 48ms/step - loss: 0.9646 - f1_score: 0.6940 - val_loss: 1.3372 - val_f1_score: 0.5804
Epoch 186/500
28/28 [=====] - 2s 55ms/step - loss: 0.9300 - f1_score: 0.7049 - val_loss: 1.3302 - val_f1_score: 0.5748
Epoch 187/500
28/28 [=====] - 1s 50ms/step - loss: 0.9686 - f1_score: 0.6926 - val_loss: 1.3875 - val_f1_score: 0.5588
Epoch 188/500
28/28 [=====] - 1s 52ms/step - loss: 0.9251 - f1_score: 0.7075 - val_loss: 1.3437 - val_f1_score: 0.5767
Epoch 189/500
28/28 [=====] - 1s 48ms/step - loss: 0.9445 - f1_score: 0.6959 - val_loss: 1.3518 - val_f1_score: 0.5786
Epoch 190/500
28/28 [=====] - 1s 51ms/step - loss: 0.9576 - f1_score: 0.7011 - val_loss: 1.3429 - val_f1_score: 0.5667
Epoch 191/500
28/28 [=====] - 2s 54ms/step - loss: 0.9527 - f1_score: 0.7086 - val_loss: 1.3338 - val_f1_score: 0.5869
Epoch 192/500
28/28 [=====] - ETA: 0s - loss: 0.9306 - f1_score: 0.7034

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
```

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28/28 [=====] - 6s 238ms/step - loss: 0.9306 -  
f1_score: 0.7034 - val_loss: 1.3342 - val_f1_score: 0.5943  
Epoch 193/500  
28/28 [=====] - 1s 50ms/step - loss: 0.9231 - f1_score:  
0.7054 - val_loss: 1.3466 - val_f1_score: 0.5727  
Epoch 194/500  
28/28 [=====] - 1s 50ms/step - loss: 0.9330 - f1_score:  
0.6974 - val_loss: 1.3834 - val_f1_score: 0.5524  
Epoch 195/500  
28/28 [=====] - 1s 52ms/step - loss: 0.9032 - f1_score:  
0.7217 - val_loss: 1.3367 - val_f1_score: 0.5752  
Epoch 196/500  
28/28 [=====] - ETA: 0s - loss: 0.9053 - f1_score:  
0.7162  
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 253ms/step - loss: 0.9053 -  
f1_score: 0.7162 - val_loss: 1.3231 - val_f1_score: 0.5988  
Epoch 197/500  
27/28 [=====>..] - ETA: 0s - loss: 0.9017 - f1_score:  
0.7145  
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 238ms/step - loss: 0.9030 -  
f1_score: 0.7141 - val_loss: 1.3257 - val_f1_score: 0.6034  
Epoch 198/500  
28/28 [=====] - 1s 50ms/step - loss: 0.9137 - f1_score:  
0.7028 - val_loss: 1.3228 - val_f1_score: 0.5919  
Epoch 199/500  
28/28 [=====] - 1s 47ms/step - loss: 0.8893 - f1_score:  
0.7199 - val_loss: 1.3179 - val_f1_score: 0.6022  
Epoch 200/500  
28/28 [=====] - 1s 47ms/step - loss: 0.8985 - f1_score:  
0.7201 - val_loss: 1.3461 - val_f1_score: 0.5855  
Epoch 201/500  
28/28 [=====] - ETA: 0s - loss: 0.8840 - f1_score:  
0.7211
```

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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 212ms/step - loss: 0.8840 -
f1_score: 0.7211 - val_loss: 1.3194 - val_f1_score: 0.6040
Epoch 202/500
28/28 [=====] - 1s 51ms/step - loss: 0.8895 - f1_score:
0.7273 - val_loss: 1.3468 - val_f1_score: 0.5825
Epoch 203/500
28/28 [=====] - 1s 47ms/step - loss: 0.8748 - f1_score:
0.7252 - val_loss: 1.3193 - val_f1_score: 0.5874
Epoch 204/500
27/28 [=====>..] - ETA: 0s - loss: 0.8861 - f1_score:
0.7146

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: 0.8868 -
f1_score: 0.7129 - val_loss: 1.3381 - val_f1_score: 0.6054
Epoch 205/500
28/28 [=====] - 1s 47ms/step - loss: 0.8958 - f1_score:
0.7159 - val_loss: 1.3365 - val_f1_score: 0.5873
Epoch 206/500
28/28 [=====] - 1s 51ms/step - loss: 0.8742 - f1_score:
0.7243 - val_loss: 1.3195 - val_f1_score: 0.5974
Epoch 207/500
28/28 [=====] - 1s 47ms/step - loss: 0.8599 - f1_score:
0.7296 - val_loss: 1.3162 - val_f1_score: 0.5782
Epoch 208/500
28/28 [=====] - 1s 48ms/step - loss: 0.8520 - f1_score:
0.7254 - val_loss: 1.3569 - val_f1_score: 0.5769
Epoch 209/500
28/28 [=====] - 1s 52ms/step - loss: 0.8625 - f1_score:
0.7325 - val_loss: 1.3377 - val_f1_score: 0.5754
Epoch 210/500
28/28 [=====] - 1s 51ms/step - loss: 0.8282 - f1_score:
0.7361 - val_loss: 1.2804 - val_f1_score: 0.6033
Epoch 211/500
28/28 [=====] - 1s 51ms/step - loss: 0.8524 - f1_score:
0.7227 - val_loss: 1.3154 - val_f1_score: 0.5825
```

```
Epoch 212/500
28/28 [=====] - 1s 49ms/step - loss: 0.8210 - f1_score: 0.7431 - val_loss: 1.2945 - val_f1_score: 0.5926
Epoch 213/500
28/28 [=====] - 1s 53ms/step - loss: 0.8427 - f1_score: 0.7293 - val_loss: 1.3453 - val_f1_score: 0.5965
Epoch 214/500
28/28 [=====] - 1s 48ms/step - loss: 0.8230 - f1_score: 0.7424 - val_loss: 1.3055 - val_f1_score: 0.5990
Epoch 215/500
27/28 [=====>..] - ETA: 0s - loss: 0.8244 - f1_score: 0.7469

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 213ms/step - loss: 0.8223 - f1_score: 0.7451 - val_loss: 1.3073 - val_f1_score: 0.6058
Epoch 216/500
28/28 [=====] - 1s 47ms/step - loss: 0.8588 - f1_score: 0.7101 - val_loss: 1.2885 - val_f1_score: 0.5981
Epoch 217/500
28/28 [=====] - 2s 55ms/step - loss: 0.8372 - f1_score: 0.7269 - val_loss: 1.3086 - val_f1_score: 0.5943
Epoch 218/500
28/28 [=====] - 1s 52ms/step - loss: 0.8133 - f1_score: 0.7488 - val_loss: 1.3078 - val_f1_score: 0.5905
Epoch 219/500
28/28 [=====] - 1s 50ms/step - loss: 0.7970 - f1_score: 0.7482 - val_loss: 1.3386 - val_f1_score: 0.5723
Epoch 220/500
28/28 [=====] - 2s 55ms/step - loss: 0.8216 - f1_score: 0.7396 - val_loss: 1.3072 - val_f1_score: 0.5887
Epoch 221/500
28/28 [=====] - 1s 49ms/step - loss: 0.8029 - f1_score: 0.7399 - val_loss: 1.3199 - val_f1_score: 0.5906
Epoch 222/500
28/28 [=====] - 1s 50ms/step - loss: 0.7976 - f1_score: 0.7479 - val_loss: 1.3000 - val_f1_score: 0.5982
Epoch 223/500
28/28 [=====] - 1s 50ms/step - loss: 0.8185 - f1_score: 0.7433 - val_loss: 1.2899 - val_f1_score: 0.5987
Epoch 224/500
28/28 [=====] - 2s 55ms/step - loss: 0.7859 - f1_score: 0.7491 - val_loss: 1.3167 - val_f1_score: 0.6051
```

```
Epoch 225/500
28/28 [=====] - 1s 49ms/step - loss: 0.7925 - f1_score: 0.7558 - val_loss: 1.3085 - val_f1_score: 0.5769
Epoch 226/500
28/28 [=====] - 1s 50ms/step - loss: 0.7841 - f1_score: 0.7445 - val_loss: 1.3023 - val_f1_score: 0.5938
Epoch 227/500
28/28 [=====] - ETA: 0s - loss: 0.7738 - f1_score: 0.7495

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: 0.7738 - f1_score: 0.7495 - val_loss: 1.2890 - val_f1_score: 0.6184
Epoch 228/500
28/28 [=====] - 1s 47ms/step - loss: 0.7754 - f1_score: 0.7532 - val_loss: 1.3236 - val_f1_score: 0.5919
Epoch 229/500
28/28 [=====] - 1s 48ms/step - loss: 0.7696 - f1_score: 0.7519 - val_loss: 1.3426 - val_f1_score: 0.5967
Epoch 230/500
28/28 [=====] - 1s 47ms/step - loss: 0.7730 - f1_score: 0.7537 - val_loss: 1.3060 - val_f1_score: 0.5954
Epoch 231/500
28/28 [=====] - 1s 53ms/step - loss: 0.7598 - f1_score: 0.7638 - val_loss: 1.2965 - val_f1_score: 0.6056
Epoch 232/500
28/28 [=====] - 1s 48ms/step - loss: 0.7778 - f1_score: 0.7573 - val_loss: 1.3073 - val_f1_score: 0.6143
Epoch 233/500
28/28 [=====] - 1s 48ms/step - loss: 0.7485 - f1_score: 0.7565 - val_loss: 1.2781 - val_f1_score: 0.6007
Epoch 234/500
28/28 [=====] - 1s 53ms/step - loss: 0.7601 - f1_score: 0.7651 - val_loss: 1.2938 - val_f1_score: 0.6001
Epoch 235/500
28/28 [=====] - 1s 53ms/step - loss: 0.7500 - f1_score: 0.7672 - val_loss: 1.2796 - val_f1_score: 0.5933
Epoch 236/500
28/28 [=====] - 1s 48ms/step - loss: 0.7312 - f1_score: 0.7700 - val_loss: 1.3069 - val_f1_score: 0.6000
Epoch 237/500
28/28 [=====] - 1s 53ms/step - loss: 0.7420 - f1_score: 0.7701 - val_loss: 1.3023 - val_f1_score: 0.6028
```

```
Epoch 238/500
28/28 [=====] - 2s 55ms/step - loss: 0.7531 - f1_score: 0.7565 - val_loss: 1.2850 - val_f1_score: 0.6045
Epoch 239/500
28/28 [=====] - 1s 49ms/step - loss: 0.7254 - f1_score: 0.7655 - val_loss: 1.2790 - val_f1_score: 0.6070
Epoch 240/500
28/28 [=====] - 1s 49ms/step - loss: 0.7689 - f1_score: 0.7603 - val_loss: 1.2917 - val_f1_score: 0.6024
Epoch 241/500
28/28 [=====] - 2s 55ms/step - loss: 0.7393 - f1_score: 0.7633 - val_loss: 1.3010 - val_f1_score: 0.5832
Epoch 242/500
28/28 [=====] - 1s 50ms/step - loss: 0.7453 - f1_score: 0.7540 - val_loss: 1.2834 - val_f1_score: 0.5975
Epoch 243/500
28/28 [=====] - 1s 49ms/step - loss: 0.7431 - f1_score: 0.7578 - val_loss: 1.3223 - val_f1_score: 0.5912
Epoch 244/500
28/28 [=====] - 1s 53ms/step - loss: 0.7148 - f1_score: 0.7766 - val_loss: 1.2982 - val_f1_score: 0.6125
Epoch 245/500
28/28 [=====] - 2s 57ms/step - loss: 0.7264 - f1_score: 0.7639 - val_loss: 1.2781 - val_f1_score: 0.5888
Epoch 246/500
28/28 [=====] - 1s 50ms/step - loss: 0.7137 - f1_score: 0.7774 - val_loss: 1.2527 - val_f1_score: 0.6168
Epoch 247/500
28/28 [=====] - 2s 63ms/step - loss: 0.7233 - f1_score: 0.7757 - val_loss: 1.2862 - val_f1_score: 0.5890
Epoch 248/500
28/28 [=====] - 2s 57ms/step - loss: 0.6849 - f1_score: 0.7755 - val_loss: 1.3039 - val_f1_score: 0.6115
Epoch 249/500
28/28 [=====] - 1s 50ms/step - loss: 0.7072 - f1_score: 0.7789 - val_loss: 1.2770 - val_f1_score: 0.6028
Epoch 250/500
28/28 [=====] - 1s 51ms/step - loss: 0.7120 - f1_score: 0.7725 - val_loss: 1.2592 - val_f1_score: 0.6051
Epoch 251/500
28/28 [=====] - 2s 58ms/step - loss: 0.7023 - f1_score: 0.7756 - val_loss: 1.3039 - val_f1_score: 0.6104
Epoch 252/500
28/28 [=====] - 1s 52ms/step - loss: 0.7232 - f1_score: 0.7725 - val_loss: 1.2696 - val_f1_score: 0.6064
Epoch 253/500
28/28 [=====] - 1s 51ms/step - loss: 0.7234 - f1_score: 0.7648 - val_loss: 1.2529 - val_f1_score: 0.6126
```

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Epoch 254/500
28/28 [=====] - 2s 57ms/step - loss: 0.7235 - f1_score: 0.7658 - val_loss: 1.2605 - val_f1_score: 0.6112
Epoch 255/500
28/28 [=====] - 1s 52ms/step - loss: 0.6770 - f1_score: 0.7904 - val_loss: 1.2931 - val_f1_score: 0.6090
Epoch 256/500
28/28 [=====] - 1s 52ms/step - loss: 0.6916 - f1_score: 0.7760 - val_loss: 1.3070 - val_f1_score: 0.6122
Epoch 257/500
28/28 [=====] - 1s 50ms/step - loss: 0.6695 - f1_score: 0.7887 - val_loss: 1.2956 - val_f1_score: 0.5972
Epoch 258/500
28/28 [=====] - 2s 59ms/step - loss: 0.6885 - f1_score: 0.7762 - val_loss: 1.2842 - val_f1_score: 0.6155
Epoch 259/500
28/28 [=====] - 2s 55ms/step - loss: 0.7035 - f1_score: 0.7839 - val_loss: 1.2509 - val_f1_score: 0.6089
Epoch 260/500
28/28 [=====] - 1s 54ms/step - loss: 0.6639 - f1_score: 0.7914 - val_loss: 1.3029 - val_f1_score: 0.6116
Epoch 261/500
28/28 [=====] - ETA: 0s - loss: 0.6527 - f1_score: 0.7847

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 262ms/step - loss: 0.6527 - f1_score: 0.7847 - val_loss: 1.2502 - val_f1_score: 0.6355
Epoch 262/500
28/28 [=====] - 1s 49ms/step - loss: 0.6554 - f1_score: 0.7958 - val_loss: 1.2492 - val_f1_score: 0.6186
Epoch 263/500
28/28 [=====] - 1s 49ms/step - loss: 0.6690 - f1_score: 0.7841 - val_loss: 1.3021 - val_f1_score: 0.5832
Epoch 264/500
28/28 [=====] - 2s 54ms/step - loss: 0.6928 - f1_score: 0.7710 - val_loss: 1.3343 - val_f1_score: 0.5927
Epoch 265/500
28/28 [=====] - 1s 49ms/step - loss: 0.6896 - f1_score: 0.7857 - val_loss: 1.3242 - val_f1_score: 0.6037
Epoch 266/500
28/28 [=====] - 1s 50ms/step - loss: 0.6660 - f1_score: 0.7875 - val_loss: 1.2840 - val_f1_score: 0.6117
```

```
Epoch 267/500
28/28 [=====] - 1s 50ms/step - loss: 0.6522 - f1_score: 0.7943 - val_loss: 1.2734 - val_f1_score: 0.6161
Epoch 268/500
28/28 [=====] - 2s 56ms/step - loss: 0.6419 - f1_score: 0.7970 - val_loss: 1.2975 - val_f1_score: 0.6182
Epoch 269/500
28/28 [=====] - 1s 49ms/step - loss: 0.6659 - f1_score: 0.7903 - val_loss: 1.3046 - val_f1_score: 0.6159
Epoch 270/500
28/28 [=====] - 1s 49ms/step - loss: 0.6847 - f1_score: 0.7767 - val_loss: 1.2715 - val_f1_score: 0.6107
Epoch 271/500
28/28 [=====] - 2s 57ms/step - loss: 0.6501 - f1_score: 0.7946 - val_loss: 1.3082 - val_f1_score: 0.6009
Epoch 272/500
28/28 [=====] - 1s 50ms/step - loss: 0.6624 - f1_score: 0.7806 - val_loss: 1.2838 - val_f1_score: 0.6022
Epoch 273/500
27/28 [=====>..] - ETA: 0s - loss: 0.6254 - f1_score: 0.8051

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 218ms/step - loss: 0.6307 - f1_score: 0.8037 - val_loss: 1.2803 - val_f1_score: 0.6422
Epoch 274/500
28/28 [=====] - 1s 50ms/step - loss: 0.6380 - f1_score: 0.8020 - val_loss: 1.3234 - val_f1_score: 0.6146
Epoch 275/500
28/28 [=====] - 2s 58ms/step - loss: 0.6440 - f1_score: 0.7848 - val_loss: 1.2751 - val_f1_score: 0.6241
Epoch 276/500
28/28 [=====] - 1s 50ms/step - loss: 0.6430 - f1_score: 0.7954 - val_loss: 1.2613 - val_f1_score: 0.6174
Epoch 277/500
28/28 [=====] - 2s 54ms/step - loss: 0.6327 - f1_score: 0.7903 - val_loss: 1.2571 - val_f1_score: 0.6103
Epoch 278/500
28/28 [=====] - 2s 56ms/step - loss: 0.6025 - f1_score: 0.8091 - val_loss: 1.3454 - val_f1_score: 0.5951
Epoch 279/500
28/28 [=====] - 1s 49ms/step - loss: 0.6011 - f1_score: 0.8081 - val_loss: 1.3039 - val_f1_score: 0.6058
```

```
Epoch 280/500
28/28 [=====] - 1s 54ms/step - loss: 0.6070 - f1_score: 0.8084 - val_loss: 1.3283 - val_f1_score: 0.6105
Epoch 281/500
28/28 [=====] - 1s 51ms/step - loss: 0.6236 - f1_score: 0.8009 - val_loss: 1.2903 - val_f1_score: 0.6251
Epoch 282/500
28/28 [=====] - 2s 57ms/step - loss: 0.6165 - f1_score: 0.7984 - val_loss: 1.2539 - val_f1_score: 0.6236
Epoch 283/500
28/28 [=====] - 1s 49ms/step - loss: 0.6177 - f1_score: 0.8106 - val_loss: 1.2623 - val_f1_score: 0.5982
Epoch 284/500
28/28 [=====] - 1s 51ms/step - loss: 0.6003 - f1_score: 0.8142 - val_loss: 1.2555 - val_f1_score: 0.6328
Epoch 285/500
28/28 [=====] - 2s 61ms/step - loss: 0.6294 - f1_score: 0.7989 - val_loss: 1.2882 - val_f1_score: 0.6224
Epoch 286/500
28/28 [=====] - 1s 51ms/step - loss: 0.6053 - f1_score: 0.8117 - val_loss: 1.2786 - val_f1_score: 0.6174
Epoch 287/500
28/28 [=====] - 1s 51ms/step - loss: 0.6362 - f1_score: 0.8068 - val_loss: 1.2634 - val_f1_score: 0.6223
Epoch 288/500
28/28 [=====] - 2s 58ms/step - loss: 0.5929 - f1_score: 0.8083 - val_loss: 1.2749 - val_f1_score: 0.6117
Epoch 289/500
28/28 [=====] - 1s 51ms/step - loss: 0.5880 - f1_score: 0.8125 - val_loss: 1.2933 - val_f1_score: 0.6263
Epoch 290/500
28/28 [=====] - 1s 52ms/step - loss: 0.6054 - f1_score: 0.8085 - val_loss: 1.2514 - val_f1_score: 0.6185
Epoch 291/500
28/28 [=====] - 2s 63ms/step - loss: 0.5865 - f1_score: 0.8176 - val_loss: 1.2516 - val_f1_score: 0.6363
Epoch 292/500
28/28 [=====] - 2s 56ms/step - loss: 0.5805 - f1_score: 0.8140 - val_loss: 1.2654 - val_f1_score: 0.6186
Epoch 293/500
28/28 [=====] - 1s 50ms/step - loss: 0.5970 - f1_score: 0.8129 - val_loss: 1.2622 - val_f1_score: 0.6214
Epoch 294/500
28/28 [=====] - 1s 50ms/step - loss: 0.5887 - f1_score: 0.8173 - val_loss: 1.3104 - val_f1_score: 0.6226
Epoch 295/500
28/28 [=====] - 2s 56ms/step - loss: 0.5972 - f1_score: 0.8088 - val_loss: 1.2719 - val_f1_score: 0.6259
```

```
Epoch 296/500
28/28 [=====] - 2s 57ms/step - loss: 0.5725 - f1_score: 0.8237 - val_loss: 1.2794 - val_f1_score: 0.6052
Epoch 297/500
28/28 [=====] - 1s 53ms/step - loss: 0.5798 - f1_score: 0.8221 - val_loss: 1.2679 - val_f1_score: 0.6101
Epoch 298/500
28/28 [=====] - 2s 66ms/step - loss: 0.5694 - f1_score: 0.8183 - val_loss: 1.2999 - val_f1_score: 0.6084
Epoch 299/500
28/28 [=====] - 2s 55ms/step - loss: 0.5923 - f1_score: 0.8105 - val_loss: 1.3195 - val_f1_score: 0.6273
Epoch 300/500
28/28 [=====] - 2s 54ms/step - loss: 0.5928 - f1_score: 0.8124 - val_loss: 1.2865 - val_f1_score: 0.6217
Epoch 301/500
28/28 [=====] - 2s 60ms/step - loss: 0.5434 - f1_score: 0.8317 - val_loss: 1.2662 - val_f1_score: 0.6333
Epoch 302/500
28/28 [=====] - 2s 55ms/step - loss: 0.5487 - f1_score: 0.8275 - val_loss: 1.3018 - val_f1_score: 0.6296
Epoch 303/500
27/28 [=====>..] - ETA: 0s - loss: 0.5854 - f1_score: 0.8239

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 [=====] - 8s 276ms/step - loss: 0.5852 - f1_score: 0.8236 - val_loss: 1.2675 - val_f1_score: 0.6439
Epoch 304/500
28/28 [=====] - 2s 55ms/step - loss: 0.5726 - f1_score: 0.8209 - val_loss: 1.2835 - val_f1_score: 0.6368
Epoch 305/500
28/28 [=====] - 1s 51ms/step - loss: 0.5723 - f1_score: 0.8207 - val_loss: 1.3577 - val_f1_score: 0.6171
Epoch 306/500
28/28 [=====] - 1s 49ms/step - loss: 0.5442 - f1_score: 0.8282 - val_loss: 1.2533 - val_f1_score: 0.6417
Epoch 307/500
28/28 [=====] - 2s 55ms/step - loss: 0.5848 - f1_score: 0.8157 - val_loss: 1.2861 - val_f1_score: 0.6391
Epoch 308/500
28/28 [=====] - 1s 50ms/step - loss: 0.5692 - f1_score: 0.8137 - val_loss: 1.3367 - val_f1_score: 0.6003
```

```
Epoch 309/500
28/28 [=====] - 1s 49ms/step - loss: 0.5497 - f1_score: 0.8293 - val_loss: 1.3103 - val_f1_score: 0.6263
Epoch 310/500
28/28 [=====] - 1s 49ms/step - loss: 0.5470 - f1_score: 0.8337 - val_loss: 1.2735 - val_f1_score: 0.6306
Epoch 311/500
28/28 [=====] - 2s 59ms/step - loss: 0.5390 - f1_score: 0.8367 - val_loss: 1.3259 - val_f1_score: 0.5994
Epoch 312/500
28/28 [=====] - 1s 51ms/step - loss: 0.5470 - f1_score: 0.8229 - val_loss: 1.2810 - val_f1_score: 0.6222
Epoch 313/500
28/28 [=====] - 1s 50ms/step - loss: 0.5172 - f1_score: 0.8410 - val_loss: 1.2720 - val_f1_score: 0.6251
Epoch 314/500
28/28 [=====] - 2s 66ms/step - loss: 0.5531 - f1_score: 0.8233 - val_loss: 1.2892 - val_f1_score: 0.6334
Epoch 315/500
28/28 [=====] - 2s 56ms/step - loss: 0.5563 - f1_score: 0.8246 - val_loss: 1.3183 - val_f1_score: 0.6217
Epoch 316/500
27/28 [=====>..] - ETA: 0s - loss: 0.5414 - f1_score: 0.8327

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 [=====] - 8s 301ms/step - loss: 0.5399 - f1_score: 0.8331 - val_loss: 1.2751 - val_f1_score: 0.6487
Epoch 317/500
28/28 [=====] - 1s 47ms/step - loss: 0.5569 - f1_score: 0.8209 - val_loss: 1.2828 - val_f1_score: 0.6142
Epoch 318/500
28/28 [=====] - 1s 46ms/step - loss: 0.5511 - f1_score: 0.8319 - val_loss: 1.3465 - val_f1_score: 0.6032
Epoch 319/500
28/28 [=====] - 1s 46ms/step - loss: 0.5343 - f1_score: 0.8331 - val_loss: 1.3337 - val_f1_score: 0.6310
Epoch 320/500
28/28 [=====] - 1s 52ms/step - loss: 0.5327 - f1_score: 0.8339 - val_loss: 1.3401 - val_f1_score: 0.6046
Epoch 321/500
28/28 [=====] - 1s 47ms/step - loss: 0.5384 - f1_score: 0.8330 - val_loss: 1.2489 - val_f1_score: 0.6479
```

```
Epoch 322/500
28/28 [=====] - 1s 47ms/step - loss: 0.5368 - f1_score: 0.8311 - val_loss: 1.2590 - val_f1_score: 0.6295
Epoch 323/500
28/28 [=====] - 2s 54ms/step - loss: 0.4915 - f1_score: 0.8447 - val_loss: 1.3019 - val_f1_score: 0.6136
Epoch 324/500
28/28 [=====] - 1s 48ms/step - loss: 0.5232 - f1_score: 0.8304 - val_loss: 1.2748 - val_f1_score: 0.6364
Epoch 325/500
28/28 [=====] - 1s 51ms/step - loss: 0.4999 - f1_score: 0.8422 - val_loss: 1.2812 - val_f1_score: 0.6269
Epoch 326/500
28/28 [=====] - 1s 47ms/step - loss: 0.5331 - f1_score: 0.8397 - val_loss: 1.3406 - val_f1_score: 0.6093
Epoch 327/500
28/28 [=====] - 1s 53ms/step - loss: 0.4976 - f1_score: 0.8434 - val_loss: 1.2993 - val_f1_score: 0.6138
Epoch 328/500
28/28 [=====] - 1s 47ms/step - loss: 0.5242 - f1_score: 0.8302 - val_loss: 1.2893 - val_f1_score: 0.6248
Epoch 329/500
28/28 [=====] - 1s 48ms/step - loss: 0.5123 - f1_score: 0.8368 - val_loss: 1.2478 - val_f1_score: 0.6349
Epoch 330/500
28/28 [=====] - 1s 49ms/step - loss: 0.4996 - f1_score: 0.8421 - val_loss: 1.2836 - val_f1_score: 0.6173
Epoch 331/500
28/28 [=====] - 2s 55ms/step - loss: 0.4899 - f1_score: 0.8479 - val_loss: 1.3320 - val_f1_score: 0.5940
Epoch 332/500
28/28 [=====] - 1s 48ms/step - loss: 0.4974 - f1_score: 0.8438 - val_loss: 1.2670 - val_f1_score: 0.6275
Epoch 333/500
28/28 [=====] - 1s 51ms/step - loss: 0.5045 - f1_score: 0.8407 - val_loss: 1.2684 - val_f1_score: 0.6394
Epoch 334/500
28/28 [=====] - 2s 55ms/step - loss: 0.5011 - f1_score: 0.8446 - val_loss: 1.2870 - val_f1_score: 0.6418
Epoch 335/500
28/28 [=====] - 1s 49ms/step - loss: 0.5161 - f1_score: 0.8311 - val_loss: 1.2462 - val_f1_score: 0.6349
Epoch 336/500
28/28 [=====] - 2s 54ms/step - loss: 0.4953 - f1_score: 0.8427 - val_loss: 1.2667 - val_f1_score: 0.6147
Epoch 337/500
28/28 [=====] - 2s 55ms/step - loss: 0.5202 - f1_score: 0.8326 - val_loss: 1.2798 - val_f1_score: 0.6057
```

```
Epoch 338/500
28/28 [=====] - ETA: 0s - loss: 0.5026 - f1_score: 0.8371
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 247ms/step - loss: 0.5026 - f1_score: 0.8371 - val_loss: 1.3077 - val_f1_score: 0.6554
Epoch 339/500
28/28 [=====] - 1s 48ms/step - loss: 0.4810 - f1_score: 0.8497 - val_loss: 1.2999 - val_f1_score: 0.6407
Epoch 340/500
28/28 [=====] - 1s 47ms/step - loss: 0.4854 - f1_score: 0.8502 - val_loss: 1.2930 - val_f1_score: 0.6441
Epoch 341/500
28/28 [=====] - 1s 51ms/step - loss: 0.4807 - f1_score: 0.8472 - val_loss: 1.2690 - val_f1_score: 0.6315
Epoch 342/500
28/28 [=====] - 1s 47ms/step - loss: 0.4640 - f1_score: 0.8541 - val_loss: 1.2992 - val_f1_score: 0.6275
Epoch 343/500
28/28 [=====] - 1s 50ms/step - loss: 0.4948 - f1_score: 0.8419 - val_loss: 1.3230 - val_f1_score: 0.6124
Epoch 344/500
28/28 [=====] - 1s 54ms/step - loss: 0.4705 - f1_score: 0.8549 - val_loss: 1.3524 - val_f1_score: 0.6320
Epoch 345/500
28/28 [=====] - 1s 52ms/step - loss: 0.4801 - f1_score: 0.8444 - val_loss: 1.3188 - val_f1_score: 0.6295
Epoch 346/500
28/28 [=====] - 1s 51ms/step - loss: 0.4872 - f1_score: 0.8496 - val_loss: 1.3234 - val_f1_score: 0.6168
Epoch 347/500
28/28 [=====] - 2s 56ms/step - loss: 0.4558 - f1_score: 0.8620 - val_loss: 1.3075 - val_f1_score: 0.6283
Epoch 348/500
28/28 [=====] - 2s 64ms/step - loss: 0.4573 - f1_score: 0.8550 - val_loss: 1.3221 - val_f1_score: 0.6139
Epoch 349/500
28/28 [=====] - 2s 56ms/step - loss: 0.4876 - f1_score: 0.8472 - val_loss: 1.2706 - val_f1_score: 0.6307
Epoch 350/500
28/28 [=====] - 2s 57ms/step - loss: 0.4398 - f1_score: 0.8629 - val_loss: 1.3421 - val_f1_score: 0.6132
```

```
Epoch 351/500
28/28 [=====] - 2s 60ms/step - loss: 0.4826 - f1_score: 0.8522 - val_loss: 1.2890 - val_f1_score: 0.6421
Epoch 352/500
28/28 [=====] - 1s 50ms/step - loss: 0.4704 - f1_score: 0.8519 - val_loss: 1.3071 - val_f1_score: 0.6399
Epoch 353/500
28/28 [=====] - 1s 48ms/step - loss: 0.4818 - f1_score: 0.8424 - val_loss: 1.3131 - val_f1_score: 0.6228
Epoch 354/500
28/28 [=====] - 2s 60ms/step - loss: 0.4606 - f1_score: 0.8531 - val_loss: 1.3600 - val_f1_score: 0.6178
Epoch 355/500
28/28 [=====] - 1s 49ms/step - loss: 0.4662 - f1_score: 0.8528 - val_loss: 1.3358 - val_f1_score: 0.6084
Epoch 356/500
28/28 [=====] - 1s 47ms/step - loss: 0.4794 - f1_score: 0.8515 - val_loss: 1.3075 - val_f1_score: 0.6322
Epoch 357/500
28/28 [=====] - 1s 47ms/step - loss: 0.4538 - f1_score: 0.8584 - val_loss: 1.2786 - val_f1_score: 0.6254
Epoch 358/500
28/28 [=====] - 1s 53ms/step - loss: 0.4715 - f1_score: 0.8499 - val_loss: 1.3457 - val_f1_score: 0.6110
Epoch 359/500
28/28 [=====] - 1s 51ms/step - loss: 0.4449 - f1_score: 0.8576 - val_loss: 1.2767 - val_f1_score: 0.6473
Epoch 360/500
28/28 [=====] - 1s 48ms/step - loss: 0.4585 - f1_score: 0.8528 - val_loss: 1.3076 - val_f1_score: 0.6418
Epoch 361/500
28/28 [=====] - 2s 54ms/step - loss: 0.4465 - f1_score: 0.8650 - val_loss: 1.3214 - val_f1_score: 0.6325
Epoch 362/500
28/28 [=====] - 1s 50ms/step - loss: 0.4286 - f1_score: 0.8683 - val_loss: 1.2927 - val_f1_score: 0.6251
Epoch 363/500
28/28 [=====] - 1s 50ms/step - loss: 0.4718 - f1_score: 0.8488 - val_loss: 1.3030 - val_f1_score: 0.6327
Epoch 364/500
28/28 [=====] - 1s 50ms/step - loss: 0.4037 - f1_score: 0.8776 - val_loss: 1.3171 - val_f1_score: 0.6392
Epoch 365/500
27/28 [=====>..] - ETA: 0s - loss: 0.4553 - f1_score: 0.8562
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op, _jit_compiled_convolution_op while saving (showing 2 of 2). These functions will
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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 248ms/step - loss: 0.4543 - f1_score: 0.8571 - val_loss: 1.3607 - val_f1_score: 0.6667
Epoch 366/500
28/28 [=====] - 1s 52ms/step - loss: 0.4421 - f1_score: 0.8664 - val_loss: 1.3442 - val_f1_score: 0.6187
Epoch 367/500
28/28 [=====] - 1s 48ms/step - loss: 0.4635 - f1_score: 0.8555 - val_loss: 1.3378 - val_f1_score: 0.6271
Epoch 368/500
28/28 [=====] - 1s 52ms/step - loss: 0.4531 - f1_score: 0.8599 - val_loss: 1.3376 - val_f1_score: 0.6241
Epoch 369/500
28/28 [=====] - 1s 49ms/step - loss: 0.4577 - f1_score: 0.8497 - val_loss: 1.2853 - val_f1_score: 0.6148
Epoch 370/500
28/28 [=====] - 2s 56ms/step - loss: 0.4582 - f1_score: 0.8544 - val_loss: 1.3430 - val_f1_score: 0.6065
Epoch 371/500
28/28 [=====] - 2s 64ms/step - loss: 0.4432 - f1_score: 0.8664 - val_loss: 1.2917 - val_f1_score: 0.6237
Epoch 372/500
28/28 [=====] - 1s 48ms/step - loss: 0.4299 - f1_score: 0.8650 - val_loss: 1.3887 - val_f1_score: 0.6154
Epoch 373/500
28/28 [=====] - 1s 53ms/step - loss: 0.4093 - f1_score: 0.8734 - val_loss: 1.2989 - val_f1_score: 0.6479
Epoch 374/500
28/28 [=====] - 1s 48ms/step - loss: 0.4479 - f1_score: 0.8630 - val_loss: 1.3580 - val_f1_score: 0.6257
Epoch 375/500
28/28 [=====] - 1s 50ms/step - loss: 0.4187 - f1_score: 0.8611 - val_loss: 1.3028 - val_f1_score: 0.6382
Epoch 376/500
28/28 [=====] - 1s 47ms/step - loss: 0.4158 - f1_score: 0.8685 - val_loss: 1.2724 - val_f1_score: 0.6469
Epoch 377/500
28/28 [=====] - 1s 47ms/step - loss: 0.4423 - f1_score: 0.8647 - val_loss: 1.3149 - val_f1_score: 0.6404
Epoch 378/500
28/28 [=====] - 2s 56ms/step - loss: 0.4242 - f1_score: 0.8606 - val_loss: 1.3116 - val_f1_score: 0.6352
Epoch 379/500
28/28 [=====] - 1s 52ms/step - loss: 0.4372 - f1_score:
```

```
0.8650 - val_loss: 1.3289 - val_f1_score: 0.6318
Epoch 380/500
28/28 [=====] - 1s 49ms/step - loss: 0.4070 - f1_score:
0.8721 - val_loss: 1.3112 - val_f1_score: 0.6281
Epoch 381/500
28/28 [=====] - 1s 50ms/step - loss: 0.4281 - f1_score:
0.8600 - val_loss: 1.3023 - val_f1_score: 0.6450
Epoch 382/500
28/28 [=====] - 2s 57ms/step - loss: 0.4188 - f1_score:
0.8669 - val_loss: 1.2771 - val_f1_score: 0.6446
Epoch 383/500
28/28 [=====] - 1s 48ms/step - loss: 0.4326 - f1_score:
0.8659 - val_loss: 1.3287 - val_f1_score: 0.6412
Epoch 384/500
28/28 [=====] - 1s 50ms/step - loss: 0.4202 - f1_score:
0.8731 - val_loss: 1.2976 - val_f1_score: 0.6423
Epoch 385/500
28/28 [=====] - 2s 57ms/step - loss: 0.4251 - f1_score:
0.8633 - val_loss: 1.3062 - val_f1_score: 0.6471
Epoch 386/500
28/28 [=====] - 1s 52ms/step - loss: 0.4049 - f1_score:
0.8727 - val_loss: 1.3164 - val_f1_score: 0.6327
Epoch 387/500
28/28 [=====] - 1s 53ms/step - loss: 0.4097 - f1_score:
0.8716 - val_loss: 1.3107 - val_f1_score: 0.6255
Epoch 388/500
28/28 [=====] - 1s 48ms/step - loss: 0.4002 - f1_score:
0.8743 - val_loss: 1.3012 - val_f1_score: 0.6292
Epoch 389/500
28/28 [=====] - 2s 56ms/step - loss: 0.4277 - f1_score:
0.8583 - val_loss: 1.3154 - val_f1_score: 0.6390
Epoch 390/500
28/28 [=====] - 1s 50ms/step - loss: 0.3891 - f1_score:
0.8819 - val_loss: 1.3303 - val_f1_score: 0.6153
Epoch 391/500
28/28 [=====] - 1s 48ms/step - loss: 0.4158 - f1_score:
0.8711 - val_loss: 1.3175 - val_f1_score: 0.6276
Epoch 392/500
28/28 [=====] - 2s 63ms/step - loss: 0.4038 - f1_score:
0.8780 - val_loss: 1.3223 - val_f1_score: 0.6341
Epoch 393/500
28/28 [=====] - 1s 47ms/step - loss: 0.3944 - f1_score:
0.8749 - val_loss: 1.3274 - val_f1_score: 0.6370
Epoch 394/500
28/28 [=====] - 1s 46ms/step - loss: 0.4034 - f1_score:
0.8707 - val_loss: 1.3155 - val_f1_score: 0.6380
Epoch 395/500
28/28 [=====] - 1s 46ms/step - loss: 0.3826 - f1_score:
```

```
0.8779 - val_loss: 1.3771 - val_f1_score: 0.6304
Epoch 396/500
28/28 [=====] - 2s 58ms/step - loss: 0.3826 - f1_score:
0.8807 - val_loss: 1.3286 - val_f1_score: 0.6340
Epoch 397/500
28/28 [=====] - 1s 46ms/step - loss: 0.4096 - f1_score:
0.8594 - val_loss: 1.3142 - val_f1_score: 0.6337
Epoch 398/500
28/28 [=====] - 1s 49ms/step - loss: 0.3995 - f1_score:
0.8732 - val_loss: 1.3227 - val_f1_score: 0.6349
Epoch 399/500
28/28 [=====] - 1s 47ms/step - loss: 0.4001 - f1_score:
0.8655 - val_loss: 1.3159 - val_f1_score: 0.6483
Epoch 400/500
28/28 [=====] - 1s 47ms/step - loss: 0.3941 - f1_score:
0.8788 - val_loss: 1.3534 - val_f1_score: 0.6164
Epoch 401/500
28/28 [=====] - 1s 47ms/step - loss: 0.3992 - f1_score:
0.8755 - val_loss: 1.3141 - val_f1_score: 0.6474
Epoch 402/500
28/28 [=====] - 1s 46ms/step - loss: 0.3854 - f1_score:
0.8774 - val_loss: 1.3769 - val_f1_score: 0.6318
Epoch 403/500
28/28 [=====] - 1s 52ms/step - loss: 0.3744 - f1_score:
0.8798 - val_loss: 1.3061 - val_f1_score: 0.6370
Epoch 404/500
28/28 [=====] - 1s 47ms/step - loss: 0.3928 - f1_score:
0.8724 - val_loss: 1.3836 - val_f1_score: 0.6486
Epoch 405/500
28/28 [=====] - 1s 46ms/step - loss: 0.3929 - f1_score:
0.8783 - val_loss: 1.4036 - val_f1_score: 0.6303
Epoch 406/500
28/28 [=====] - 1s 47ms/step - loss: 0.4005 - f1_score:
0.8739 - val_loss: 1.3228 - val_f1_score: 0.6328
Epoch 407/500
28/28 [=====] - 1s 46ms/step - loss: 0.3566 - f1_score:
0.8922 - val_loss: 1.3246 - val_f1_score: 0.6464
Epoch 408/500
28/28 [=====] - 1s 46ms/step - loss: 0.3878 - f1_score:
0.8801 - val_loss: 1.3545 - val_f1_score: 0.6585
Epoch 409/500
28/28 [=====] - 1s 46ms/step - loss: 0.3426 - f1_score:
0.8962 - val_loss: 1.3431 - val_f1_score: 0.6376
Epoch 410/500
28/28 [=====] - 1s 46ms/step - loss: 0.3858 - f1_score:
0.8801 - val_loss: 1.3220 - val_f1_score: 0.6424
Epoch 411/500
28/28 [=====] - 1s 52ms/step - loss: 0.3637 - f1_score:
```

```
0.8909 - val_loss: 1.3406 - val_f1_score: 0.6346
Epoch 412/500
28/28 [=====] - 1s 47ms/step - loss: 0.3888 - f1_score:
0.8802 - val_loss: 1.4070 - val_f1_score: 0.6249
Epoch 413/500
28/28 [=====] - 1s 47ms/step - loss: 0.3677 - f1_score:
0.8831 - val_loss: 1.3252 - val_f1_score: 0.6435
Epoch 414/500
28/28 [=====] - 1s 46ms/step - loss: 0.3876 - f1_score:
0.8791 - val_loss: 1.4212 - val_f1_score: 0.6095
Epoch 415/500
28/28 [=====] - 1s 47ms/step - loss: 0.3839 - f1_score:
0.8755 - val_loss: 1.3242 - val_f1_score: 0.6387
Epoch 416/500
28/28 [=====] - 1s 46ms/step - loss: 0.3658 - f1_score:
0.8853 - val_loss: 1.2957 - val_f1_score: 0.6487
Epoch 417/500
28/28 [=====] - 1s 46ms/step - loss: 0.3475 - f1_score:
0.8933 - val_loss: 1.3482 - val_f1_score: 0.6177
Epoch 418/500
28/28 [=====] - 1s 53ms/step - loss: 0.3618 - f1_score:
0.8922 - val_loss: 1.3079 - val_f1_score: 0.6382
Epoch 419/500
28/28 [=====] - 1s 46ms/step - loss: 0.3667 - f1_score:
0.8846 - val_loss: 1.3434 - val_f1_score: 0.6311
Epoch 420/500
28/28 [=====] - 1s 47ms/step - loss: 0.3860 - f1_score:
0.8752 - val_loss: 1.3214 - val_f1_score: 0.6297
Epoch 421/500
28/28 [=====] - 1s 46ms/step - loss: 0.3670 - f1_score:
0.8889 - val_loss: 1.3732 - val_f1_score: 0.6322
Epoch 422/500
28/28 [=====] - 1s 52ms/step - loss: 0.3680 - f1_score:
0.8859 - val_loss: 1.3742 - val_f1_score: 0.6260
Epoch 423/500
28/28 [=====] - 1s 46ms/step - loss: 0.3728 - f1_score:
0.8852 - val_loss: 1.3412 - val_f1_score: 0.6506
Epoch 424/500
28/28 [=====] - 1s 45ms/step - loss: 0.3641 - f1_score:
0.8867 - val_loss: 1.3363 - val_f1_score: 0.6476
Epoch 425/500
28/28 [=====] - 1s 47ms/step - loss: 0.3426 - f1_score:
0.8934 - val_loss: 1.4025 - val_f1_score: 0.6329
Epoch 426/500
28/28 [=====] - 1s 51ms/step - loss: 0.3463 - f1_score:
0.8905 - val_loss: 1.3535 - val_f1_score: 0.6219
Epoch 427/500
28/28 [=====] - 1s 46ms/step - loss: 0.3642 - f1_score:
```

```
0.8917 - val_loss: 1.3454 - val_f1_score: 0.6430
Epoch 428/500
28/28 [=====] - 1s 46ms/step - loss: 0.3516 - f1_score:
0.8885 - val_loss: 1.3206 - val_f1_score: 0.6525
Epoch 429/500
28/28 [=====] - 1s 46ms/step - loss: 0.3519 - f1_score:
0.8894 - val_loss: 1.3392 - val_f1_score: 0.6378
Epoch 430/500
28/28 [=====] - 1s 53ms/step - loss: 0.3509 - f1_score:
0.8932 - val_loss: 1.3566 - val_f1_score: 0.6378
Epoch 431/500
28/28 [=====] - 1s 46ms/step - loss: 0.3423 - f1_score:
0.8877 - val_loss: 1.4045 - val_f1_score: 0.6250
Epoch 432/500
27/28 [=====>..] - ETA: 0s - loss: 0.3531 - f1_score:
0.8839

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 236ms/step - loss: 0.3509 -
f1_score: 0.8858 - val_loss: 1.3758 - val_f1_score: 0.6672
Epoch 433/500
28/28 [=====] - 1s 45ms/step - loss: 0.3495 - f1_score:
0.8956 - val_loss: 1.3549 - val_f1_score: 0.6457
Epoch 434/500
28/28 [=====] - 1s 45ms/step - loss: 0.3199 - f1_score:
0.8998 - val_loss: 1.3793 - val_f1_score: 0.6301
Epoch 435/500
28/28 [=====] - 1s 45ms/step - loss: 0.3574 - f1_score:
0.8920 - val_loss: 1.3408 - val_f1_score: 0.6271
Epoch 436/500
28/28 [=====] - 1s 46ms/step - loss: 0.3713 - f1_score:
0.8819 - val_loss: 1.3986 - val_f1_score: 0.6310
Epoch 437/500
28/28 [=====] - 2s 54ms/step - loss: 0.3602 - f1_score:
0.8897 - val_loss: 1.3754 - val_f1_score: 0.6328
Epoch 438/500
28/28 [=====] - 1s 47ms/step - loss: 0.3724 - f1_score:
0.8833 - val_loss: 1.4747 - val_f1_score: 0.6307
Epoch 439/500
28/28 [=====] - 1s 48ms/step - loss: 0.3458 - f1_score:
0.8896 - val_loss: 1.3778 - val_f1_score: 0.6251
Epoch 440/500
28/28 [=====] - 1s 48ms/step - loss: 0.3501 - f1_score:
```

```
0.8938 - val_loss: 1.3490 - val_f1_score: 0.6414
Epoch 441/500
28/28 [=====] - 1s 46ms/step - loss: 0.3292 - f1_score:
0.8935 - val_loss: 1.3697 - val_f1_score: 0.6242
Epoch 442/500
28/28 [=====] - 1s 46ms/step - loss: 0.3142 - f1_score:
0.9049 - val_loss: 1.3971 - val_f1_score: 0.6369
Epoch 443/500
28/28 [=====] - 1s 46ms/step - loss: 0.3439 - f1_score:
0.8922 - val_loss: 1.3493 - val_f1_score: 0.6269
Epoch 444/500
28/28 [=====] - 1s 49ms/step - loss: 0.3353 - f1_score:
0.8953 - val_loss: 1.3492 - val_f1_score: 0.6387
Epoch 445/500
28/28 [=====] - 1s 53ms/step - loss: 0.3349 - f1_score:
0.8953 - val_loss: 1.3923 - val_f1_score: 0.6130
Epoch 446/500
28/28 [=====] - 1s 46ms/step - loss: 0.3368 - f1_score:
0.8946 - val_loss: 1.3616 - val_f1_score: 0.6469
Epoch 447/500
28/28 [=====] - 1s 47ms/step - loss: 0.3440 - f1_score:
0.8937 - val_loss: 1.4889 - val_f1_score: 0.5994
Epoch 448/500
28/28 [=====] - 1s 49ms/step - loss: 0.3640 - f1_score:
0.8826 - val_loss: 1.3395 - val_f1_score: 0.6435
Epoch 449/500
28/28 [=====] - 1s 46ms/step - loss: 0.3161 - f1_score:
0.9071 - val_loss: 1.3233 - val_f1_score: 0.6473
Epoch 450/500
28/28 [=====] - 1s 46ms/step - loss: 0.3375 - f1_score:
0.8908 - val_loss: 1.4132 - val_f1_score: 0.6343
Epoch 451/500
28/28 [=====] - 1s 46ms/step - loss: 0.3531 - f1_score:
0.8830 - val_loss: 1.3212 - val_f1_score: 0.6446
Epoch 452/500
28/28 [=====] - 1s 52ms/step - loss: 0.3329 - f1_score:
0.8974 - val_loss: 1.3742 - val_f1_score: 0.6313
Epoch 453/500
28/28 [=====] - 1s 46ms/step - loss: 0.3409 - f1_score:
0.8938 - val_loss: 1.3332 - val_f1_score: 0.6117
Epoch 454/500
28/28 [=====] - 1s 46ms/step - loss: 0.3267 - f1_score:
0.9049 - val_loss: 1.3522 - val_f1_score: 0.6472
Epoch 455/500
28/28 [=====] - 1s 47ms/step - loss: 0.3349 - f1_score:
0.8985 - val_loss: 1.3125 - val_f1_score: 0.6490
Epoch 456/500
28/28 [=====] - 1s 48ms/step - loss: 0.3302 - f1_score:
```

```
0.8898 - val_loss: 1.3418 - val_f1_score: 0.6417
Epoch 457/500
28/28 [=====] - 1s 46ms/step - loss: 0.3187 - f1_score: 0.9053 - val_loss: 1.4298 - val_f1_score: 0.6240
Epoch 458/500
28/28 [=====] - 1s 46ms/step - loss: 0.3557 - f1_score: 0.8854 - val_loss: 1.3125 - val_f1_score: 0.6408
Epoch 459/500
28/28 [=====] - 1s 46ms/step - loss: 0.3063 - f1_score: 0.9050 - val_loss: 1.3599 - val_f1_score: 0.6350
Epoch 460/500
28/28 [=====] - 1s 52ms/step - loss: 0.3095 - f1_score: 0.9034 - val_loss: 1.3240 - val_f1_score: 0.6513
Epoch 461/500
28/28 [=====] - 1s 47ms/step - loss: 0.3330 - f1_score: 0.9008 - val_loss: 1.3588 - val_f1_score: 0.6316
Epoch 462/500
28/28 [=====] - 1s 46ms/step - loss: 0.3279 - f1_score: 0.8954 - val_loss: 1.3458 - val_f1_score: 0.6340
Epoch 463/500
28/28 [=====] - 1s 46ms/step - loss: 0.3018 - f1_score: 0.9048 - val_loss: 1.4070 - val_f1_score: 0.6533
Epoch 464/500
28/28 [=====] - 1s 46ms/step - loss: 0.3159 - f1_score: 0.9061 - val_loss: 1.3775 - val_f1_score: 0.6338
Epoch 465/500
28/28 [=====] - 1s 46ms/step - loss: 0.3090 - f1_score: 0.9009 - val_loss: 1.3438 - val_f1_score: 0.6331
Epoch 466/500
28/28 [=====] - 1s 47ms/step - loss: 0.3163 - f1_score: 0.9026 - val_loss: 1.4021 - val_f1_score: 0.6409
Epoch 467/500
28/28 [=====] - 1s 53ms/step - loss: 0.3279 - f1_score: 0.8948 - val_loss: 1.3562 - val_f1_score: 0.6287
Epoch 468/500
28/28 [=====] - 1s 47ms/step - loss: 0.3150 - f1_score: 0.9076 - val_loss: 1.3615 - val_f1_score: 0.6524
Epoch 469/500
28/28 [=====] - 1s 47ms/step - loss: 0.3032 - f1_score: 0.9024 - val_loss: 1.3480 - val_f1_score: 0.6275
Epoch 470/500
28/28 [=====] - 1s 46ms/step - loss: 0.3123 - f1_score: 0.9108 - val_loss: 1.3665 - val_f1_score: 0.6391
Epoch 471/500
28/28 [=====] - 1s 46ms/step - loss: 0.3164 - f1_score: 0.9003 - val_loss: 1.4251 - val_f1_score: 0.6257
Epoch 472/500
28/28 [=====] - 1s 46ms/step - loss: 0.2950 - f1_score:
```

```
0.9050 - val_loss: 1.3624 - val_f1_score: 0.6523
Epoch 473/500
28/28 [=====] - 1s 52ms/step - loss: 0.3258 - f1_score: 0.8924 - val_loss: 1.3848 - val_f1_score: 0.6466
Epoch 474/500
28/28 [=====] - 1s 46ms/step - loss: 0.3134 - f1_score: 0.9121 - val_loss: 1.3781 - val_f1_score: 0.6435
Epoch 475/500
28/28 [=====] - 2s 56ms/step - loss: 0.3029 - f1_score: 0.9070 - val_loss: 1.4515 - val_f1_score: 0.6408
Epoch 476/500
28/28 [=====] - 1s 47ms/step - loss: 0.2938 - f1_score: 0.9078 - val_loss: 1.3292 - val_f1_score: 0.6612
Epoch 477/500
28/28 [=====] - 1s 46ms/step - loss: 0.3234 - f1_score: 0.8980 - val_loss: 1.4044 - val_f1_score: 0.6414
Epoch 478/500
28/28 [=====] - 1s 47ms/step - loss: 0.3101 - f1_score: 0.9041 - val_loss: 1.4087 - val_f1_score: 0.6380
Epoch 479/500
28/28 [=====] - 1s 47ms/step - loss: 0.2864 - f1_score: 0.9179 - val_loss: 1.3639 - val_f1_score: 0.6477
Epoch 480/500
28/28 [=====] - 1s 47ms/step - loss: 0.3000 - f1_score: 0.9053 - val_loss: 1.4594 - val_f1_score: 0.6252
Epoch 481/500
28/28 [=====] - 1s 46ms/step - loss: 0.3009 - f1_score: 0.9080 - val_loss: 1.4213 - val_f1_score: 0.6372
Epoch 482/500
28/28 [=====] - 1s 53ms/step - loss: 0.3149 - f1_score: 0.9023 - val_loss: 1.3759 - val_f1_score: 0.6409
Epoch 483/500
28/28 [=====] - 1s 46ms/step - loss: 0.3148 - f1_score: 0.9017 - val_loss: 1.3332 - val_f1_score: 0.6464
Epoch 484/500
28/28 [=====] - 1s 47ms/step - loss: 0.2990 - f1_score: 0.9066 - val_loss: 1.3341 - val_f1_score: 0.6429
Epoch 485/500
28/28 [=====] - 1s 47ms/step - loss: 0.2973 - f1_score: 0.9144 - val_loss: 1.4137 - val_f1_score: 0.6334
Epoch 486/500
28/28 [=====] - 1s 46ms/step - loss: 0.2906 - f1_score: 0.9124 - val_loss: 1.3543 - val_f1_score: 0.6537
Epoch 487/500
28/28 [=====] - 1s 46ms/step - loss: 0.3080 - f1_score: 0.8999 - val_loss: 1.4130 - val_f1_score: 0.6375
Epoch 488/500
28/28 [=====] - 1s 46ms/step - loss: 0.3280 - f1_score:
```

```
0.8930 - val_loss: 1.3629 - val_f1_score: 0.6350
Epoch 489/500
28/28 [=====] - 1s 48ms/step - loss: 0.2885 - f1_score: 0.9167 - val_loss: 1.3316 - val_f1_score: 0.6525
Epoch 490/500
28/28 [=====] - 1s 51ms/step - loss: 0.3119 - f1_score: 0.9050 - val_loss: 1.3769 - val_f1_score: 0.6325
Epoch 491/500
28/28 [=====] - 1s 46ms/step - loss: 0.2820 - f1_score: 0.9060 - val_loss: 1.4034 - val_f1_score: 0.6426
Epoch 492/500
28/28 [=====] - 1s 46ms/step - loss: 0.2966 - f1_score: 0.9093 - val_loss: 1.3374 - val_f1_score: 0.6472
Epoch 493/500
28/28 [=====] - 1s 46ms/step - loss: 0.2797 - f1_score: 0.9150 - val_loss: 1.4481 - val_f1_score: 0.6346
Epoch 494/500
27/28 [=====>..] - ETA: 0s - loss: 0.2832 - f1_score: 0.9115

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 [=====] - 8s 298ms/step - loss: 0.2868 - f1_score: 0.9106 - val_loss: 1.3521 - val_f1_score: 0.6815
Epoch 495/500
28/28 [=====] - 1s 44ms/step - loss: 0.2739 - f1_score: 0.9172 - val_loss: 1.4129 - val_f1_score: 0.6434
Epoch 496/500
28/28 [=====] - 1s 45ms/step - loss: 0.3013 - f1_score: 0.9081 - val_loss: 1.4439 - val_f1_score: 0.6333
Epoch 497/500
28/28 [=====] - 1s 45ms/step - loss: 0.2853 - f1_score: 0.9127 - val_loss: 1.4566 - val_f1_score: 0.6367
Epoch 498/500
28/28 [=====] - 1s 45ms/step - loss: 0.3049 - f1_score: 0.8970 - val_loss: 1.4301 - val_f1_score: 0.6387
Epoch 499/500
28/28 [=====] - 1s 45ms/step - loss: 0.2987 - f1_score: 0.9086 - val_loss: 1.4153 - val_f1_score: 0.6373
Epoch 500/500
28/28 [=====] - 1s 48ms/step - loss: 0.2949 - f1_score: 0.9106 - val_loss: 1.4347 - val_f1_score: 0.6497
```

```
[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)
```

```
[136]: hist_df = pd.read_csv('2 1DCNN/history.csv', index_col=0)
hist_df.tail()
```

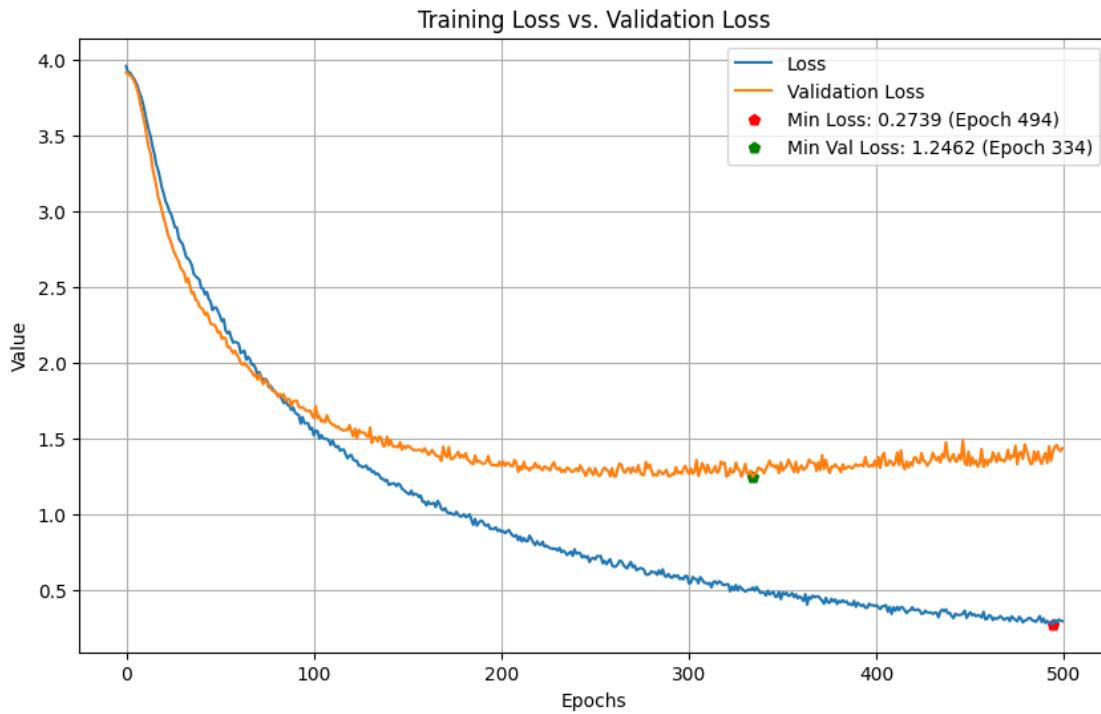
```
[136]:      loss  f1_score  val_loss  val_f1_score
495  0.301309  0.908118  1.443902  0.633263
496  0.285335  0.912714  1.456624  0.636725
497  0.304906  0.896972  1.430125  0.638678
498  0.298705  0.908557  1.415282  0.637305
499  0.294931  0.910637  1.434662  0.649675
```

```
[137]: # 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()
```



```
[138]: # 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()

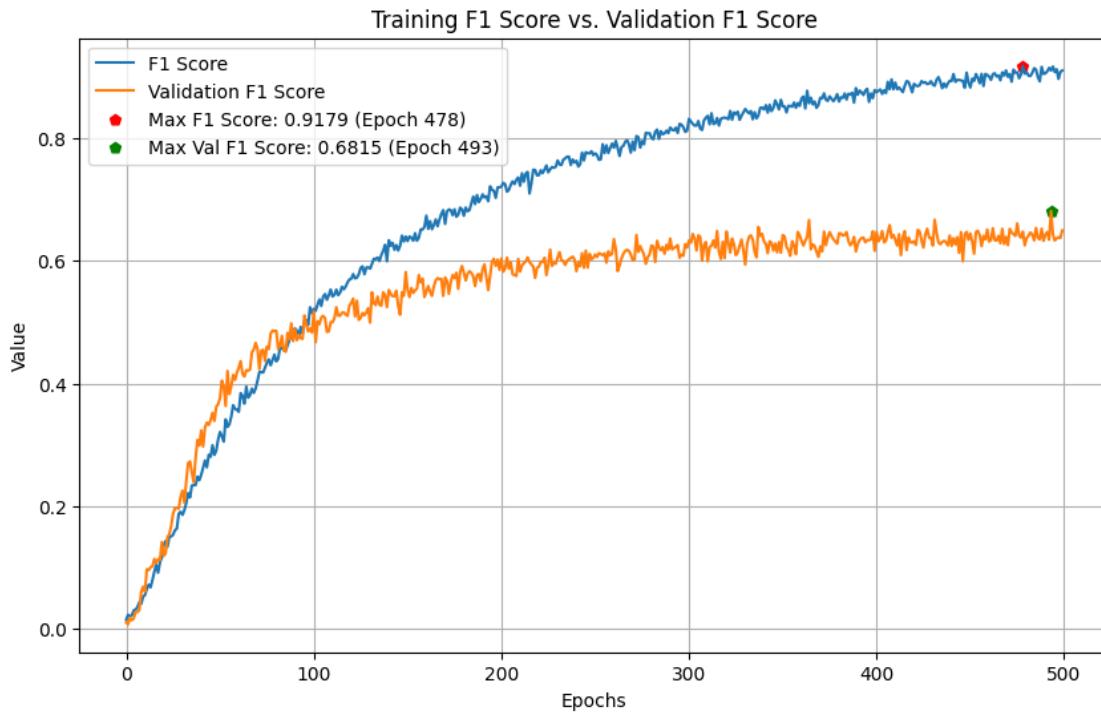
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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()

```



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

11/11 [=====] - 0s 7ms/step

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

AXE	0.800	1.000	0.889	8
BACKPACK	0.545	1.000	0.706	6
BASKETBALL	0.909	1.000	0.952	10
BEE	0.667	0.200	0.308	10
BELT	0.667	1.000	0.800	4
BITE	1.000	0.500	0.667	8
BREAKFAST	0.833	0.833	0.833	6
CANCER	0.889	1.000	0.941	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	0.000	0.000	0.000	6
DECIDE	0.667	0.333	0.444	6
DEMAND	0.800	0.500	0.615	8
DEVELOP	0.667	0.333	0.444	6
DINNER	0.667	0.500	0.571	8
DOG	0.364	0.667	0.471	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	0.667	0.500	0.571	4
EAT	0.667	1.000	0.800	6
EDIT	0.545	1.000	0.706	6
ELEVATOR	0.462	0.750	0.571	8
FINE	1.000	0.250	0.400	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	0.714	0.833	0.769	6
GUESS	1.000	1.000	1.000	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	0.375	0.500	0.429	6
HURDLE/TRIP	0.667	0.500	0.571	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	0.667	0.250	0.364	8
MAPLE	0.800	1.000	0.889	4
MEAT	0.667	1.000	0.800	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	0.800	0.500	0.615	8
MOVIE	0.600	0.750	0.667	8
NOON	0.636	0.875	0.737	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.100	0.167	0.125	6
RAZOR	0.200	0.250	0.222	4
RIVER	1.000	1.000	1.000	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.500	0.200	0.286	10
SINK	1.000	0.167	0.286	6
SQUEEZE	1.000	0.500	0.667	4
THEY	1.000	0.250	0.400	4
TWINS	0.571	1.000	0.727	8
WHATFOR	0.800	0.800	0.800	10
accuracy			0.676	324
macro avg	0.716	0.666	0.650	324
weighted avg	0.716	0.676	0.657	324

```
[121]: reconstructed_model = tf.keras.models.load_model("2 1DCNN")
```

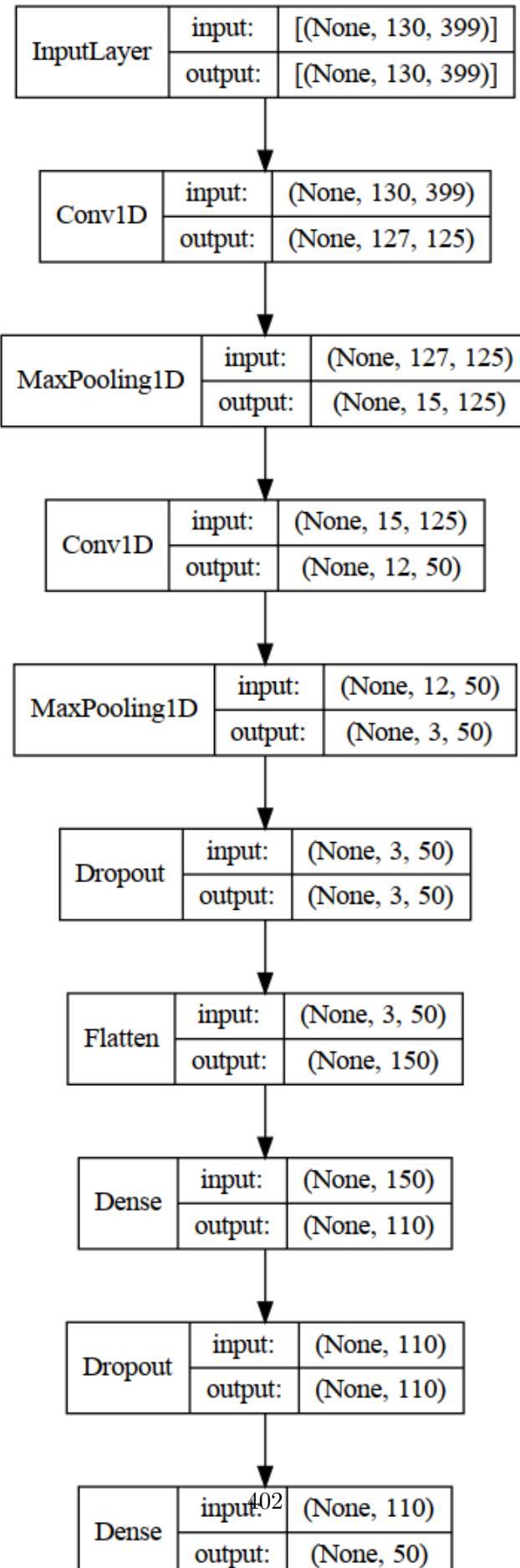
```
[122]: reconstructed_model.summary()
```

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
conv1d_2 (Conv1D)	(None, 127, 125)	199625
max_pooling1d_2 (MaxPooling 1D)	(None, 15, 125)	0
conv1d_3 (Conv1D)	(None, 12, 50)	25050
max_pooling1d_3 (MaxPooling 1D)	(None, 3, 50)	0
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
<hr/>		
Total params: 246,835		
Trainable params: 246,835		
Non-trainable params: 0		

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

```
[123]:
```



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

2023-09-15 12:34:04.902305: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [=====] - 7s 31ms/step - loss: 1.3521 - f1_score: 0.6815
```

[124]: [1.3520959615707397, 0.6814532279968262]

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

84/84 [=====] - 1s 9ms/step - loss: 0.0371 - f1_score: 0.9996
```

[125]: [0.03709415718913078, 0.9995914697647095]

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

	precision	recall	f1-score	support
AXE	0.857	0.750	0.800	8
BACKPACK	0.500	1.000	0.667	6
BASKETBALL	0.909	1.000	0.952	10
BEE	0.500	0.200	0.286	10
BELT	0.667	1.000	0.800	4
BITE	1.000	0.625	0.769	8
BREAKFAST	1.000	0.667	0.800	6
CANCER	0.889	1.000	0.941	8
CHRISTMAS	0.800	0.667	0.727	6
CONFUSED	0.455	0.833	0.588	6
DARK	0.800	1.000	0.889	4
DEAF	0.111	0.167	0.133	6
DECIDE	0.667	0.333	0.444	6
DEMAND	0.833	0.625	0.714	8
DEVELOP	1.000	0.667	0.800	6
DINNER	1.000	0.500	0.667	8
DOG	0.500	0.667	0.571	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	0.667	0.500	0.571	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	0.500	0.500	0.500	4
FOREIGNER	0.625	0.833	0.714	6
GUESS	1.000	1.000	1.000	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	0.600	0.500	0.545	6
HURDLE/TRIP	0.250	0.250	0.250	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.857	0.750	0.800	8
LUNCH	0.600	0.375	0.462	8
MAPLE	0.800	1.000	0.889	4
MEAT	0.667	1.000	0.800	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.667	0.750	0.706	8
NOON	0.467	0.875	0.609	8
PARTY	0.857	0.750	0.800	8
PATIENT	0.000	0.000	0.000	6
RAZOR	0.200	0.250	0.222	4
RIVER	1.000	1.000	1.000	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.667	0.400	0.500	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	0.500	0.750	0.600	8
WHATFOR	0.800	0.800	0.800	10
accuracy			0.694	324
macro avg	0.719	0.688	0.681	324
weighted avg	0.726	0.694	0.689	324

## 4.6 Hyperparameter Tuning 3 1D CNN Layers

```
[60]: from keras_tuner import HyperModel
from kerastuner.tuners import Hyperband
from tensorflow.keras.callbacks import EarlyStopping
```

```
/tmp/ipykernel_865683/1222377179.py:2: DeprecationWarning: `import kerastuner` is deprecated, please use `import keras_tuner`.
  from kerastuner.tuners import Hyperband
```

```
[61]: 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='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)
```

```
[62]: 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/CSPNext/hyperband/',
    project_name='3_1D_CNN',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/3_1D_CNN/tuner0.json
```

```
[63]: 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'}
```

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

```
[66]: tuner.search(Xtrain,  
                  Ytrain,  
                  epochs=1000,  
                  validation_data=(Xval, Yval),  
                  batch_size=96,  
                  callbacks=[es])
```

```
Trial 725 Complete [00h 13m 56s]  
val_f1_score: 0.5884857177734375
```

```
Best val_f1_score So Far: 0.6642428636550903  
Total elapsed time: 00h 50m 44s  
INFO:tensorflow:Oracle triggered exit
```

```
[ ]: best_model = tuner.get_best_models(num_models=6)[0]
```

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

```
Model: "sequential"
```

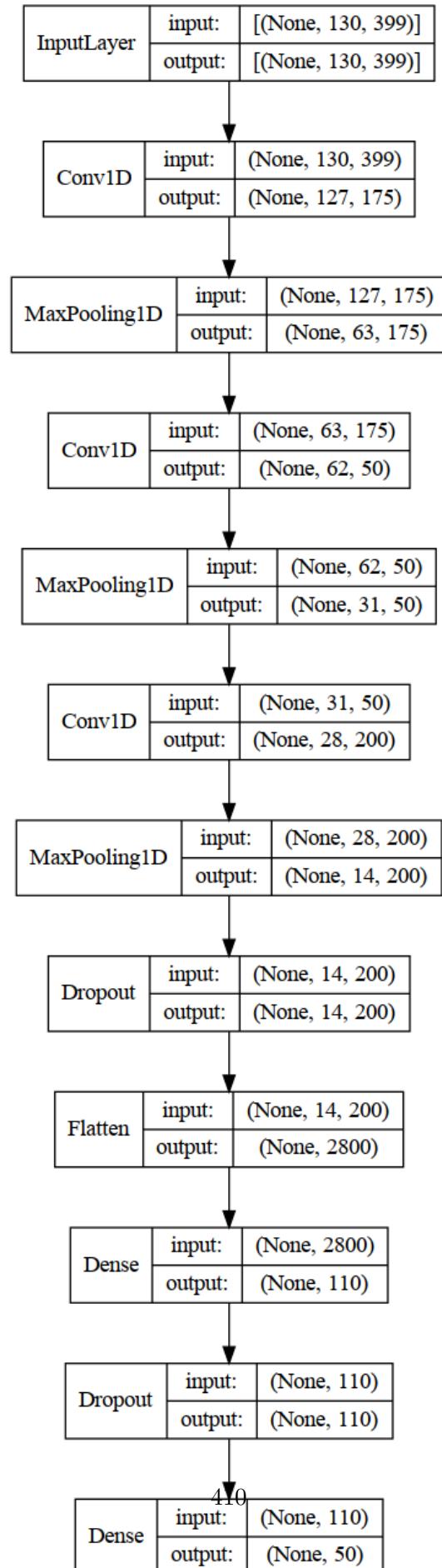
Layer (type)	Output Shape	Param #
conv1d (Conv1D)	(None, 127, 175)	279475
max_pooling1d (MaxPooling1D )	(None, 63, 175)	0
conv1d_1 (Conv1D)	(None, 62, 50)	17550
max_pooling1d_1 (MaxPooling 1D)	(None, 31, 50)	0
conv1d_2 (Conv1D)	(None, 28, 200)	40200
max_pooling1d_2 (MaxPooling 1D)	(None, 14, 200)	0

```
dropout (Dropout)           (None, 14, 200)          0
flatten (Flatten)           (None, 2800)            0
dense (Dense)               (None, 110)             308110
dropout_1 (Dropout)         (None, 110)             0
dense_1 (Dense)             (None, 50)              5550
```

```
=====
Total params: 650,885
Trainable params: 650,885
Non-trainable params: 0
```

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

```
[69]:
```



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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/3_1D_CNN
Showing 10 best trials
Objective(name="val_f1_score", direction="max")
```

```
Trial 0700 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 4
filters_2: 50
kernel_2: 2
filters_3: 200
kernel_3: 4
dropout_1: 0.75
units_5: 110
dropout_2: 0.7
learning_rate: 0.0005114665076835432
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0693
Score: 0.6642428636550903
```

```
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: 0666
```

Score: 0.663768470287323

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: 0.6440820693969727

Trial 0715 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: 0.6412738561630249

Trial 0670 summary  
Hyperparameters:  
dense\_activation: mish  
filters\_1: 150  
kernel\_1: 4  
filters\_2: 125

```
kernel_2: 3
filters_3: 175
kernel_3: 3
dropout_1: 0.7
units_5: 100
dropout_2: 0.5
learning_rate: 0.000660547128589356
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 3
tuner/round: 3
tuner/trial_id: 0664
Score: 0.6137906014919281
```

```
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: 0.6126325130462646
```

```
Trial 0693 summary
Hyperparameters:
dense_activation: mish
filters_1: 175
kernel_1: 4
filters_2: 50
kernel_2: 2
filters_3: 200
kernel_3: 4
dropout_1: 0.75
units_5: 110
dropout_2: 0.7
learning_rate: 0.0005114665076835432
tuner/epochs: 100
tuner/initial_epoch: 34
```

```
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0681
Score: 0.5999394655227661
```

```
Trial 0701 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: 0696
Score: 0.5989722609519958
```

```
Trial 0716 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: 0.589201420545578
```

```
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: 0.5884857177734375
```

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

11/11 [=====] - 1s 31ms/step - loss: 1.4420 - f1_score: 0.6648
```

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

84/84 [=====] - 1s 13ms/step - loss: 0.0543 - f1_score: 0.9975
```

```
[73]: bestHP = tuner.get_best_hyperparameters(num_trials=6)[0]
```

```
[74]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='3 1D CNN/',
    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: 3.9455 - f1_score: 0.0226
```

```
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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 17s 454ms/step - loss: 3.9455 -
f1_score: 0.0226 - val_loss: 3.9094 - val_f1_score: 0.0034
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 3.9294 - f1_score:
0.0237

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 218ms/step - loss: 3.9294 -
f1_score: 0.0237 - val_loss: 3.9047 - val_f1_score: 0.0087
Epoch 3/500
28/28 [=====] - 2s 66ms/step - loss: 3.9199 - f1_score:
0.0190 - val_loss: 3.9036 - val_f1_score: 0.0072
Epoch 4/500
28/28 [=====] - ETA: 0s - loss: 3.9141 - f1_score:
0.0251

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 222ms/step - loss: 3.9141 -
f1_score: 0.0251 - val_loss: 3.9037 - val_f1_score: 0.0116
Epoch 5/500
28/28 [=====] - ETA: 0s - loss: 3.9025 - f1_score:
0.0241

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 7s 259ms/step - loss: 3.9025 -
f1_score: 0.0241 - val_loss: 3.8935 - val_f1_score: 0.0126
```

```
Epoch 6/500
28/28 [=====] - ETA: 0s - loss: 3.8793 - f1_score: 0.0360

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 231ms/step - loss: 3.8793 - f1_score: 0.0360 - val_loss: 3.8653 - val_f1_score: 0.0131
Epoch 7/500
28/28 [=====] - ETA: 0s - loss: 3.8304 - f1_score: 0.0352

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 226ms/step - loss: 3.8304 - f1_score: 0.0352 - val_loss: 3.7742 - val_f1_score: 0.0270
Epoch 8/500
28/28 [=====] - ETA: 0s - loss: 3.7638 - f1_score: 0.0401

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 220ms/step - loss: 3.7638 - f1_score: 0.0401 - val_loss: 3.6288 - val_f1_score: 0.0430
Epoch 9/500
28/28 [=====] - 2s 66ms/step - loss: 3.6514 - f1_score: 0.0629 - val_loss: 3.4788 - val_f1_score: 0.0302
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 3.5476 - f1_score: 0.0765

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/assets
```

```
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 222ms/step - loss: 3.5476 -
f1_score: 0.0765 - val_loss: 3.5120 - val_f1_score: 0.0513
Epoch 11/500
28/28 [=====] - ETA: 0s - loss: 3.4711 - f1_score:
0.0815

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 243ms/step - loss: 3.4711 -
f1_score: 0.0815 - val_loss: 3.2655 - val_f1_score: 0.0860
Epoch 12/500
28/28 [=====] - ETA: 0s - loss: 3.3418 - f1_score:
0.1135

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 236ms/step - loss: 3.3418 -
f1_score: 0.1135 - val_loss: 3.1376 - val_f1_score: 0.0997
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 3.2260 - f1_score:
0.1240

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 229ms/step - loss: 3.2260 -
f1_score: 0.1240 - val_loss: 3.0233 - val_f1_score: 0.1348
Epoch 14/500
28/28 [=====] - 2s 66ms/step - loss: 3.1516 - f1_score:
0.1396 - val_loss: 2.9261 - val_f1_score: 0.1329
Epoch 15/500
28/28 [=====] - ETA: 0s - loss: 3.0207 - f1_score:
0.1541
```

```
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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 214ms/step - loss: 3.0207 -
f1_score: 0.1541 - val_loss: 2.8229 - val_f1_score: 0.1640
Epoch 16/500
28/28 [=====] - ETA: 0s - loss: 2.9382 - f1_score:
0.1819

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 218ms/step - loss: 2.9382 -
f1_score: 0.1819 - val_loss: 2.7539 - val_f1_score: 0.1738
Epoch 17/500
28/28 [=====] - ETA: 0s - loss: 2.8438 - f1_score:
0.2078

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 217ms/step - loss: 2.8438 -
f1_score: 0.2078 - val_loss: 2.7188 - val_f1_score: 0.1878
Epoch 18/500
28/28 [=====] - ETA: 0s - loss: 2.7942 - f1_score:
0.2076

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 217ms/step - loss: 2.7942 -
f1_score: 0.2076 - val_loss: 2.6029 - val_f1_score: 0.2009
Epoch 19/500
28/28 [=====] - 2s 65ms/step - loss: 2.7154 - f1_score:
0.2183 - val_loss: 2.5623 - val_f1_score: 0.1977
```

```
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 2.6545 - f1_score: 0.2324
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 202ms/step - loss: 2.6545 - f1_score: 0.2324 - val_loss: 2.4816 - val_f1_score: 0.2435
Epoch 21/500
28/28 [=====] - ETA: 0s - loss: 2.6072 - f1_score: 0.2279
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 243ms/step - loss: 2.6072 - f1_score: 0.2279 - val_loss: 2.4355 - val_f1_score: 0.2462
Epoch 22/500
28/28 [=====] - 2s 66ms/step - loss: 2.5055 - f1_score: 0.2586 - val_loss: 2.4948 - val_f1_score: 0.2288
Epoch 23/500
28/28 [=====] - ETA: 0s - loss: 2.4587 - f1_score: 0.2776
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 249ms/step - loss: 2.4587 - f1_score: 0.2776 - val_loss: 2.3497 - val_f1_score: 0.2684
Epoch 24/500
28/28 [=====] - 2s 67ms/step - loss: 2.4129 - f1_score: 0.2955 - val_loss: 2.3254 - val_f1_score: 0.2645
Epoch 25/500
28/28 [=====] - ETA: 0s - loss: 2.3711 - f1_score: 0.3048
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/assets
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INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 6s 221ms/step - loss: 2.3711 -  
f1_score: 0.3048 - val_loss: 2.2991 - val_f1_score: 0.2724  
Epoch 26/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.3263 - f1_score:  
0.3008
```

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/assets
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INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 6s 215ms/step - loss: 2.3263 -  
f1_score: 0.3008 - val_loss: 2.2371 - val_f1_score: 0.2766  
Epoch 27/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.3145 - f1_score:  
0.3052
```

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/assets
```

```
INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 6s 224ms/step - loss: 2.3145 -  
f1_score: 0.3052 - val_loss: 2.2139 - val_f1_score: 0.2770  
Epoch 28/500
```

```
28/28 [=====] - 2s 65ms/step - loss: 2.2256 - f1_score:  
0.3236 - val_loss: 2.2235 - val_f1_score: 0.2609  
Epoch 29/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.1689 - f1_score:  
0.3419
```

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/assets
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INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 7s 248ms/step - loss: 2.1689 -  
f1_score: 0.3419 - val_loss: 2.1325 - val_f1_score: 0.3152  
Epoch 30/500
```

```
28/28 [=====] - 2s 66ms/step - loss: 2.1452 - f1_score:
```

```
0.3655 - val_loss: 2.1884 - val_f1_score: 0.3025
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 2.1212 - f1_score: 0.3578

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 7s 243ms/step - loss: 2.1212 - f1_score: 0.3578 - val_loss: 2.1541 - val_f1_score: 0.3311
Epoch 32/500
28/28 [=====] - 2s 66ms/step - loss: 2.0789 - f1_score: 0.3619 - val_loss: 2.1357 - val_f1_score: 0.3052
Epoch 33/500
28/28 [=====] - ETA: 0s - loss: 2.0523 - f1_score: 0.3828

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 216ms/step - loss: 2.0523 - f1_score: 0.3828 - val_loss: 2.0773 - val_f1_score: 0.3473
Epoch 34/500
28/28 [=====] - 2s 66ms/step - loss: 1.9753 - f1_score: 0.4024 - val_loss: 2.0884 - val_f1_score: 0.3326
Epoch 35/500
28/28 [=====] - ETA: 0s - loss: 1.9514 - f1_score: 0.4021

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 234ms/step - loss: 1.9514 - f1_score: 0.4021 - val_loss: 2.0488 - val_f1_score: 0.3683
Epoch 36/500
28/28 [=====] - 2s 65ms/step - loss: 1.9155 - f1_score: 0.4057 - val_loss: 2.0110 - val_f1_score: 0.3533
Epoch 37/500
28/28 [=====] - 2s 67ms/step - loss: 1.8700 - f1_score:
```

```
0.4233 - val_loss: 2.0108 - val_f1_score: 0.3575
Epoch 38/500
28/28 [=====] - ETA: 0s - loss: 1.8461 - f1_score: 0.4313

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 8s 289ms/step - loss: 1.8461 - f1_score: 0.4313 - val_loss: 1.9702 - val_f1_score: 0.3828
Epoch 39/500
28/28 [=====] - 2s 66ms/step - loss: 1.8233 - f1_score: 0.4393 - val_loss: 1.9826 - val_f1_score: 0.3554
Epoch 40/500
28/28 [=====] - ETA: 0s - loss: 1.8474 - f1_score: 0.4314

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 229ms/step - loss: 1.8474 - f1_score: 0.4314 - val_loss: 1.9250 - val_f1_score: 0.4046
Epoch 41/500
28/28 [=====] - 2s 66ms/step - loss: 1.7774 - f1_score: 0.4560 - val_loss: 1.9275 - val_f1_score: 0.3994
Epoch 42/500
28/28 [=====] - 2s 66ms/step - loss: 1.7955 - f1_score: 0.4362 - val_loss: 1.9348 - val_f1_score: 0.3842
Epoch 43/500
28/28 [=====] - 2s 67ms/step - loss: 1.6905 - f1_score: 0.4854 - val_loss: 1.9178 - val_f1_score: 0.3811
Epoch 44/500
28/28 [=====] - ETA: 0s - loss: 1.6831 - f1_score: 0.4794

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 6s 228ms/step - loss: 1.6831 -  
f1_score: 0.4794 - val_loss: 1.8571 - val_f1_score: 0.4458  
Epoch 45/500  
28/28 [=====] - 2s 66ms/step - loss: 1.6466 - f1_score:  
0.4813 - val_loss: 1.8758 - val_f1_score: 0.4211  
Epoch 46/500  
28/28 [=====] - 2s 66ms/step - loss: 1.6048 - f1_score:  
0.4905 - val_loss: 1.8860 - val_f1_score: 0.4154  
Epoch 47/500  
28/28 [=====] - 2s 66ms/step - loss: 1.5925 - f1_score:  
0.4995 - val_loss: 1.8232 - val_f1_score: 0.4415  
Epoch 48/500  
28/28 [=====] - 2s 66ms/step - loss: 1.6193 - f1_score:  
0.4950 - val_loss: 1.8246 - val_f1_score: 0.4203  
Epoch 49/500  
28/28 [=====] - ETA: 0s - loss: 1.5621 - f1_score:  
0.5092  
  
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/assets  
  
INFO:tensorflow:Assets written to: 3 1D CNN/assets  
  
28/28 [=====] - 6s 232ms/step - loss: 1.5621 -  
f1_score: 0.5092 - val_loss: 1.8054 - val_f1_score: 0.4458  
Epoch 50/500  
28/28 [=====] - 2s 66ms/step - loss: 1.5734 - f1_score:  
0.5110 - val_loss: 1.8474 - val_f1_score: 0.4100  
Epoch 51/500  
28/28 [=====] - ETA: 0s - loss: 1.5275 - f1_score:  
0.5221  
  
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/assets  
  
INFO:tensorflow:Assets written to: 3 1D CNN/assets  
  
28/28 [=====] - 6s 229ms/step - loss: 1.5275 -  
f1_score: 0.5221 - val_loss: 1.7770 - val_f1_score: 0.4689  
Epoch 52/500  
28/28 [=====] - 2s 66ms/step - loss: 1.4974 - f1_score:  
0.5264 - val_loss: 1.8606 - val_f1_score: 0.4194  
Epoch 53/500  
28/28 [=====] - 2s 66ms/step - loss: 1.4721 - f1_score:  
0.5459 - val_loss: 1.7381 - val_f1_score: 0.4624  
Epoch 54/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.4926 - f1_score: 0.5197
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 272ms/step - loss: 1.4926 - f1_score: 0.5197 - val_loss: 1.7246 - val_f1_score: 0.4778
Epoch 55/500
28/28 [=====] - ETA: 0s - loss: 1.4499 - f1_score: 0.5419
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 5s 198ms/step - loss: 1.4499 - f1_score: 0.5419 - val_loss: 1.7387 - val_f1_score: 0.4830
Epoch 56/500
28/28 [=====] - ETA: 0s - loss: 1.4523 - f1_score: 0.5385
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 224ms/step - loss: 1.4523 - f1_score: 0.5385 - val_loss: 1.7117 - val_f1_score: 0.4851
Epoch 57/500
28/28 [=====] - 2s 66ms/step - loss: 1.3963 - f1_score: 0.5594 - val_loss: 1.8051 - val_f1_score: 0.4462
Epoch 58/500
28/28 [=====] - 2s 66ms/step - loss: 1.3479 - f1_score: 0.5739 - val_loss: 1.7781 - val_f1_score: 0.4311
Epoch 59/500
28/28 [=====] - ETA: 0s - loss: 1.3531 - 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 CNN/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 248ms/step - loss: 1.3531 - f1_score: 0.5515 - val_loss: 1.7037 - val_f1_score: 0.4887
Epoch 60/500
28/28 [=====] - 2s 66ms/step - loss: 1.3560 - f1_score: 0.5680 - val_loss: 1.7398 - val_f1_score: 0.4633
Epoch 61/500
28/28 [=====] - 2s 66ms/step - loss: 1.3487 - f1_score: 0.5624 - val_loss: 1.7830 - val_f1_score: 0.4334
Epoch 62/500
28/28 [=====] - 2s 66ms/step - loss: 1.3249 - f1_score: 0.5764 - val_loss: 1.6772 - val_f1_score: 0.4871
Epoch 63/500
28/28 [=====] - 2s 66ms/step - loss: 1.2815 - f1_score: 0.5940 - val_loss: 1.7351 - val_f1_score: 0.4863
Epoch 64/500
28/28 [=====] - 2s 66ms/step - loss: 1.2817 - f1_score: 0.5865 - val_loss: 1.6972 - val_f1_score: 0.4692
Epoch 65/500
28/28 [=====] - 2s 66ms/step - loss: 1.2529 - f1_score: 0.5941 - val_loss: 1.6426 - val_f1_score: 0.4638
Epoch 66/500
28/28 [=====] - 2s 67ms/step - loss: 1.2382 - f1_score: 0.6044 - val_loss: 1.6358 - val_f1_score: 0.4881
Epoch 67/500
28/28 [=====] - 2s 67ms/step - loss: 1.2725 - f1_score: 0.5892 - val_loss: 1.6594 - val_f1_score: 0.4697
Epoch 68/500
28/28 [=====] - ETA: 0s - loss: 1.2464 - f1_score: 0.6008
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 21s 764ms/step - loss: 1.2464 - f1_score: 0.6008 - val_loss: 1.5913 - val_f1_score: 0.5237
Epoch 69/500
28/28 [=====] - 2s 65ms/step - loss: 1.2219 - f1_score: 0.6063 - val_loss: 1.5912 - val_f1_score: 0.5148
Epoch 70/500
28/28 [=====] - 2s 66ms/step - loss: 1.2064 - f1_score: 0.6169 - val_loss: 1.5941 - val_f1_score: 0.5195
Epoch 71/500
```

```
28/28 [=====] - 2s 67ms/step - loss: 1.1855 - f1_score: 0.6147 - val_loss: 1.6145 - val_f1_score: 0.5094
Epoch 72/500
28/28 [=====] - 2s 66ms/step - loss: 1.2087 - f1_score: 0.6165 - val_loss: 1.6826 - val_f1_score: 0.4893
Epoch 73/500
28/28 [=====] - 2s 67ms/step - loss: 1.1685 - f1_score: 0.6231 - val_loss: 1.6184 - val_f1_score: 0.4895
Epoch 74/500
28/28 [=====] - 2s 66ms/step - loss: 1.1435 - f1_score: 0.6305 - val_loss: 1.6075 - val_f1_score: 0.5131
Epoch 75/500
28/28 [=====] - 2s 66ms/step - loss: 1.1056 - f1_score: 0.6249 - val_loss: 1.6350 - val_f1_score: 0.4999
Epoch 76/500
28/28 [=====] - ETA: 0s - loss: 1.1333 - f1_score: 0.6287

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 255ms/step - loss: 1.1333 - f1_score: 0.6287 - val_loss: 1.6221 - val_f1_score: 0.5379
Epoch 77/500
28/28 [=====] - 2s 68ms/step - loss: 1.1030 - f1_score: 0.6363 - val_loss: 1.5921 - val_f1_score: 0.5257
Epoch 78/500
28/28 [=====] - 2s 65ms/step - loss: 1.0769 - f1_score: 0.6480 - val_loss: 1.5621 - val_f1_score: 0.5031
Epoch 79/500
28/28 [=====] - ETA: 0s - loss: 1.0850 - f1_score: 0.6484

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 225ms/step - loss: 1.0850 - f1_score: 0.6484 - val_loss: 1.5203 - val_f1_score: 0.5558
Epoch 80/500
28/28 [=====] - 2s 69ms/step - loss: 1.0268 - f1_score: 0.6655 - val_loss: 1.5663 - val_f1_score: 0.5381
Epoch 81/500
```

```
28/28 [=====] - 2s 66ms/step - loss: 1.0382 - f1_score: 0.6498 - val_loss: 1.6130 - val_f1_score: 0.5348
Epoch 82/500
28/28 [=====] - 2s 66ms/step - loss: 1.0468 - f1_score: 0.6541 - val_loss: 1.5822 - val_f1_score: 0.5235
Epoch 83/500
28/28 [=====] - 2s 67ms/step - loss: 1.0218 - f1_score: 0.6683 - val_loss: 1.5333 - val_f1_score: 0.5304
Epoch 84/500
28/28 [=====] - 2s 67ms/step - loss: 1.0504 - f1_score: 0.6639 - val_loss: 1.5986 - val_f1_score: 0.5214
Epoch 85/500
28/28 [=====] - 2s 69ms/step - loss: 0.9971 - f1_score: 0.6677 - val_loss: 1.6345 - val_f1_score: 0.5105
Epoch 86/500
28/28 [=====] - 2s 67ms/step - loss: 1.0243 - f1_score: 0.6697 - val_loss: 1.6495 - val_f1_score: 0.4945
Epoch 87/500
28/28 [=====] - 2s 69ms/step - loss: 1.0252 - f1_score: 0.6612 - val_loss: 1.5572 - val_f1_score: 0.5365
Epoch 88/500
28/28 [=====] - 2s 68ms/step - loss: 1.0020 - f1_score: 0.6685 - val_loss: 1.5816 - val_f1_score: 0.5084
Epoch 89/500
28/28 [=====] - 2s 67ms/step - loss: 0.9883 - f1_score: 0.6778 - val_loss: 1.5615 - val_f1_score: 0.5465
Epoch 90/500
28/28 [=====] - 2s 67ms/step - loss: 0.9869 - f1_score: 0.6826 - val_loss: 1.5826 - val_f1_score: 0.5262
Epoch 91/500
28/28 [=====] - 2s 68ms/step - loss: 0.9654 - f1_score: 0.6740 - val_loss: 1.5744 - val_f1_score: 0.5431
Epoch 92/500
28/28 [=====] - 2s 68ms/step - loss: 0.9667 - f1_score: 0.6840 - val_loss: 1.5641 - val_f1_score: 0.5417
Epoch 93/500
28/28 [=====] - 2s 74ms/step - loss: 0.9673 - f1_score: 0.6935 - val_loss: 1.5551 - val_f1_score: 0.5478
Epoch 94/500
28/28 [=====] - 2s 68ms/step - loss: 0.8949 - f1_score: 0.7004 - val_loss: 1.5140 - val_f1_score: 0.5512
Epoch 95/500
28/28 [=====] - 2s 67ms/step - loss: 0.9224 - f1_score: 0.6971 - val_loss: 1.5185 - val_f1_score: 0.5480
Epoch 96/500
28/28 [=====] - 2s 68ms/step - loss: 0.9052 - f1_score: 0.7063 - val_loss: 1.5481 - val_f1_score: 0.5428
Epoch 97/500
```

```
28/28 [=====] - ETA: 0s - loss: 0.8993 - f1_score: 0.6976
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 8s 290ms/step - loss: 0.8993 - f1_score: 0.6976 - val_loss: 1.5600 - val_f1_score: 0.5622
Epoch 98/500
28/28 [=====] - 2s 66ms/step - loss: 0.8950 - f1_score: 0.7072 - val_loss: 1.5681 - val_f1_score: 0.5342
Epoch 99/500
28/28 [=====] - 2s 66ms/step - loss: 0.8926 - f1_score: 0.7081 - val_loss: 1.5554 - val_f1_score: 0.5433
Epoch 100/500
28/28 [=====] - ETA: 0s - loss: 0.9025 - f1_score: 0.6966
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 227ms/step - loss: 0.9025 - f1_score: 0.6966 - val_loss: 1.5581 - val_f1_score: 0.5676
Epoch 101/500
28/28 [=====] - 2s 66ms/step - loss: 0.8563 - f1_score: 0.7155 - val_loss: 1.5652 - val_f1_score: 0.5463
Epoch 102/500
28/28 [=====] - 2s 67ms/step - loss: 0.8972 - f1_score: 0.7044 - val_loss: 1.5547 - val_f1_score: 0.5641
Epoch 103/500
28/28 [=====] - 2s 67ms/step - loss: 0.8844 - f1_score: 0.7095 - val_loss: 1.5090 - val_f1_score: 0.5495
Epoch 104/500
28/28 [=====] - 2s 68ms/step - loss: 0.8400 - f1_score: 0.7076 - val_loss: 1.5047 - val_f1_score: 0.5478
Epoch 105/500
28/28 [=====] - 2s 67ms/step - loss: 0.9223 - f1_score: 0.6853 - val_loss: 1.5246 - val_f1_score: 0.5470
Epoch 106/500
28/28 [=====] - 2s 68ms/step - loss: 0.8451 - f1_score: 0.7248 - val_loss: 1.6164 - val_f1_score: 0.5623
Epoch 107/500
```

```
28/28 [=====] - 2s 67ms/step - loss: 0.8612 - f1_score: 0.7141 - val_loss: 1.4867 - val_f1_score: 0.5616
Epoch 108/500
28/28 [=====] - ETA: 0s - loss: 0.8172 - f1_score: 0.7316

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 247ms/step - loss: 0.8172 - f1_score: 0.7316 - val_loss: 1.5326 - val_f1_score: 0.5841
Epoch 109/500
28/28 [=====] - 2s 69ms/step - loss: 0.8564 - f1_score: 0.7252 - val_loss: 1.6160 - val_f1_score: 0.5201
Epoch 110/500
28/28 [=====] - 2s 67ms/step - loss: 0.8035 - f1_score: 0.7396 - val_loss: 1.6072 - val_f1_score: 0.5377
Epoch 111/500
28/28 [=====] - 2s 67ms/step - loss: 0.8159 - f1_score: 0.7316 - val_loss: 1.5029 - val_f1_score: 0.5687
Epoch 112/500
28/28 [=====] - 2s 67ms/step - loss: 0.7854 - f1_score: 0.7311 - val_loss: 1.5355 - val_f1_score: 0.5798
Epoch 113/500
28/28 [=====] - 2s 68ms/step - loss: 0.7937 - f1_score: 0.7402 - val_loss: 1.5263 - val_f1_score: 0.5643
Epoch 114/500
28/28 [=====] - 2s 68ms/step - loss: 0.7915 - f1_score: 0.7260 - val_loss: 1.5733 - val_f1_score: 0.5318
Epoch 115/500
28/28 [=====] - 2s 68ms/step - loss: 0.7954 - f1_score: 0.7357 - val_loss: 1.5434 - val_f1_score: 0.5492
Epoch 116/500
28/28 [=====] - 2s 68ms/step - loss: 0.8234 - f1_score: 0.7396 - val_loss: 1.4927 - val_f1_score: 0.5658
Epoch 117/500
28/28 [=====] - 2s 68ms/step - loss: 0.7703 - f1_score: 0.7424 - val_loss: 1.4620 - val_f1_score: 0.5753
Epoch 118/500
28/28 [=====] - 2s 68ms/step - loss: 0.7757 - f1_score: 0.7519 - val_loss: 1.4888 - val_f1_score: 0.5598
Epoch 119/500
28/28 [=====] - 2s 68ms/step - loss: 0.7433 - f1_score: 0.7506 - val_loss: 1.5438 - val_f1_score: 0.5563
Epoch 120/500
```

```
28/28 [=====] - 2s 68ms/step - loss: 0.7976 - f1_score: 0.7347 - val_loss: 1.4766 - val_f1_score: 0.5710
Epoch 121/500
28/28 [=====] - 2s 68ms/step - loss: 0.7697 - f1_score: 0.7359 - val_loss: 1.5403 - val_f1_score: 0.5411
Epoch 122/500
28/28 [=====] - ETA: 0s - loss: 0.7466 - f1_score: 0.7520

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 7s 258ms/step - loss: 0.7466 - f1_score: 0.7520 - val_loss: 1.5130 - val_f1_score: 0.5890
Epoch 123/500
28/28 [=====] - ETA: 0s - loss: 0.7404 - f1_score: 0.7692

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 222ms/step - loss: 0.7404 - f1_score: 0.7692 - val_loss: 1.4547 - val_f1_score: 0.5954
Epoch 124/500
28/28 [=====] - 2s 66ms/step - loss: 0.7287 - f1_score: 0.7568 - val_loss: 1.4534 - val_f1_score: 0.5698
Epoch 125/500
28/28 [=====] - 2s 68ms/step - loss: 0.7568 - f1_score: 0.7613 - val_loss: 1.4907 - val_f1_score: 0.5722
Epoch 126/500
28/28 [=====] - 2s 67ms/step - loss: 0.7391 - f1_score: 0.7609 - val_loss: 1.5076 - val_f1_score: 0.5840
Epoch 127/500
28/28 [=====] - 2s 67ms/step - loss: 0.6957 - f1_score: 0.7725 - val_loss: 1.5316 - val_f1_score: 0.5619
Epoch 128/500
28/28 [=====] - 2s 67ms/step - loss: 0.7279 - f1_score: 0.7522 - val_loss: 1.5452 - val_f1_score: 0.5562
Epoch 129/500
28/28 [=====] - 2s 69ms/step - loss: 0.7515 - f1_score: 0.7477 - val_loss: 1.4480 - val_f1_score: 0.5820
Epoch 130/500
```

```
28/28 [=====] - 2s 68ms/step - loss: 0.7105 - f1_score: 0.7621 - val_loss: 1.4668 - val_f1_score: 0.5920
Epoch 131/500
28/28 [=====] - 2s 68ms/step - loss: 0.7075 - f1_score: 0.7775 - val_loss: 1.4345 - val_f1_score: 0.5805
Epoch 132/500
28/28 [=====] - 2s 67ms/step - loss: 0.7066 - f1_score: 0.7657 - val_loss: 1.5186 - val_f1_score: 0.5688
Epoch 133/500
28/28 [=====] - 2s 68ms/step - loss: 0.6797 - f1_score: 0.7731 - val_loss: 1.5085 - val_f1_score: 0.5665
Epoch 134/500
28/28 [=====] - 2s 68ms/step - loss: 0.7368 - f1_score: 0.7554 - val_loss: 1.4748 - val_f1_score: 0.5790
Epoch 135/500
28/28 [=====] - 2s 70ms/step - loss: 0.7039 - f1_score: 0.7612 - val_loss: 1.5429 - val_f1_score: 0.5555
Epoch 136/500
28/28 [=====] - 2s 71ms/step - loss: 0.6771 - f1_score: 0.7800 - val_loss: 1.4777 - val_f1_score: 0.5662
Epoch 137/500
28/28 [=====] - 2s 68ms/step - loss: 0.6942 - f1_score: 0.7727 - val_loss: 1.4719 - val_f1_score: 0.5860
Epoch 138/500
28/28 [=====] - 2s 68ms/step - loss: 0.6758 - f1_score: 0.7728 - val_loss: 1.5159 - val_f1_score: 0.5546
Epoch 139/500
28/28 [=====] - 2s 69ms/step - loss: 0.6730 - f1_score: 0.7793 - val_loss: 1.5160 - val_f1_score: 0.5723
Epoch 140/500
28/28 [=====] - 2s 71ms/step - loss: 0.6307 - f1_score: 0.7877 - val_loss: 1.5593 - val_f1_score: 0.5470
Epoch 141/500
28/28 [=====] - 2s 69ms/step - loss: 0.6695 - f1_score: 0.7771 - val_loss: 1.5037 - val_f1_score: 0.5841
Epoch 142/500
28/28 [=====] - 2s 69ms/step - loss: 0.6311 - f1_score: 0.7812 - val_loss: 1.4994 - val_f1_score: 0.5784
Epoch 143/500
28/28 [=====] - 2s 68ms/step - loss: 0.6855 - f1_score: 0.7665 - val_loss: 1.5028 - val_f1_score: 0.5880
Epoch 144/500
28/28 [=====] - ETA: 0s - loss: 0.6494 - f1_score: 0.7736
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 256ms/step - loss: 0.6494 - f1_score: 0.7736 - val_loss: 1.4778 - val_f1_score: 0.5956
Epoch 145/500
28/28 [=====] - ETA: 0s - loss: 0.6839 - f1_score: 0.7660

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 224ms/step - loss: 0.6839 - f1_score: 0.7660 - val_loss: 1.5285 - val_f1_score: 0.6088
Epoch 146/500
28/28 [=====] - 2s 67ms/step - loss: 0.6629 - f1_score: 0.7814 - val_loss: 1.5313 - val_f1_score: 0.5713
Epoch 147/500
28/28 [=====] - 2s 67ms/step - loss: 0.6532 - f1_score: 0.7780 - val_loss: 1.5115 - val_f1_score: 0.5779
Epoch 148/500
28/28 [=====] - 2s 67ms/step - loss: 0.6467 - f1_score: 0.7815 - val_loss: 1.4533 - val_f1_score: 0.5903
Epoch 149/500
28/28 [=====] - 2s 77ms/step - loss: 0.6023 - f1_score: 0.7955 - val_loss: 1.5820 - val_f1_score: 0.5648
Epoch 150/500
28/28 [=====] - 2s 68ms/step - loss: 0.6408 - f1_score: 0.7894 - val_loss: 1.4101 - val_f1_score: 0.6083
Epoch 151/500
28/28 [=====] - 2s 68ms/step - loss: 0.6445 - f1_score: 0.7724 - val_loss: 1.4365 - val_f1_score: 0.6039
Epoch 152/500
28/28 [=====] - 2s 68ms/step - loss: 0.6191 - f1_score: 0.7934 - val_loss: 1.4809 - val_f1_score: 0.6079
Epoch 153/500
28/28 [=====] - 2s 68ms/step - loss: 0.6166 - f1_score: 0.7982 - val_loss: 1.4462 - val_f1_score: 0.6007
Epoch 154/500
28/28 [=====] - 2s 67ms/step - loss: 0.5938 - f1_score: 0.8037 - val_loss: 1.4739 - val_f1_score: 0.5907
Epoch 155/500
28/28 [=====] - 2s 67ms/step - loss: 0.5940 - f1_score: 0.7995 - val_loss: 1.4469 - val_f1_score: 0.6062
Epoch 156/500
```

```
28/28 [=====] - 2s 68ms/step - loss: 0.6182 - f1_score: 0.7911 - val_loss: 1.5288 - val_f1_score: 0.5973
Epoch 157/500
28/28 [=====] - 2s 69ms/step - loss: 0.6143 - f1_score: 0.7922 - val_loss: 1.4846 - val_f1_score: 0.5678
Epoch 158/500
28/28 [=====] - 2s 69ms/step - loss: 0.5917 - f1_score: 0.7968 - val_loss: 1.5363 - val_f1_score: 0.5819
Epoch 159/500
28/28 [=====] - 2s 68ms/step - loss: 0.5861 - f1_score: 0.7951 - val_loss: 1.4991 - val_f1_score: 0.5913
Epoch 160/500
28/28 [=====] - 2s 69ms/step - loss: 0.5823 - f1_score: 0.8036 - val_loss: 1.5085 - val_f1_score: 0.5853
Epoch 161/500
28/28 [=====] - 2s 75ms/step - loss: 0.5802 - f1_score: 0.8061 - val_loss: 1.5007 - val_f1_score: 0.5973
Epoch 162/500
28/28 [=====] - ETA: 0s - loss: 0.5782 - f1_score: 0.8100

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 6s 231ms/step - loss: 0.5782 - f1_score: 0.8100 - val_loss: 1.4267 - val_f1_score: 0.6117
Epoch 163/500
28/28 [=====] - 2s 67ms/step - loss: 0.6122 - f1_score: 0.7911 - val_loss: 1.5330 - val_f1_score: 0.5913
Epoch 164/500
28/28 [=====] - 2s 67ms/step - loss: 0.5623 - f1_score: 0.8101 - val_loss: 1.5140 - val_f1_score: 0.5992
Epoch 165/500
28/28 [=====] - 2s 69ms/step - loss: 0.5728 - f1_score: 0.7988 - val_loss: 1.5014 - val_f1_score: 0.6028
Epoch 166/500
28/28 [=====] - ETA: 0s - loss: 0.5812 - f1_score: 0.8012

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
```

```
28/28 [=====] - 7s 252ms/step - loss: 0.5812 -  
f1_score: 0.8012 - val_loss: 1.4339 - val_f1_score: 0.6192  
Epoch 167/500  
28/28 [=====] - 2s 66ms/step - loss: 0.5581 - f1_score:  
0.8136 - val_loss: 1.5337 - val_f1_score: 0.5962  
Epoch 168/500  
28/28 [=====] - 2s 67ms/step - loss: 0.5800 - f1_score:  
0.8107 - val_loss: 1.5016 - val_f1_score: 0.5792  
Epoch 169/500  
28/28 [=====] - 2s 67ms/step - loss: 0.5986 - f1_score:  
0.8003 - val_loss: 1.4617 - val_f1_score: 0.6113  
Epoch 170/500  
28/28 [=====] - 2s 68ms/step - loss: 0.5942 - f1_score:  
0.7940 - val_loss: 1.5359 - val_f1_score: 0.6175  
Epoch 171/500  
28/28 [=====] - 2s 68ms/step - loss: 0.5762 - f1_score:  
0.8032 - val_loss: 1.4756 - val_f1_score: 0.6123  
Epoch 172/500  
28/28 [=====] - 2s 69ms/step - loss: 0.5647 - f1_score:  
0.8090 - val_loss: 1.5349 - val_f1_score: 0.6002  
Epoch 173/500  
28/28 [=====] - 2s 68ms/step - loss: 0.5344 - f1_score:  
0.8172 - val_loss: 1.5108 - val_f1_score: 0.6030  
Epoch 174/500  
28/28 [=====] - 2s 68ms/step - loss: 0.5348 - f1_score:  
0.8216 - val_loss: 1.4161 - val_f1_score: 0.6183  
Epoch 175/500  
28/28 [=====] - 2s 68ms/step - loss: 0.5651 - f1_score:  
0.8119 - val_loss: 1.4986 - val_f1_score: 0.5970  
Epoch 176/500  
28/28 [=====] - ETA: 0s - loss: 0.5346 - f1_score:  
0.8329
```

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

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28/28 [=====] - 23s 851ms/step - loss: 0.5346 -  
f1_score: 0.8329 - val_loss: 1.4650 - val_f1_score: 0.6248  
Epoch 177/500
```

```
28/28 [=====] - ETA: 0s - loss: 0.5364 - f1_score:  
0.8211
```

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 268ms/step - loss: 0.5364 - f1_score: 0.8211 - val_loss: 1.4958 - val_f1_score: 0.6405
Epoch 178/500
28/28 [=====] - 2s 66ms/step - loss: 0.5542 - f1_score: 0.8195 - val_loss: 1.5377 - val_f1_score: 0.6030
Epoch 179/500
28/28 [=====] - 2s 66ms/step - loss: 0.5379 - f1_score: 0.8215 - val_loss: 1.5169 - val_f1_score: 0.5893
Epoch 180/500
28/28 [=====] - 2s 66ms/step - loss: 0.5291 - f1_score: 0.8279 - val_loss: 1.5638 - val_f1_score: 0.6063
Epoch 181/500
28/28 [=====] - 2s 66ms/step - loss: 0.5374 - f1_score: 0.8193 - val_loss: 1.4980 - val_f1_score: 0.6048
Epoch 182/500
28/28 [=====] - 2s 66ms/step - loss: 0.5333 - f1_score: 0.8304 - val_loss: 1.5620 - val_f1_score: 0.5925
Epoch 183/500
28/28 [=====] - 2s 66ms/step - loss: 0.5197 - f1_score: 0.8200 - val_loss: 1.4982 - val_f1_score: 0.6341
Epoch 184/500
28/28 [=====] - 2s 66ms/step - loss: 0.5481 - f1_score: 0.8255 - val_loss: 1.5188 - val_f1_score: 0.6191
Epoch 185/500
28/28 [=====] - 2s 66ms/step - loss: 0.5043 - f1_score: 0.8226 - val_loss: 1.5236 - val_f1_score: 0.6147
Epoch 186/500
28/28 [=====] - 2s 66ms/step - loss: 0.5030 - f1_score: 0.8251 - val_loss: 1.4601 - val_f1_score: 0.6169
Epoch 187/500
28/28 [=====] - 2s 67ms/step - loss: 0.5157 - f1_score: 0.8159 - val_loss: 1.4389 - val_f1_score: 0.6214
Epoch 188/500
28/28 [=====] - 2s 67ms/step - loss: 0.4840 - f1_score: 0.8370 - val_loss: 1.4887 - val_f1_score: 0.6397
Epoch 189/500
28/28 [=====] - 2s 68ms/step - loss: 0.5075 - f1_score: 0.8289 - val_loss: 1.5292 - val_f1_score: 0.6043
Epoch 190/500
28/28 [=====] - 2s 67ms/step - loss: 0.5160 - f1_score: 0.8306 - val_loss: 1.5338 - val_f1_score: 0.5815
Epoch 191/500
28/28 [=====] - 2s 68ms/step - loss: 0.5387 - f1_score: 0.8154 - val_loss: 1.5246 - val_f1_score: 0.5994
Epoch 192/500
```

```
28/28 [=====] - ETA: 0s - loss: 0.4987 - f1_score: 0.8358
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 22s 806ms/step - loss: 0.4987 - f1_score: 0.8358 - val_loss: 1.4093 - val_f1_score: 0.6418
Epoch 193/500
28/28 [=====] - 2s 66ms/step - loss: 0.5150 - f1_score: 0.8269 - val_loss: 1.5285 - val_f1_score: 0.6250
Epoch 194/500
28/28 [=====] - 2s 66ms/step - loss: 0.5092 - f1_score: 0.8287 - val_loss: 1.4418 - val_f1_score: 0.6262
Epoch 195/500
28/28 [=====] - 2s 67ms/step - loss: 0.4977 - f1_score: 0.8290 - val_loss: 1.5946 - val_f1_score: 0.5875
Epoch 196/500
28/28 [=====] - 2s 68ms/step - loss: 0.5038 - f1_score: 0.8229 - val_loss: 1.5872 - val_f1_score: 0.6012
Epoch 197/500
28/28 [=====] - 2s 66ms/step - loss: 0.5045 - f1_score: 0.8326 - val_loss: 1.5225 - val_f1_score: 0.6288
Epoch 198/500
28/28 [=====] - 2s 66ms/step - loss: 0.5255 - f1_score: 0.8329 - val_loss: 1.5440 - val_f1_score: 0.6355
Epoch 199/500
28/28 [=====] - 2s 66ms/step - loss: 0.4690 - f1_score: 0.8477 - val_loss: 1.5133 - val_f1_score: 0.6228
Epoch 200/500
28/28 [=====] - 2s 67ms/step - loss: 0.4921 - f1_score: 0.8255 - val_loss: 1.5688 - val_f1_score: 0.6201
Epoch 201/500
28/28 [=====] - 2s 66ms/step - loss: 0.5118 - f1_score: 0.8184 - val_loss: 1.4997 - val_f1_score: 0.6303
Epoch 202/500
28/28 [=====] - 2s 67ms/step - loss: 0.5043 - f1_score: 0.8289 - val_loss: 1.5206 - val_f1_score: 0.6376
Epoch 203/500
28/28 [=====] - 2s 67ms/step - loss: 0.5007 - f1_score: 0.8312 - val_loss: 1.5354 - val_f1_score: 0.6156
Epoch 204/500
28/28 [=====] - 2s 67ms/step - loss: 0.5080 - f1_score: 0.8272 - val_loss: 1.4408 - val_f1_score: 0.6150
Epoch 205/500
```

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28/28 [=====] - ETA: 0s - loss: 0.4582 - f1_score: 0.8495
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 255ms/step - loss: 0.4582 - f1_score: 0.8495 - val_loss: 1.4905 - val_f1_score: 0.6470
Epoch 206/500
28/28 [=====] - 2s 67ms/step - loss: 0.5138 - f1_score: 0.8230 - val_loss: 1.5045 - val_f1_score: 0.6162
Epoch 207/500
28/28 [=====] - 2s 68ms/step - loss: 0.4874 - f1_score: 0.8373 - val_loss: 1.5712 - val_f1_score: 0.6099
Epoch 208/500
28/28 [=====] - 2s 68ms/step - loss: 0.5049 - f1_score: 0.8254 - val_loss: 1.4590 - val_f1_score: 0.6413
Epoch 209/500
28/28 [=====] - 2s 68ms/step - loss: 0.4876 - f1_score: 0.8382 - val_loss: 1.5897 - val_f1_score: 0.6172
Epoch 210/500
28/28 [=====] - 2s 69ms/step - loss: 0.4750 - f1_score: 0.8486 - val_loss: 1.4717 - val_f1_score: 0.6343
Epoch 211/500
28/28 [=====] - 2s 79ms/step - loss: 0.4640 - f1_score: 0.8438 - val_loss: 1.5145 - val_f1_score: 0.6296
Epoch 212/500
28/28 [=====] - 2s 78ms/step - loss: 0.4529 - f1_score: 0.8496 - val_loss: 1.4768 - val_f1_score: 0.6080
Epoch 213/500
28/28 [=====] - 2s 77ms/step - loss: 0.4777 - f1_score: 0.8395 - val_loss: 1.4608 - val_f1_score: 0.6394
Epoch 214/500
28/28 [=====] - 2s 70ms/step - loss: 0.4828 - f1_score: 0.8312 - val_loss: 1.6666 - val_f1_score: 0.5907
Epoch 215/500
28/28 [=====] - 2s 69ms/step - loss: 0.4612 - f1_score: 0.8386 - val_loss: 1.4487 - val_f1_score: 0.6365
Epoch 216/500
28/28 [=====] - 2s 69ms/step - loss: 0.4920 - f1_score: 0.8380 - val_loss: 1.4195 - val_f1_score: 0.6382
Epoch 217/500
28/28 [=====] - 2s 69ms/step - loss: 0.4672 - f1_score: 0.8395 - val_loss: 1.4940 - val_f1_score: 0.6216
Epoch 218/500
```

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28/28 [=====] - 2s 70ms/step - loss: 0.4614 - f1_score: 0.8456 - val_loss: 1.5357 - val_f1_score: 0.6404
Epoch 219/500
28/28 [=====] - 2s 72ms/step - loss: 0.4564 - f1_score: 0.8549 - val_loss: 1.4689 - val_f1_score: 0.6305
Epoch 220/500
28/28 [=====] - 2s 69ms/step - loss: 0.4440 - f1_score: 0.8437 - val_loss: 1.4400 - val_f1_score: 0.6404
Epoch 221/500
28/28 [=====] - 2s 69ms/step - loss: 0.4578 - f1_score: 0.8481 - val_loss: 1.5185 - val_f1_score: 0.6248
Epoch 222/500
28/28 [=====] - 2s 69ms/step - loss: 0.4518 - f1_score: 0.8480 - val_loss: 1.4789 - val_f1_score: 0.6255
Epoch 223/500
28/28 [=====] - 2s 69ms/step - loss: 0.4254 - f1_score: 0.8587 - val_loss: 1.4303 - val_f1_score: 0.6272
Epoch 224/500
28/28 [=====] - 2s 74ms/step - loss: 0.4529 - f1_score: 0.8601 - val_loss: 1.4978 - val_f1_score: 0.6432
Epoch 225/500
28/28 [=====] - 2s 70ms/step - loss: 0.4239 - f1_score: 0.8538 - val_loss: 1.4510 - val_f1_score: 0.6290
Epoch 226/500
28/28 [=====] - 2s 69ms/step - loss: 0.4644 - f1_score: 0.8385 - val_loss: 1.4601 - val_f1_score: 0.6353
Epoch 227/500
28/28 [=====] - 2s 70ms/step - loss: 0.4443 - f1_score: 0.8409 - val_loss: 1.4927 - val_f1_score: 0.6406
Epoch 228/500
28/28 [=====] - 2s 72ms/step - loss: 0.4336 - f1_score: 0.8583 - val_loss: 1.6191 - val_f1_score: 0.5939
Epoch 229/500
28/28 [=====] - 2s 69ms/step - loss: 0.4407 - f1_score: 0.8467 - val_loss: 1.4744 - val_f1_score: 0.6392
Epoch 230/500
28/28 [=====] - 2s 70ms/step - loss: 0.4246 - f1_score: 0.8614 - val_loss: 1.5016 - val_f1_score: 0.6362
Epoch 231/500
28/28 [=====] - ETA: 0s - loss: 0.4541 - f1_score: 0.8503
```

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/assets

INFO:tensorflow:Assets written to: 3 1D CNN/assets

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28/28 [=====] - 6s 232ms/step - loss: 0.4541 -  
f1_score: 0.8503 - val_loss: 1.4538 - val_f1_score: 0.6511  
Epoch 232/500  
28/28 [=====] - ETA: 0s - loss: 0.4370 - f1_score:  
0.8549  
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/assets  
INFO:tensorflow:Assets written to: 3 1D CNN/assets  
28/28 [=====] - 7s 251ms/step - loss: 0.4370 -  
f1_score: 0.8549 - val_loss: 1.4663 - val_f1_score: 0.6526  
Epoch 233/500  
28/28 [=====] - 2s 67ms/step - loss: 0.4288 - f1_score:  
0.8499 - val_loss: 1.5041 - val_f1_score: 0.6289  
Epoch 234/500  
28/28 [=====] - 2s 67ms/step - loss: 0.4535 - f1_score:  
0.8593 - val_loss: 1.4377 - val_f1_score: 0.6445  
Epoch 235/500  
28/28 [=====] - 2s 68ms/step - loss: 0.3999 - f1_score:  
0.8676 - val_loss: 1.4858 - val_f1_score: 0.6394  
Epoch 236/500  
28/28 [=====] - 2s 68ms/step - loss: 0.4258 - f1_score:  
0.8485 - val_loss: 1.6599 - val_f1_score: 0.6091  
Epoch 237/500  
28/28 [=====] - 2s 69ms/step - loss: 0.4254 - f1_score:  
0.8616 - val_loss: 1.5481 - val_f1_score: 0.6397  
Epoch 238/500  
28/28 [=====] - 2s 69ms/step - loss: 0.4208 - f1_score:  
0.8535 - val_loss: 1.4930 - val_f1_score: 0.6378  
Epoch 239/500  
28/28 [=====] - 2s 69ms/step - loss: 0.4163 - f1_score:  
0.8654 - val_loss: 1.5717 - val_f1_score: 0.6319  
Epoch 240/500  
28/28 [=====] - 2s 69ms/step - loss: 0.4279 - f1_score:  
0.8614 - val_loss: 1.4707 - val_f1_score: 0.6456  
Epoch 241/500  
28/28 [=====] - 2s 73ms/step - loss: 0.3998 - f1_score:  
0.8687 - val_loss: 1.4642 - val_f1_score: 0.6291  
Epoch 242/500  
28/28 [=====] - 2s 68ms/step - loss: 0.4438 - f1_score:  
0.8409 - val_loss: 1.4414 - val_f1_score: 0.6466  
Epoch 243/500  
28/28 [=====] - 2s 70ms/step - loss: 0.4014 - f1_score:  
0.8681 - val_loss: 1.6180 - val_f1_score: 0.6224  
Epoch 244/500
```

```
28/28 [=====] - 2s 70ms/step - loss: 0.4330 - f1_score: 0.8453 - val_loss: 1.5243 - val_f1_score: 0.6186
Epoch 245/500
28/28 [=====] - 2s 69ms/step - loss: 0.4296 - f1_score: 0.8577 - val_loss: 1.4954 - val_f1_score: 0.6414
Epoch 246/500
28/28 [=====] - ETA: 0s - loss: 0.4058 - f1_score: 0.8653

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 6s 236ms/step - loss: 0.4058 - f1_score: 0.8653 - val_loss: 1.4151 - val_f1_score: 0.6603
Epoch 247/500
28/28 [=====] - 2s 67ms/step - loss: 0.4161 - f1_score: 0.8621 - val_loss: 1.5564 - val_f1_score: 0.6535
Epoch 248/500
28/28 [=====] - 2s 71ms/step - loss: 0.3976 - f1_score: 0.8653 - val_loss: 1.4453 - val_f1_score: 0.6397
Epoch 249/500
28/28 [=====] - 2s 69ms/step - loss: 0.3707 - f1_score: 0.8761 - val_loss: 1.4984 - val_f1_score: 0.6456
Epoch 250/500
28/28 [=====] - 2s 69ms/step - loss: 0.3976 - f1_score: 0.8697 - val_loss: 1.3964 - val_f1_score: 0.6412
Epoch 251/500
28/28 [=====] - 2s 69ms/step - loss: 0.4464 - f1_score: 0.8521 - val_loss: 1.4982 - val_f1_score: 0.6467
Epoch 252/500
28/28 [=====] - 2s 69ms/step - loss: 0.3980 - f1_score: 0.8675 - val_loss: 1.5409 - val_f1_score: 0.6497
Epoch 253/500
28/28 [=====] - 2s 70ms/step - loss: 0.4430 - f1_score: 0.8478 - val_loss: 1.5302 - val_f1_score: 0.6456
Epoch 254/500
28/28 [=====] - 2s 70ms/step - loss: 0.4074 - f1_score: 0.8626 - val_loss: 1.5977 - val_f1_score: 0.6047
Epoch 255/500
28/28 [=====] - 2s 69ms/step - loss: 0.3803 - f1_score: 0.8751 - val_loss: 1.6109 - val_f1_score: 0.6225
Epoch 256/500
28/28 [=====] - 2s 74ms/step - loss: 0.4208 - f1_score: 0.8592 - val_loss: 1.5003 - val_f1_score: 0.6337
Epoch 257/500
```

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28/28 [=====] - 2s 71ms/step - loss: 0.3808 - f1_score: 0.8702 - val_loss: 1.5211 - val_f1_score: 0.6203
Epoch 258/500
28/28 [=====] - 2s 70ms/step - loss: 0.3967 - f1_score: 0.8707 - val_loss: 1.6104 - val_f1_score: 0.6239
Epoch 259/500
28/28 [=====] - 2s 71ms/step - loss: 0.4076 - f1_score: 0.8601 - val_loss: 1.6012 - val_f1_score: 0.6356
Epoch 260/500
28/28 [=====] - 2s 70ms/step - loss: 0.3942 - f1_score: 0.8656 - val_loss: 1.5573 - val_f1_score: 0.6372
Epoch 261/500
28/28 [=====] - ETA: 0s - loss: 0.3710 - f1_score: 0.8770
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 272ms/step - loss: 0.3710 - f1_score: 0.8770 - val_loss: 1.4904 - val_f1_score: 0.6734
Epoch 262/500
28/28 [=====] - 2s 67ms/step - loss: 0.3930 - f1_score: 0.8704 - val_loss: 1.4717 - val_f1_score: 0.6318
Epoch 263/500
28/28 [=====] - 2s 68ms/step - loss: 0.3804 - f1_score: 0.8780 - val_loss: 1.6335 - val_f1_score: 0.6253
Epoch 264/500
28/28 [=====] - 2s 68ms/step - loss: 0.3838 - f1_score: 0.8731 - val_loss: 1.4446 - val_f1_score: 0.6657
Epoch 265/500
28/28 [=====] - 2s 69ms/step - loss: 0.3930 - f1_score: 0.8620 - val_loss: 1.5021 - val_f1_score: 0.6477
Epoch 266/500
28/28 [=====] - 2s 69ms/step - loss: 0.3713 - f1_score: 0.8820 - val_loss: 1.5527 - val_f1_score: 0.6565
Epoch 267/500
28/28 [=====] - 2s 69ms/step - loss: 0.4042 - f1_score: 0.8623 - val_loss: 1.5441 - val_f1_score: 0.6587
Epoch 268/500
28/28 [=====] - 2s 83ms/step - loss: 0.3896 - f1_score: 0.8626 - val_loss: 1.5287 - val_f1_score: 0.6505
Epoch 269/500
28/28 [=====] - 2s 69ms/step - loss: 0.3846 - f1_score: 0.8673 - val_loss: 1.4869 - val_f1_score: 0.6394
Epoch 270/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 0.4054 - f1_score: 0.8638 - val_loss: 1.5744 - val_f1_score: 0.6493
Epoch 271/500
28/28 [=====] - 2s 70ms/step - loss: 0.3991 - f1_score: 0.8645 - val_loss: 1.6199 - val_f1_score: 0.6338
Epoch 272/500
28/28 [=====] - 2s 72ms/step - loss: 0.3970 - f1_score: 0.8690 - val_loss: 1.4737 - val_f1_score: 0.6467
Epoch 273/500
28/28 [=====] - 2s 69ms/step - loss: 0.3613 - f1_score: 0.8770 - val_loss: 1.6005 - val_f1_score: 0.6385
Epoch 274/500
28/28 [=====] - 2s 70ms/step - loss: 0.4104 - f1_score: 0.8578 - val_loss: 1.5372 - val_f1_score: 0.6229
Epoch 275/500
28/28 [=====] - 2s 71ms/step - loss: 0.3736 - f1_score: 0.8808 - val_loss: 1.5510 - val_f1_score: 0.6323
Epoch 276/500
28/28 [=====] - 2s 71ms/step - loss: 0.3604 - f1_score: 0.8832 - val_loss: 1.5856 - val_f1_score: 0.6478
Epoch 277/500
28/28 [=====] - 2s 70ms/step - loss: 0.3897 - f1_score: 0.8757 - val_loss: 1.5884 - val_f1_score: 0.6330
Epoch 278/500
28/28 [=====] - 2s 69ms/step - loss: 0.3502 - f1_score: 0.8884 - val_loss: 1.5859 - val_f1_score: 0.6393
Epoch 279/500
28/28 [=====] - 2s 70ms/step - loss: 0.3500 - f1_score: 0.8829 - val_loss: 1.5547 - val_f1_score: 0.6224
Epoch 280/500
28/28 [=====] - 2s 70ms/step - loss: 0.3800 - f1_score: 0.8724 - val_loss: 1.5326 - val_f1_score: 0.6324
Epoch 281/500
28/28 [=====] - 2s 72ms/step - loss: 0.3552 - f1_score: 0.8851 - val_loss: 1.5065 - val_f1_score: 0.6525
Epoch 282/500
28/28 [=====] - 2s 72ms/step - loss: 0.3766 - f1_score: 0.8774 - val_loss: 1.4402 - val_f1_score: 0.6535
Epoch 283/500
28/28 [=====] - 2s 70ms/step - loss: 0.3435 - f1_score: 0.8833 - val_loss: 1.5487 - val_f1_score: 0.6411
Epoch 284/500
28/28 [=====] - 2s 69ms/step - loss: 0.3395 - f1_score: 0.8871 - val_loss: 1.5731 - val_f1_score: 0.6532
Epoch 285/500
28/28 [=====] - 2s 70ms/step - loss: 0.3769 - f1_score: 0.8718 - val_loss: 1.6545 - val_f1_score: 0.6486
Epoch 286/500
```

```
28/28 [=====] - ETA: 0s - loss: 0.3666 - f1_score: 0.8765
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 8s 279ms/step - loss: 0.3666 - f1_score: 0.8765 - val_loss: 1.5653 - val_f1_score: 0.6832
Epoch 287/500
28/28 [=====] - 2s 67ms/step - loss: 0.3589 - f1_score: 0.8793 - val_loss: 1.5798 - val_f1_score: 0.6689
Epoch 288/500
28/28 [=====] - 2s 68ms/step - loss: 0.3385 - f1_score: 0.8837 - val_loss: 1.4468 - val_f1_score: 0.6663
Epoch 289/500
28/28 [=====] - 2s 69ms/step - loss: 0.3707 - f1_score: 0.8750 - val_loss: 1.7082 - val_f1_score: 0.6263
Epoch 290/500
28/28 [=====] - 2s 69ms/step - loss: 0.3710 - f1_score: 0.8767 - val_loss: 1.6400 - val_f1_score: 0.6430
Epoch 291/500
28/28 [=====] - 2s 70ms/step - loss: 0.3596 - f1_score: 0.8840 - val_loss: 1.4440 - val_f1_score: 0.6607
Epoch 292/500
28/28 [=====] - 2s 69ms/step - loss: 0.3789 - f1_score: 0.8698 - val_loss: 1.5199 - val_f1_score: 0.6570
Epoch 293/500
28/28 [=====] - 2s 72ms/step - loss: 0.3461 - f1_score: 0.8895 - val_loss: 1.4958 - val_f1_score: 0.6534
Epoch 294/500
28/28 [=====] - 2s 70ms/step - loss: 0.3439 - f1_score: 0.8834 - val_loss: 1.5016 - val_f1_score: 0.6310
Epoch 295/500
28/28 [=====] - 2s 69ms/step - loss: 0.3334 - f1_score: 0.8864 - val_loss: 1.6334 - val_f1_score: 0.6480
Epoch 296/500
28/28 [=====] - 2s 70ms/step - loss: 0.3355 - f1_score: 0.8878 - val_loss: 1.5848 - val_f1_score: 0.6395
Epoch 297/500
28/28 [=====] - 2s 70ms/step - loss: 0.3431 - f1_score: 0.8830 - val_loss: 1.4400 - val_f1_score: 0.6567
Epoch 298/500
28/28 [=====] - 2s 70ms/step - loss: 0.3695 - f1_score: 0.8755 - val_loss: 1.5256 - val_f1_score: 0.6596
Epoch 299/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 0.3437 - f1_score: 0.8856 - val_loss: 1.5086 - val_f1_score: 0.6311
Epoch 300/500
28/28 [=====] - 2s 69ms/step - loss: 0.3670 - f1_score: 0.8805 - val_loss: 1.6311 - val_f1_score: 0.6413
Epoch 301/500
28/28 [=====] - 2s 69ms/step - loss: 0.3870 - f1_score: 0.8663 - val_loss: 1.5019 - val_f1_score: 0.6382
Epoch 302/500
28/28 [=====] - 2s 69ms/step - loss: 0.3725 - f1_score: 0.8807 - val_loss: 1.5512 - val_f1_score: 0.6295
Epoch 303/500
28/28 [=====] - 2s 70ms/step - loss: 0.3702 - f1_score: 0.8741 - val_loss: 1.5980 - val_f1_score: 0.6615
Epoch 304/500
28/28 [=====] - 2s 72ms/step - loss: 0.3802 - f1_score: 0.8704 - val_loss: 1.6444 - val_f1_score: 0.6474
Epoch 305/500
28/28 [=====] - 2s 69ms/step - loss: 0.3452 - f1_score: 0.8809 - val_loss: 1.4692 - val_f1_score: 0.6648
Epoch 306/500
28/28 [=====] - 2s 70ms/step - loss: 0.3399 - f1_score: 0.8901 - val_loss: 1.5574 - val_f1_score: 0.6325
Epoch 307/500
28/28 [=====] - 2s 70ms/step - loss: 0.3499 - f1_score: 0.8821 - val_loss: 1.4537 - val_f1_score: 0.6738
Epoch 308/500
28/28 [=====] - 2s 70ms/step - loss: 0.3231 - f1_score: 0.8998 - val_loss: 1.5551 - val_f1_score: 0.6685
Epoch 309/500
28/28 [=====] - 2s 70ms/step - loss: 0.3374 - f1_score: 0.8868 - val_loss: 1.5468 - val_f1_score: 0.6812
Epoch 310/500
28/28 [=====] - 2s 75ms/step - loss: 0.3334 - f1_score: 0.8859 - val_loss: 1.6043 - val_f1_score: 0.6423
Epoch 311/500
28/28 [=====] - 2s 70ms/step - loss: 0.3702 - f1_score: 0.8862 - val_loss: 1.5576 - val_f1_score: 0.6454
Epoch 312/500
28/28 [=====] - 2s 70ms/step - loss: 0.3410 - f1_score: 0.8870 - val_loss: 1.4888 - val_f1_score: 0.6699
Epoch 313/500
28/28 [=====] - 2s 71ms/step - loss: 0.3518 - f1_score: 0.8830 - val_loss: 1.4953 - val_f1_score: 0.6789
Epoch 314/500
28/28 [=====] - 2s 71ms/step - loss: 0.3509 - f1_score: 0.8805 - val_loss: 1.4774 - val_f1_score: 0.6640
Epoch 315/500
```

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28/28 [=====] - 2s 71ms/step - loss: 0.3485 - f1_score: 0.8811 - val_loss: 1.5909 - val_f1_score: 0.6506
Epoch 316/500
28/28 [=====] - 2s 70ms/step - loss: 0.3315 - f1_score: 0.8976 - val_loss: 1.4675 - val_f1_score: 0.6487
Epoch 317/500
28/28 [=====] - 2s 71ms/step - loss: 0.3363 - f1_score: 0.8881 - val_loss: 1.4826 - val_f1_score: 0.6737
Epoch 318/500
28/28 [=====] - 2s 72ms/step - loss: 0.3159 - f1_score: 0.8944 - val_loss: 1.5095 - val_f1_score: 0.6544
Epoch 319/500
28/28 [=====] - 2s 70ms/step - loss: 0.3324 - f1_score: 0.8861 - val_loss: 1.5740 - val_f1_score: 0.6320
Epoch 320/500
28/28 [=====] - 2s 71ms/step - loss: 0.3380 - f1_score: 0.8946 - val_loss: 1.6344 - val_f1_score: 0.6588
Epoch 321/500
28/28 [=====] - 2s 71ms/step - loss: 0.3523 - f1_score: 0.8806 - val_loss: 1.6555 - val_f1_score: 0.6699
Epoch 322/500
28/28 [=====] - 2s 70ms/step - loss: 0.3067 - f1_score: 0.8955 - val_loss: 1.4862 - val_f1_score: 0.6649
Epoch 323/500
28/28 [=====] - 2s 71ms/step - loss: 0.3229 - f1_score: 0.8930 - val_loss: 1.6325 - val_f1_score: 0.6482
Epoch 324/500
28/28 [=====] - 2s 73ms/step - loss: 0.3417 - f1_score: 0.8915 - val_loss: 1.4735 - val_f1_score: 0.6348
Epoch 325/500
28/28 [=====] - 2s 71ms/step - loss: 0.3214 - f1_score: 0.8932 - val_loss: 1.5412 - val_f1_score: 0.6643
Epoch 326/500
28/28 [=====] - 2s 72ms/step - loss: 0.3370 - f1_score: 0.8825 - val_loss: 1.5446 - val_f1_score: 0.6327
Epoch 327/500
28/28 [=====] - 2s 71ms/step - loss: 0.3311 - f1_score: 0.8904 - val_loss: 1.5889 - val_f1_score: 0.6443
Epoch 328/500
28/28 [=====] - 2s 71ms/step - loss: 0.3256 - f1_score: 0.8848 - val_loss: 1.5905 - val_f1_score: 0.6278
Epoch 329/500
28/28 [=====] - 2s 70ms/step - loss: 0.3233 - f1_score: 0.8951 - val_loss: 1.5896 - val_f1_score: 0.6488
Epoch 330/500
28/28 [=====] - 2s 71ms/step - loss: 0.3236 - f1_score: 0.8959 - val_loss: 1.6099 - val_f1_score: 0.6578
Epoch 331/500
```

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28/28 [=====] - 2s 70ms/step - loss: 0.3345 - f1_score: 0.8867 - val_loss: 1.4993 - val_f1_score: 0.6788
Epoch 332/500
28/28 [=====] - 2s 71ms/step - loss: 0.3451 - f1_score: 0.8904 - val_loss: 1.5302 - val_f1_score: 0.6698
Epoch 333/500
28/28 [=====] - 2s 71ms/step - loss: 0.3354 - f1_score: 0.8848 - val_loss: 1.6718 - val_f1_score: 0.6458
Epoch 334/500
28/28 [=====] - 2s 73ms/step - loss: 0.3353 - f1_score: 0.8880 - val_loss: 1.5010 - val_f1_score: 0.6470
Epoch 335/500
28/28 [=====] - 2s 71ms/step - loss: 0.2981 - f1_score: 0.9062 - val_loss: 1.5029 - val_f1_score: 0.6420
Epoch 336/500
28/28 [=====] - 2s 73ms/step - loss: 0.3186 - f1_score: 0.8865 - val_loss: 1.4883 - val_f1_score: 0.6797
Epoch 337/500
28/28 [=====] - 2s 73ms/step - loss: 0.3579 - f1_score: 0.8837 - val_loss: 1.5069 - val_f1_score: 0.6547
Epoch 338/500
28/28 [=====] - 2s 70ms/step - loss: 0.3419 - f1_score: 0.8807 - val_loss: 1.5038 - val_f1_score: 0.6439
Epoch 339/500
28/28 [=====] - 2s 71ms/step - loss: 0.3359 - f1_score: 0.8848 - val_loss: 1.5639 - val_f1_score: 0.6521
Epoch 340/500
28/28 [=====] - 2s 72ms/step - loss: 0.3369 - f1_score: 0.8898 - val_loss: 1.5550 - val_f1_score: 0.6409
Epoch 341/500
28/28 [=====] - 2s 71ms/step - loss: 0.3303 - f1_score: 0.8873 - val_loss: 1.6787 - val_f1_score: 0.6383
Epoch 342/500
28/28 [=====] - 2s 71ms/step - loss: 0.3244 - f1_score: 0.8909 - val_loss: 1.5420 - val_f1_score: 0.6780
Epoch 343/500
28/28 [=====] - 2s 70ms/step - loss: 0.3170 - f1_score: 0.8977 - val_loss: 1.5492 - val_f1_score: 0.6752
Epoch 344/500
28/28 [=====] - 2s 72ms/step - loss: 0.3375 - f1_score: 0.8888 - val_loss: 1.5771 - val_f1_score: 0.6341
Epoch 345/500
28/28 [=====] - 2s 75ms/step - loss: 0.3098 - f1_score: 0.8961 - val_loss: 1.6354 - val_f1_score: 0.6381
Epoch 346/500
28/28 [=====] - 2s 70ms/step - loss: 0.3085 - f1_score: 0.8914 - val_loss: 1.5819 - val_f1_score: 0.6803
Epoch 347/500
```

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28/28 [=====] - 2s 70ms/step - loss: 0.3186 - f1_score: 0.8952 - val_loss: 1.7300 - val_f1_score: 0.6356
Epoch 348/500
28/28 [=====] - 2s 71ms/step - loss: 0.3217 - f1_score: 0.8919 - val_loss: 1.6580 - val_f1_score: 0.6484
Epoch 349/500
28/28 [=====] - 2s 71ms/step - loss: 0.3021 - f1_score: 0.8997 - val_loss: 1.5552 - val_f1_score: 0.6817
Epoch 350/500
28/28 [=====] - 2s 71ms/step - loss: 0.2920 - f1_score: 0.8991 - val_loss: 1.5213 - val_f1_score: 0.6633
Epoch 351/500
28/28 [=====] - ETA: 0s - loss: 0.3001 - f1_score: 0.9043

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets

28/28 [=====] - 7s 273ms/step - loss: 0.3001 - f1_score: 0.9043 - val_loss: 1.5359 - val_f1_score: 0.6873
Epoch 352/500
28/28 [=====] - 2s 67ms/step - loss: 0.3202 - f1_score: 0.8890 - val_loss: 1.5303 - val_f1_score: 0.6669
Epoch 353/500
28/28 [=====] - 2s 69ms/step - loss: 0.2925 - f1_score: 0.9017 - val_loss: 1.6528 - val_f1_score: 0.6744
Epoch 354/500
28/28 [=====] - 2s 69ms/step - loss: 0.3229 - f1_score: 0.9009 - val_loss: 1.6555 - val_f1_score: 0.6617
Epoch 355/500
28/28 [=====] - 2s 69ms/step - loss: 0.3211 - f1_score: 0.8929 - val_loss: 1.6123 - val_f1_score: 0.6421
Epoch 356/500
28/28 [=====] - 2s 69ms/step - loss: 0.3165 - f1_score: 0.8970 - val_loss: 1.6177 - val_f1_score: 0.6506
Epoch 357/500
28/28 [=====] - 2s 69ms/step - loss: 0.3248 - f1_score: 0.8880 - val_loss: 1.7251 - val_f1_score: 0.6487
Epoch 358/500
28/28 [=====] - ETA: 0s - loss: 0.3051 - f1_score: 0.9055

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 CNN/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 259ms/step - loss: 0.3051 - f1_score: 0.9055 - val_loss: 1.6474 - val_f1_score: 0.6877
Epoch 359/500
28/28 [=====] - 2s 68ms/step - loss: 0.2933 - f1_score: 0.9028 - val_loss: 1.5690 - val_f1_score: 0.6644
Epoch 360/500
28/28 [=====] - 2s 68ms/step - loss: 0.2980 - f1_score: 0.8959 - val_loss: 1.6294 - val_f1_score: 0.6451
Epoch 361/500
28/28 [=====] - 2s 69ms/step - loss: 0.2887 - f1_score: 0.9022 - val_loss: 1.6678 - val_f1_score: 0.6507
Epoch 362/500
28/28 [=====] - 2s 70ms/step - loss: 0.3027 - f1_score: 0.8979 - val_loss: 1.7035 - val_f1_score: 0.6646
Epoch 363/500
28/28 [=====] - 2s 69ms/step - loss: 0.2949 - f1_score: 0.9044 - val_loss: 1.5750 - val_f1_score: 0.6750
Epoch 364/500
28/28 [=====] - 2s 69ms/step - loss: 0.3301 - f1_score: 0.8815 - val_loss: 1.6510 - val_f1_score: 0.6582
Epoch 365/500
28/28 [=====] - 2s 70ms/step - loss: 0.3335 - f1_score: 0.8905 - val_loss: 1.6275 - val_f1_score: 0.6777
Epoch 366/500
28/28 [=====] - 2s 70ms/step - loss: 0.3227 - f1_score: 0.8849 - val_loss: 1.5881 - val_f1_score: 0.6746
Epoch 367/500
28/28 [=====] - 2s 69ms/step - loss: 0.3364 - f1_score: 0.8879 - val_loss: 1.6474 - val_f1_score: 0.6600
Epoch 368/500
28/28 [=====] - 2s 73ms/step - loss: 0.2939 - f1_score: 0.9017 - val_loss: 1.5213 - val_f1_score: 0.6628
Epoch 369/500
28/28 [=====] - 2s 70ms/step - loss: 0.3031 - f1_score: 0.8992 - val_loss: 1.7282 - val_f1_score: 0.6652
Epoch 370/500
28/28 [=====] - 2s 70ms/step - loss: 0.3380 - f1_score: 0.8865 - val_loss: 1.5518 - val_f1_score: 0.6682
Epoch 371/500
28/28 [=====] - 2s 71ms/step - loss: 0.3160 - f1_score: 0.8919 - val_loss: 1.4006 - val_f1_score: 0.6775
Epoch 372/500
28/28 [=====] - 2s 70ms/step - loss: 0.2807 - f1_score: 0.9025 - val_loss: 1.5767 - val_f1_score: 0.6647
Epoch 373/500
```

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28/28 [=====] - 2s 70ms/step - loss: 0.2687 - f1_score: 0.9024 - val_loss: 1.6658 - val_f1_score: 0.6701
Epoch 374/500
28/28 [=====] - 2s 71ms/step - loss: 0.3193 - f1_score: 0.8942 - val_loss: 1.7148 - val_f1_score: 0.6498
Epoch 375/500
28/28 [=====] - 2s 71ms/step - loss: 0.3215 - f1_score: 0.8944 - val_loss: 1.6280 - val_f1_score: 0.6785
Epoch 376/500
28/28 [=====] - 2s 70ms/step - loss: 0.2835 - f1_score: 0.9107 - val_loss: 1.4593 - val_f1_score: 0.6766
Epoch 377/500
28/28 [=====] - ETA: 0s - loss: 0.2829 - f1_score: 0.8998
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 8s 276ms/step - loss: 0.2829 - f1_score: 0.8998 - val_loss: 1.5227 - val_f1_score: 0.6920
Epoch 378/500
28/28 [=====] - 2s 67ms/step - loss: 0.3219 - f1_score: 0.8993 - val_loss: 1.4964 - val_f1_score: 0.6788
Epoch 379/500
28/28 [=====] - 2s 69ms/step - loss: 0.2886 - f1_score: 0.9104 - val_loss: 1.6414 - val_f1_score: 0.6521
Epoch 380/500
28/28 [=====] - 2s 68ms/step - loss: 0.2717 - f1_score: 0.9120 - val_loss: 1.6748 - val_f1_score: 0.6348
Epoch 381/500
28/28 [=====] - 2s 69ms/step - loss: 0.2885 - f1_score: 0.8989 - val_loss: 1.6023 - val_f1_score: 0.6753
Epoch 382/500
28/28 [=====] - 2s 69ms/step - loss: 0.3252 - f1_score: 0.8873 - val_loss: 1.7002 - val_f1_score: 0.6318
Epoch 383/500
28/28 [=====] - 2s 70ms/step - loss: 0.3054 - f1_score: 0.8997 - val_loss: 1.5757 - val_f1_score: 0.6734
Epoch 384/500
28/28 [=====] - 2s 69ms/step - loss: 0.2983 - f1_score: 0.8950 - val_loss: 1.6069 - val_f1_score: 0.6768
Epoch 385/500
28/28 [=====] - 2s 69ms/step - loss: 0.2955 - f1_score: 0.9045 - val_loss: 1.6229 - val_f1_score: 0.6554
Epoch 386/500
```

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28/28 [=====] - 2s 69ms/step - loss: 0.3091 - f1_score: 0.9006 - val_loss: 1.6585 - val_f1_score: 0.6651
Epoch 387/500
28/28 [=====] - 2s 73ms/step - loss: 0.2797 - f1_score: 0.9025 - val_loss: 1.8055 - val_f1_score: 0.6393
Epoch 388/500
28/28 [=====] - 2s 73ms/step - loss: 0.2815 - f1_score: 0.9052 - val_loss: 1.6864 - val_f1_score: 0.6778
Epoch 389/500
28/28 [=====] - 2s 69ms/step - loss: 0.2681 - f1_score: 0.9068 - val_loss: 1.6910 - val_f1_score: 0.6663
Epoch 390/500
28/28 [=====] - 2s 70ms/step - loss: 0.2742 - f1_score: 0.9101 - val_loss: 1.7537 - val_f1_score: 0.6357
Epoch 391/500
28/28 [=====] - 2s 71ms/step - loss: 0.2978 - f1_score: 0.8976 - val_loss: 1.6290 - val_f1_score: 0.6699
Epoch 392/500
28/28 [=====] - 2s 70ms/step - loss: 0.3123 - f1_score: 0.8990 - val_loss: 1.7675 - val_f1_score: 0.6557
Epoch 393/500
28/28 [=====] - 2s 70ms/step - loss: 0.2951 - f1_score: 0.8983 - val_loss: 1.6694 - val_f1_score: 0.6705
Epoch 394/500
28/28 [=====] - 2s 70ms/step - loss: 0.2870 - f1_score: 0.9013 - val_loss: 1.5375 - val_f1_score: 0.6784
Epoch 395/500
28/28 [=====] - 2s 69ms/step - loss: 0.3031 - f1_score: 0.9043 - val_loss: 1.6371 - val_f1_score: 0.6713
Epoch 396/500
28/28 [=====] - 2s 70ms/step - loss: 0.2882 - f1_score: 0.9050 - val_loss: 1.6173 - val_f1_score: 0.6885
Epoch 397/500
28/28 [=====] - 2s 70ms/step - loss: 0.2915 - f1_score: 0.9034 - val_loss: 1.5590 - val_f1_score: 0.6657
Epoch 398/500
28/28 [=====] - 2s 70ms/step - loss: 0.2784 - f1_score: 0.9089 - val_loss: 1.7225 - val_f1_score: 0.6553
Epoch 399/500
28/28 [=====] - 2s 71ms/step - loss: 0.2962 - f1_score: 0.8968 - val_loss: 1.5815 - val_f1_score: 0.6707
Epoch 400/500
28/28 [=====] - 2s 70ms/step - loss: 0.2884 - f1_score: 0.9046 - val_loss: 1.4710 - val_f1_score: 0.6918
Epoch 401/500
28/28 [=====] - 2s 72ms/step - loss: 0.3020 - f1_score: 0.8949 - val_loss: 1.6509 - val_f1_score: 0.6749
Epoch 402/500
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28/28 [=====] - 2s 71ms/step - loss: 0.2750 - f1_score: 0.9126 - val_loss: 1.5286 - val_f1_score: 0.6868
Epoch 403/500
28/28 [=====] - 2s 71ms/step - loss: 0.2878 - f1_score: 0.9040 - val_loss: 1.6475 - val_f1_score: 0.6706
Epoch 404/500
28/28 [=====] - 2s 75ms/step - loss: 0.2890 - f1_score: 0.9015 - val_loss: 1.6783 - val_f1_score: 0.6602
Epoch 405/500
28/28 [=====] - 2s 71ms/step - loss: 0.2843 - f1_score: 0.9069 - val_loss: 1.5239 - val_f1_score: 0.6706
Epoch 406/500
28/28 [=====] - 2s 71ms/step - loss: 0.2712 - f1_score: 0.9101 - val_loss: 1.6390 - val_f1_score: 0.6703
Epoch 407/500
28/28 [=====] - 2s 74ms/step - loss: 0.2772 - f1_score: 0.9114 - val_loss: 1.7179 - val_f1_score: 0.6622
Epoch 408/500
28/28 [=====] - 2s 72ms/step - loss: 0.2990 - f1_score: 0.8966 - val_loss: 1.6968 - val_f1_score: 0.6729
Epoch 409/500
28/28 [=====] - ETA: 0s - loss: 0.2672 - f1_score: 0.9116
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 8s 285ms/step - loss: 0.2672 - f1_score: 0.9116 - val_loss: 1.5001 - val_f1_score: 0.7049
Epoch 410/500
28/28 [=====] - 2s 67ms/step - loss: 0.2660 - f1_score: 0.9058 - val_loss: 1.7011 - val_f1_score: 0.6494
Epoch 411/500
28/28 [=====] - 2s 68ms/step - loss: 0.2798 - f1_score: 0.9086 - val_loss: 1.6071 - val_f1_score: 0.6706
Epoch 412/500
28/28 [=====] - 2s 70ms/step - loss: 0.2883 - f1_score: 0.9040 - val_loss: 1.6363 - val_f1_score: 0.6534
Epoch 413/500
28/28 [=====] - 2s 69ms/step - loss: 0.2939 - f1_score: 0.9010 - val_loss: 1.6441 - val_f1_score: 0.6663
Epoch 414/500
28/28 [=====] - 2s 70ms/step - loss: 0.2972 - f1_score: 0.8971 - val_loss: 1.5743 - val_f1_score: 0.6708
Epoch 415/500
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28/28 [=====] - 2s 70ms/step - loss: 0.2648 - f1_score: 0.9085 - val_loss: 1.7727 - val_f1_score: 0.6530
Epoch 416/500
28/28 [=====] - 2s 69ms/step - loss: 0.2783 - f1_score: 0.9059 - val_loss: 1.6391 - val_f1_score: 0.6677
Epoch 417/500
28/28 [=====] - 2s 70ms/step - loss: 0.2866 - f1_score: 0.9070 - val_loss: 1.5696 - val_f1_score: 0.7003
Epoch 418/500
28/28 [=====] - 2s 69ms/step - loss: 0.2587 - f1_score: 0.9110 - val_loss: 1.7154 - val_f1_score: 0.6596
Epoch 419/500
28/28 [=====] - 2s 70ms/step - loss: 0.2830 - f1_score: 0.9005 - val_loss: 1.6213 - val_f1_score: 0.6633
Epoch 420/500
28/28 [=====] - 2s 69ms/step - loss: 0.2872 - f1_score: 0.8994 - val_loss: 1.7191 - val_f1_score: 0.6509
Epoch 421/500
28/28 [=====] - 2s 70ms/step - loss: 0.2731 - f1_score: 0.9070 - val_loss: 1.6472 - val_f1_score: 0.6595
Epoch 422/500
28/28 [=====] - 2s 70ms/step - loss: 0.2626 - f1_score: 0.9135 - val_loss: 1.6557 - val_f1_score: 0.6734
Epoch 423/500
28/28 [=====] - 2s 70ms/step - loss: 0.2431 - f1_score: 0.9169 - val_loss: 1.7029 - val_f1_score: 0.6822
Epoch 424/500
28/28 [=====] - 2s 70ms/step - loss: 0.2791 - f1_score: 0.9103 - val_loss: 1.6062 - val_f1_score: 0.6942
Epoch 425/500
28/28 [=====] - 2s 71ms/step - loss: 0.2610 - f1_score: 0.9165 - val_loss: 1.4587 - val_f1_score: 0.6991
Epoch 426/500
28/28 [=====] - 2s 70ms/step - loss: 0.2790 - f1_score: 0.9094 - val_loss: 1.6392 - val_f1_score: 0.6727
Epoch 427/500
28/28 [=====] - 2s 70ms/step - loss: 0.2937 - f1_score: 0.9030 - val_loss: 1.6218 - val_f1_score: 0.6933
Epoch 428/500
28/28 [=====] - 2s 71ms/step - loss: 0.2655 - f1_score: 0.9157 - val_loss: 1.7501 - val_f1_score: 0.6868
Epoch 429/500
28/28 [=====] - 2s 71ms/step - loss: 0.2757 - f1_score: 0.9087 - val_loss: 1.6690 - val_f1_score: 0.6902
Epoch 430/500
28/28 [=====] - 2s 72ms/step - loss: 0.2706 - f1_score: 0.9108 - val_loss: 1.5485 - val_f1_score: 0.6978
Epoch 431/500
```

```
28/28 [=====] - 2s 70ms/step - loss: 0.2664 - f1_score: 0.9128 - val_loss: 1.5660 - val_f1_score: 0.6906
Epoch 432/500
28/28 [=====] - 2s 72ms/step - loss: 0.2803 - f1_score: 0.9089 - val_loss: 1.6407 - val_f1_score: 0.6883
Epoch 433/500
28/28 [=====] - 2s 71ms/step - loss: 0.2678 - f1_score: 0.9088 - val_loss: 1.6950 - val_f1_score: 0.6826
Epoch 434/500
28/28 [=====] - 2s 70ms/step - loss: 0.2752 - f1_score: 0.9069 - val_loss: 1.7265 - val_f1_score: 0.6638
Epoch 435/500
28/28 [=====] - 2s 74ms/step - loss: 0.2815 - f1_score: 0.9049 - val_loss: 1.5779 - val_f1_score: 0.6799
Epoch 436/500
28/28 [=====] - 2s 71ms/step - loss: 0.2539 - f1_score: 0.9212 - val_loss: 1.6502 - val_f1_score: 0.6700
Epoch 437/500
28/28 [=====] - 2s 70ms/step - loss: 0.2730 - f1_score: 0.9074 - val_loss: 1.6482 - val_f1_score: 0.6546
Epoch 438/500
28/28 [=====] - 2s 71ms/step - loss: 0.2779 - f1_score: 0.9092 - val_loss: 1.5272 - val_f1_score: 0.6741
Epoch 439/500
28/28 [=====] - 2s 71ms/step - loss: 0.2443 - f1_score: 0.9168 - val_loss: 1.6489 - val_f1_score: 0.6711
Epoch 440/500
28/28 [=====] - 2s 72ms/step - loss: 0.2800 - f1_score: 0.9124 - val_loss: 1.6366 - val_f1_score: 0.6903
Epoch 441/500
28/28 [=====] - 2s 71ms/step - loss: 0.2677 - f1_score: 0.9080 - val_loss: 1.5154 - val_f1_score: 0.6980
Epoch 442/500
28/28 [=====] - 2s 71ms/step - loss: 0.2752 - f1_score: 0.9093 - val_loss: 1.6201 - val_f1_score: 0.6908
Epoch 443/500
28/28 [=====] - 2s 71ms/step - loss: 0.2548 - f1_score: 0.9105 - val_loss: 1.6147 - val_f1_score: 0.7029
Epoch 444/500
28/28 [=====] - 2s 71ms/step - loss: 0.2584 - f1_score: 0.9078 - val_loss: 1.5490 - val_f1_score: 0.7011
Epoch 445/500
28/28 [=====] - 2s 72ms/step - loss: 0.2760 - f1_score: 0.9158 - val_loss: 1.5806 - val_f1_score: 0.6953
Epoch 446/500
28/28 [=====] - 2s 71ms/step - loss: 0.2525 - f1_score: 0.9141 - val_loss: 1.7473 - val_f1_score: 0.6772
Epoch 447/500
```

```
28/28 [=====] - 2s 71ms/step - loss: 0.2978 - f1_score: 0.9032 - val_loss: 1.6199 - val_f1_score: 0.6719
Epoch 448/500
28/28 [=====] - ETA: 0s - loss: 0.2526 - f1_score: 0.9210

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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 11s 400ms/step - loss: 0.2526 - f1_score: 0.9210 - val_loss: 1.5721 - val_f1_score: 0.7049
Epoch 449/500
28/28 [=====] - 2s 67ms/step - loss: 0.2552 - f1_score: 0.9131 - val_loss: 1.6411 - val_f1_score: 0.6702
Epoch 450/500
28/28 [=====] - 2s 68ms/step - loss: 0.2856 - f1_score: 0.9081 - val_loss: 1.5491 - val_f1_score: 0.6883
Epoch 451/500
28/28 [=====] - 2s 67ms/step - loss: 0.2621 - f1_score: 0.9119 - val_loss: 1.5776 - val_f1_score: 0.6896
Epoch 452/500
28/28 [=====] - 2s 68ms/step - loss: 0.2826 - f1_score: 0.9100 - val_loss: 1.6226 - val_f1_score: 0.6743
Epoch 453/500
28/28 [=====] - 2s 69ms/step - loss: 0.2596 - f1_score: 0.9141 - val_loss: 1.6001 - val_f1_score: 0.6945
Epoch 454/500
28/28 [=====] - 2s 69ms/step - loss: 0.2654 - f1_score: 0.9084 - val_loss: 1.5475 - val_f1_score: 0.6913
Epoch 455/500
28/28 [=====] - 2s 68ms/step - loss: 0.2580 - f1_score: 0.9142 - val_loss: 1.8203 - val_f1_score: 0.6699
Epoch 456/500
28/28 [=====] - 2s 69ms/step - loss: 0.2714 - f1_score: 0.9079 - val_loss: 1.5740 - val_f1_score: 0.6851
Epoch 457/500
28/28 [=====] - 2s 70ms/step - loss: 0.2456 - f1_score: 0.9187 - val_loss: 1.6578 - val_f1_score: 0.6959
Epoch 458/500
28/28 [=====] - 2s 71ms/step - loss: 0.2708 - f1_score: 0.9073 - val_loss: 1.6302 - val_f1_score: 0.6924
Epoch 459/500
28/28 [=====] - 2s 70ms/step - loss: 0.2885 - f1_score: 0.8983 - val_loss: 1.5675 - val_f1_score: 0.6919
Epoch 460/500
```

```
28/28 [=====] - 2s 70ms/step - loss: 0.2385 - f1_score: 0.9193 - val_loss: 1.7426 - val_f1_score: 0.6586
Epoch 461/500
28/28 [=====] - 2s 69ms/step - loss: 0.2330 - f1_score: 0.9235 - val_loss: 1.6418 - val_f1_score: 0.6905
Epoch 462/500
28/28 [=====] - 2s 70ms/step - loss: 0.2515 - f1_score: 0.9154 - val_loss: 1.7378 - val_f1_score: 0.6673
Epoch 463/500
28/28 [=====] - 2s 70ms/step - loss: 0.2555 - f1_score: 0.9156 - val_loss: 1.8666 - val_f1_score: 0.6491
Epoch 464/500
28/28 [=====] - 2s 73ms/step - loss: 0.3005 - f1_score: 0.8961 - val_loss: 1.6978 - val_f1_score: 0.6649
Epoch 465/500
28/28 [=====] - 2s 69ms/step - loss: 0.2406 - f1_score: 0.9190 - val_loss: 1.5803 - val_f1_score: 0.6750
Epoch 466/500
28/28 [=====] - 2s 71ms/step - loss: 0.2437 - f1_score: 0.9238 - val_loss: 1.6637 - val_f1_score: 0.6850
Epoch 467/500
28/28 [=====] - 2s 70ms/step - loss: 0.2436 - f1_score: 0.9097 - val_loss: 1.6537 - val_f1_score: 0.6731
Epoch 468/500
28/28 [=====] - 2s 70ms/step - loss: 0.2653 - f1_score: 0.9156 - val_loss: 1.5955 - val_f1_score: 0.6767
Epoch 469/500
28/28 [=====] - 2s 70ms/step - loss: 0.2794 - f1_score: 0.9150 - val_loss: 1.7972 - val_f1_score: 0.6624
Epoch 470/500
28/28 [=====] - 2s 71ms/step - loss: 0.2603 - f1_score: 0.9133 - val_loss: 1.6513 - val_f1_score: 0.6816
Epoch 471/500
28/28 [=====] - 2s 72ms/step - loss: 0.2510 - f1_score: 0.9131 - val_loss: 1.5956 - val_f1_score: 0.6932
Epoch 472/500
28/28 [=====] - 2s 75ms/step - loss: 0.2548 - f1_score: 0.9139 - val_loss: 1.6287 - val_f1_score: 0.6881
Epoch 473/500
28/28 [=====] - 2s 71ms/step - loss: 0.2404 - f1_score: 0.9193 - val_loss: 1.6602 - val_f1_score: 0.6714
Epoch 474/500
28/28 [=====] - 2s 71ms/step - loss: 0.2732 - f1_score: 0.9169 - val_loss: 1.5819 - val_f1_score: 0.6889
Epoch 475/500
28/28 [=====] - 2s 71ms/step - loss: 0.2491 - f1_score: 0.9190 - val_loss: 1.5456 - val_f1_score: 0.7034
Epoch 476/500
```

```
28/28 [=====] - 2s 71ms/step - loss: 0.2361 - f1_score: 0.9226 - val_loss: 1.7497 - val_f1_score: 0.6763
Epoch 477/500
28/28 [=====] - 2s 73ms/step - loss: 0.2473 - f1_score: 0.9108 - val_loss: 1.6088 - val_f1_score: 0.6930
Epoch 478/500
28/28 [=====] - 2s 70ms/step - loss: 0.2570 - f1_score: 0.9177 - val_loss: 1.7417 - val_f1_score: 0.6874
Epoch 479/500
28/28 [=====] - 2s 71ms/step - loss: 0.2478 - f1_score: 0.9130 - val_loss: 1.6363 - val_f1_score: 0.6745
Epoch 480/500
28/28 [=====] - 2s 71ms/step - loss: 0.2535 - f1_score: 0.9163 - val_loss: 1.5747 - val_f1_score: 0.6864
Epoch 481/500
28/28 [=====] - 2s 72ms/step - loss: 0.2871 - f1_score: 0.9107 - val_loss: 1.5584 - val_f1_score: 0.7003
Epoch 482/500
28/28 [=====] - 2s 71ms/step - loss: 0.2447 - f1_score: 0.9169 - val_loss: 1.5626 - val_f1_score: 0.6822
Epoch 483/500
28/28 [=====] - 2s 71ms/step - loss: 0.2552 - f1_score: 0.9168 - val_loss: 1.5861 - val_f1_score: 0.6768
Epoch 484/500
28/28 [=====] - 2s 72ms/step - loss: 0.2316 - f1_score: 0.9232 - val_loss: 1.6025 - val_f1_score: 0.6989
Epoch 485/500
28/28 [=====] - ETA: 0s - loss: 0.2555 - f1_score: 0.9173
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/assets
INFO:tensorflow:Assets written to: 3 1D CNN/assets
28/28 [=====] - 7s 275ms/step - loss: 0.2555 - f1_score: 0.9173 - val_loss: 1.5809 - val_f1_score: 0.7078
Epoch 486/500
28/28 [=====] - 2s 67ms/step - loss: 0.2041 - f1_score: 0.9296 - val_loss: 1.8261 - val_f1_score: 0.6595
Epoch 487/500
28/28 [=====] - 2s 70ms/step - loss: 0.2513 - f1_score: 0.9197 - val_loss: 1.5828 - val_f1_score: 0.6827
Epoch 488/500
28/28 [=====] - 2s 70ms/step - loss: 0.2574 - f1_score: 0.9163 - val_loss: 1.6714 - val_f1_score: 0.6693
Epoch 489/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 0.2788 - f1_score: 0.9096 - val_loss: 1.5576 - val_f1_score: 0.6848
Epoch 490/500
28/28 [=====] - 2s 70ms/step - loss: 0.2514 - f1_score: 0.9150 - val_loss: 1.6177 - val_f1_score: 0.6790
Epoch 491/500
28/28 [=====] - 2s 69ms/step - loss: 0.2471 - f1_score: 0.9201 - val_loss: 1.5959 - val_f1_score: 0.6793
Epoch 492/500
28/28 [=====] - 2s 69ms/step - loss: 0.2299 - f1_score: 0.9218 - val_loss: 1.5171 - val_f1_score: 0.6742
Epoch 493/500
28/28 [=====] - 2s 69ms/step - loss: 0.2486 - f1_score: 0.9159 - val_loss: 1.5752 - val_f1_score: 0.6718
Epoch 494/500
28/28 [=====] - 2s 70ms/step - loss: 0.2457 - f1_score: 0.9195 - val_loss: 1.5183 - val_f1_score: 0.6864
Epoch 495/500
28/28 [=====] - 2s 71ms/step - loss: 0.2364 - f1_score: 0.9189 - val_loss: 1.6684 - val_f1_score: 0.6942
Epoch 496/500
28/28 [=====] - 2s 70ms/step - loss: 0.2447 - f1_score: 0.9165 - val_loss: 1.4981 - val_f1_score: 0.7016
Epoch 497/500
28/28 [=====] - 2s 71ms/step - loss: 0.2252 - f1_score: 0.9279 - val_loss: 1.5334 - val_f1_score: 0.7038
Epoch 498/500
28/28 [=====] - 2s 70ms/step - loss: 0.2665 - f1_score: 0.9149 - val_loss: 1.4840 - val_f1_score: 0.7051
Epoch 499/500
28/28 [=====] - 2s 72ms/step - loss: 0.2573 - f1_score: 0.9188 - val_loss: 1.8051 - val_f1_score: 0.6852
Epoch 500/500
28/28 [=====] - 2s 70ms/step - loss: 0.2821 - f1_score: 0.9112 - val_loss: 1.6432 - val_f1_score: 0.6629
```

```
[76]: # convert the history.history dict to a pandas DataFrame:
```

```
hist_df = pd.DataFrame(History.history)

hist_csv_file = '3 1D CNN/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

```
[77]: hist_df = pd.read_csv('3 1D CNN/history.csv', index_col=0)
hist_df.tail()
```

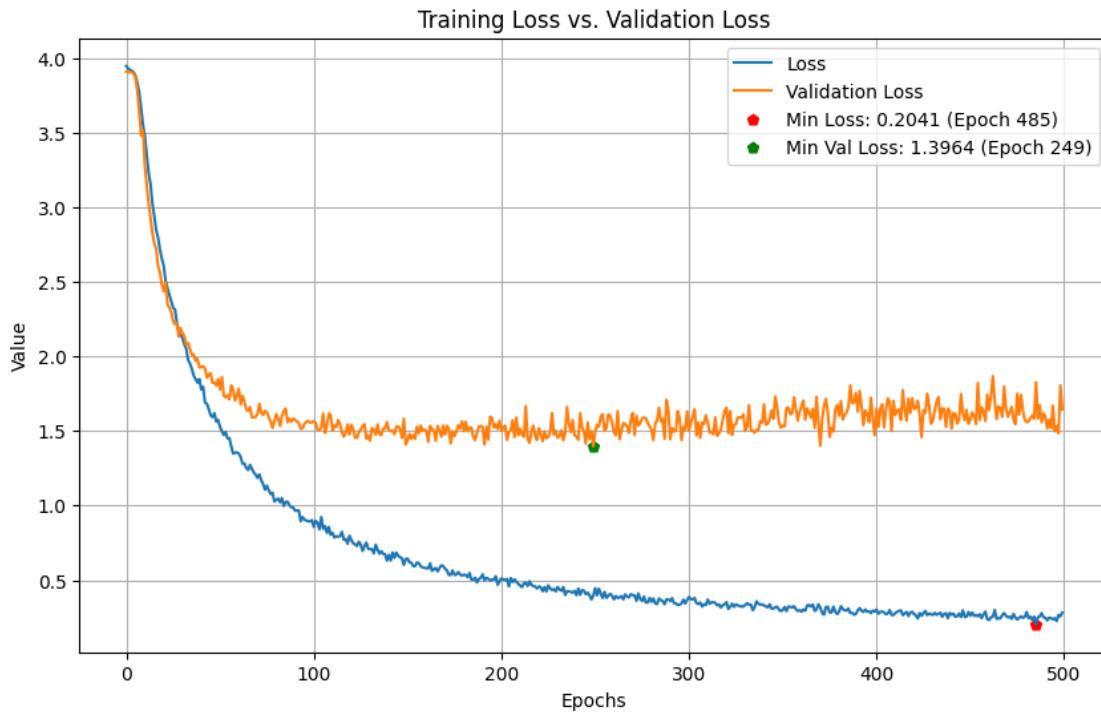
```
[77]:      loss  f1_score  val_loss  val_f1_score
495  0.244742  0.916467  1.498063      0.701633
496  0.225180  0.927880  1.533440      0.703817
497  0.266526  0.914869  1.484032      0.705128
498  0.257320  0.918846  1.805072      0.685212
499  0.282138  0.911249  1.643248      0.662925
```

```
[78]: # 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()
```



```
[79]: # 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()

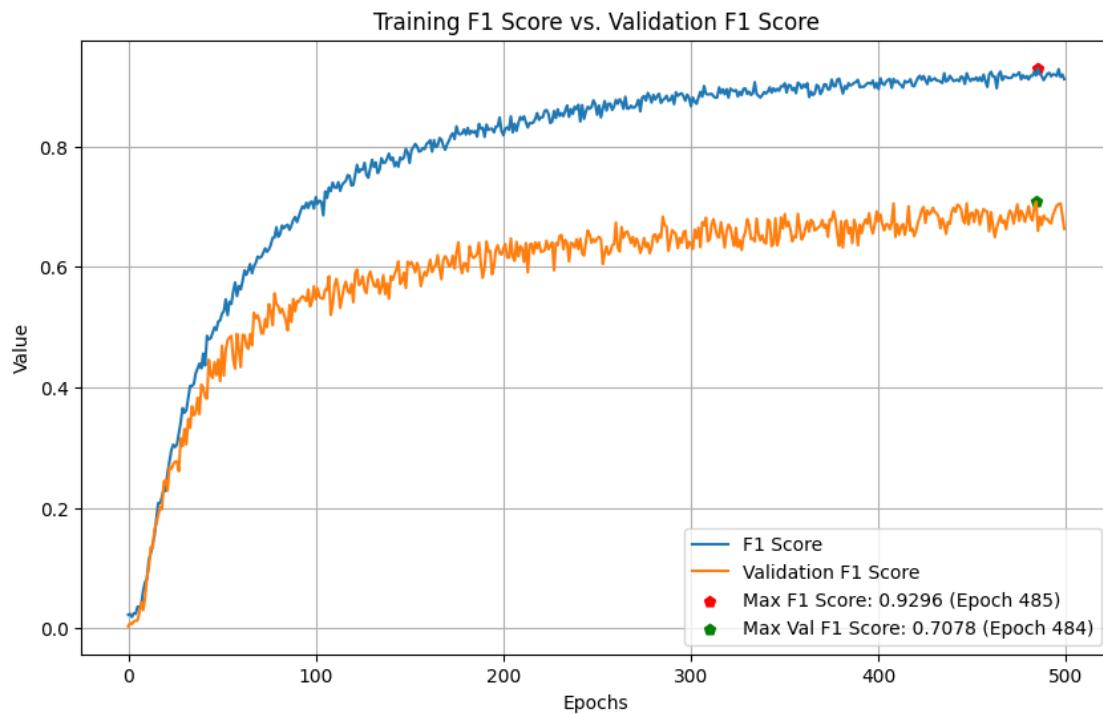
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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()

```



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

11/11 [=====] - 0s 10ms/step

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

AXE	0.750	0.750	0.750	8
BACKPACK	0.750	1.000	0.857	6
BASKETBALL	0.769	1.000	0.870	10
BEE	1.000	0.800	0.889	10
BELT	0.571	1.000	0.727	4
BITE	1.000	0.875	0.933	8
BREAKFAST	0.500	0.833	0.625	6
CANCER	1.000	1.000	1.000	8

CHRISTMAS	0.833	0.833	0.833	6
CONFUSED	0.667	0.333	0.444	6
DARK	0.667	1.000	0.800	4
DEAF	0.333	0.333	0.333	6
DECIDE	1.000	0.333	0.500	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.333	0.167	0.222	6
DINNER	1.000	0.750	0.857	8
DOG	0.273	0.500	0.353	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	0.500	0.500	0.500	4
EAT	1.000	0.667	0.800	6
EDIT	0.857	1.000	0.923	6
ELEVATOR	0.412	0.875	0.560	8
FINE	0.333	0.500	0.400	4
FLOAT	0.500	0.500	0.500	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	0.000	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	1.000	0.375	0.545	8
MAPLE	0.400	0.500	0.444	4
MEAT	0.500	1.000	0.667	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.727	1.000	0.842	8
NOON	0.800	1.000	0.889	8
PARTY	1.000	0.625	0.769	8
PATIENT	0.125	0.167	0.143	6
RAZOR	0.750	0.750	0.750	4
RIVER	0.833	0.833	0.833	6
ROCKINGCHAIR	0.727	1.000	0.842	8
SHAVE	0.833	0.500	0.625	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.333	0.250	0.286	4
THEY	0.500	0.500	0.500	4
TWINS	0.500	0.625	0.556	8
WHATFOR	1.000	0.700	0.824	10
accuracy			0.701	324
macro avg	0.704	0.675	0.663	324
weighted avg	0.739	0.701	0.693	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))
```

[81]: reconstructed\_model = tf.keras.models.load\_model("3 1D CNN")

[82]: reconstructed\_model.evaluate(Xval, Yval)

```
11/11 [=====] - 0s 13ms/step - loss: 1.5809 - f1_score:
0.7078
```

[82]: [1.5808604955673218, 0.7077520489692688]

[83]: reconstructed\_model.evaluate(Xtrain, Ytrain)

```
84/84 [=====] - 1s 12ms/step - loss: 0.0030 - f1_score:
1.0000
```

[83]: [0.0030466571915894747, 1.0]

[84]: reconstructed\_model.summary()

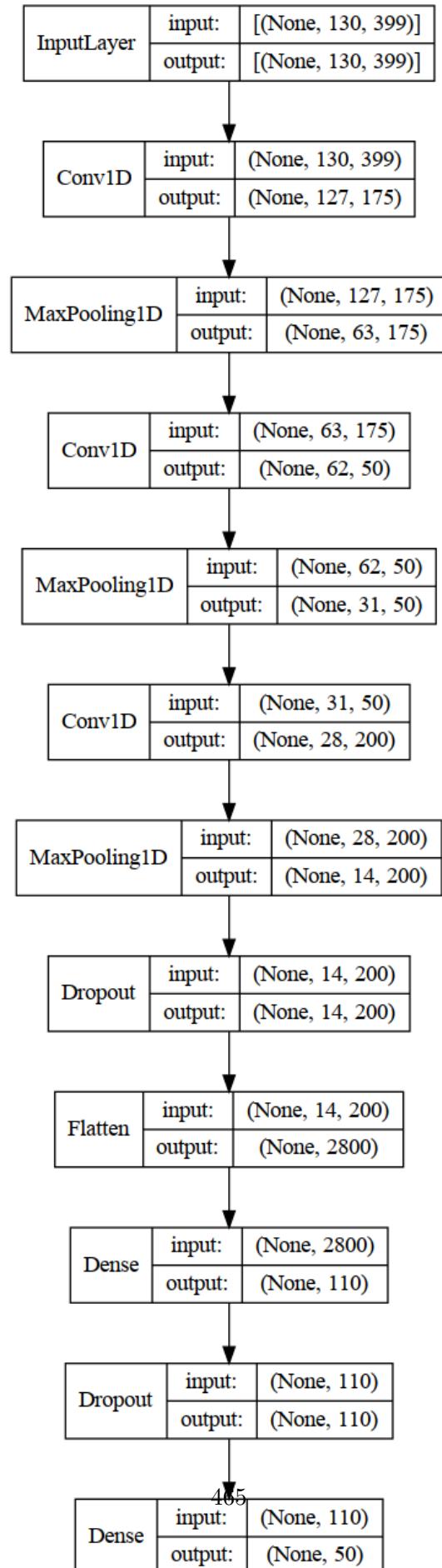
```
Model: "sequential_1"
```

Layer (type)	Output Shape	Param #
conv1d_3 (Conv1D)	(None, 127, 175)	279475
max_pooling1d_3 (MaxPooling 1D)	(None, 63, 175)	0
conv1d_4 (Conv1D)	(None, 62, 50)	17550
max_pooling1d_4 (MaxPooling 1D)	(None, 31, 50)	0
conv1d_5 (Conv1D)	(None, 28, 200)	40200

```
max_pooling1d_5 (MaxPooling  (None, 14, 200)          0  
1D)  
  
dropout_2 (Dropout)        (None, 14, 200)          0  
  
flatten_1 (Flatten)       (None, 2800)           0  
  
dense_2 (Dense)          (None, 110)            308110  
  
dropout_3 (Dropout)       (None, 110)            0  
  
dense_3 (Dense)          (None, 50)             5550
```

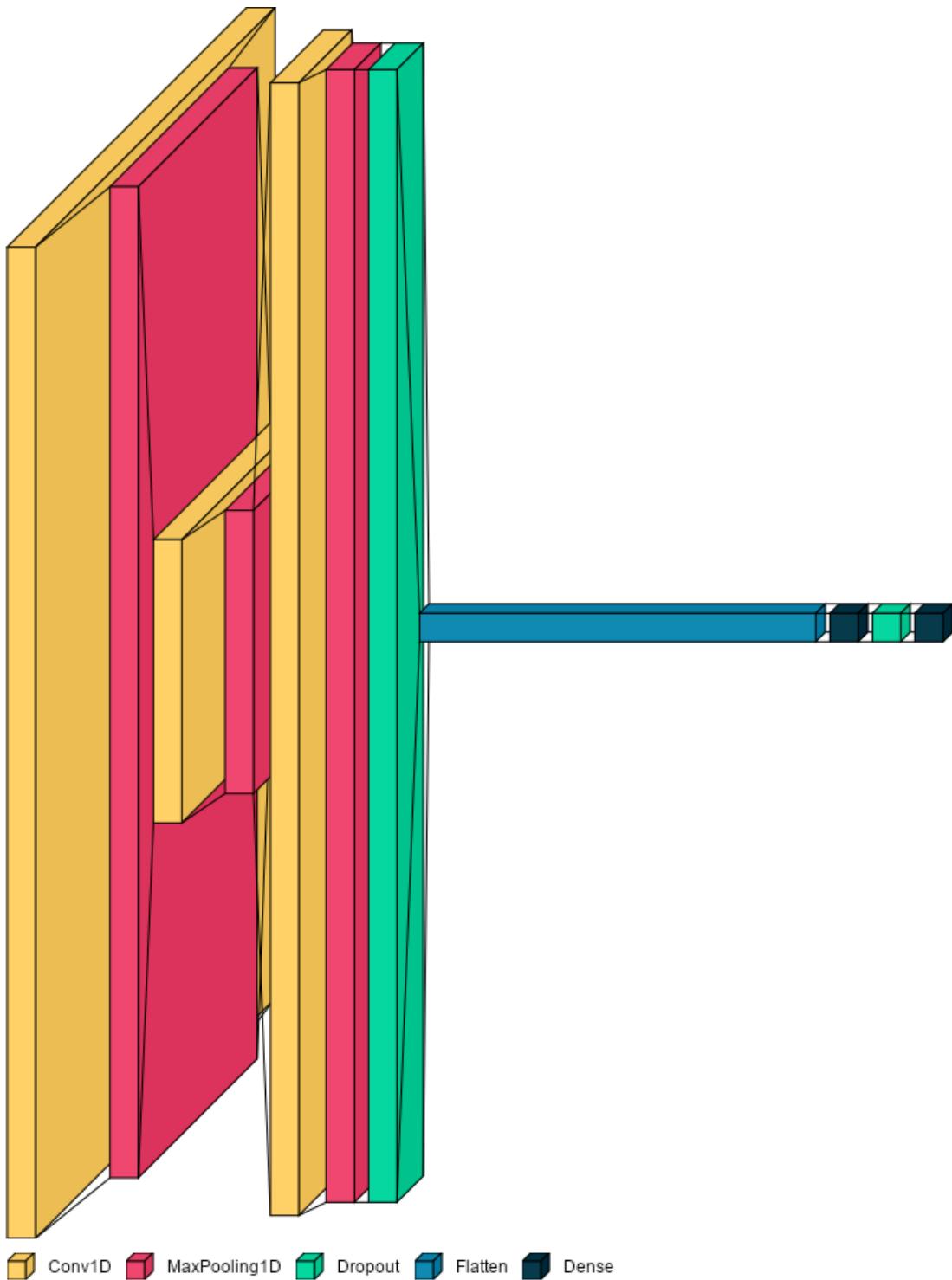
```
=====  
Total params: 650,885  
Trainable params: 650,885  
Non-trainable params: 0
```

```
[85]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)  
[85]:
```



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

[86]:



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

	precision	recall	f1-score	support
AXE	0.750	0.750	0.750	8
BACKPACK	0.857	1.000	0.923	6
BASKETBALL	0.769	1.000	0.870	10
BEE	0.889	0.800	0.842	10
BELT	0.500	1.000	0.667	4
BITE	1.000	0.875	0.933	8
BREAKFAST	0.667	0.667	0.667	6
CANCER	1.000	1.000	1.000	8
CHRISTMAS	1.000	0.833	0.909	6
CONFUSED	0.667	0.333	0.444	6
DARK	0.800	1.000	0.889	4
DEAF	0.250	0.167	0.200	6
DECIDE	1.000	0.333	0.500	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.333	0.167	0.222	6
DINNER	1.000	0.750	0.857	8
DOG	0.286	0.333	0.308	6
DOWNSIZE	0.857	0.750	0.800	8
DRAG	0.400	0.500	0.444	4
EAT	1.000	0.833	0.909	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.438	0.875	0.583	8
FINE	1.000	0.500	0.667	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.714	0.833	0.769	6
GUESS	1.000	0.875	0.933	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	0.667	0.500	0.571	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.500	0.500	0.500	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.500	0.500	0.500	4
MEAT	0.500	1.000	0.667	6
MECHANIC	0.667	1.000	0.800	4

MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.889	1.000	0.941	8
NOON	0.800	1.000	0.889	8
PARTY	1.000	0.625	0.769	8
PATIENT	0.308	0.667	0.421	6
RAZOR	0.800	1.000	0.889	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	1.000	0.900	0.947	10
SINK	1.000	0.167	0.286	6
SQUEEZE	0.500	0.250	0.333	4
THEY	0.500	0.750	0.600	4
TWINS	1.000	0.875	0.933	8
WHATFOR	0.900	0.900	0.900	10
accuracy			0.747	324
macro avg	0.753	0.717	0.708	324
weighted avg	0.786	0.747	0.742	324

## 4.7 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_572785/3109640001.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
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(
    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/CSPNext/hyperband/',
    project_name='1_1D_CNN+1_GRU',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/CSPNext/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': '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': 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 16m 56s]  
val\_f1\_score: 0.4801226407289505

Best val\_f1\_score So Far: 0.7247181534767151  
Total elapsed time: 00h 54m 15s  
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](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

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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.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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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

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```

```
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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)

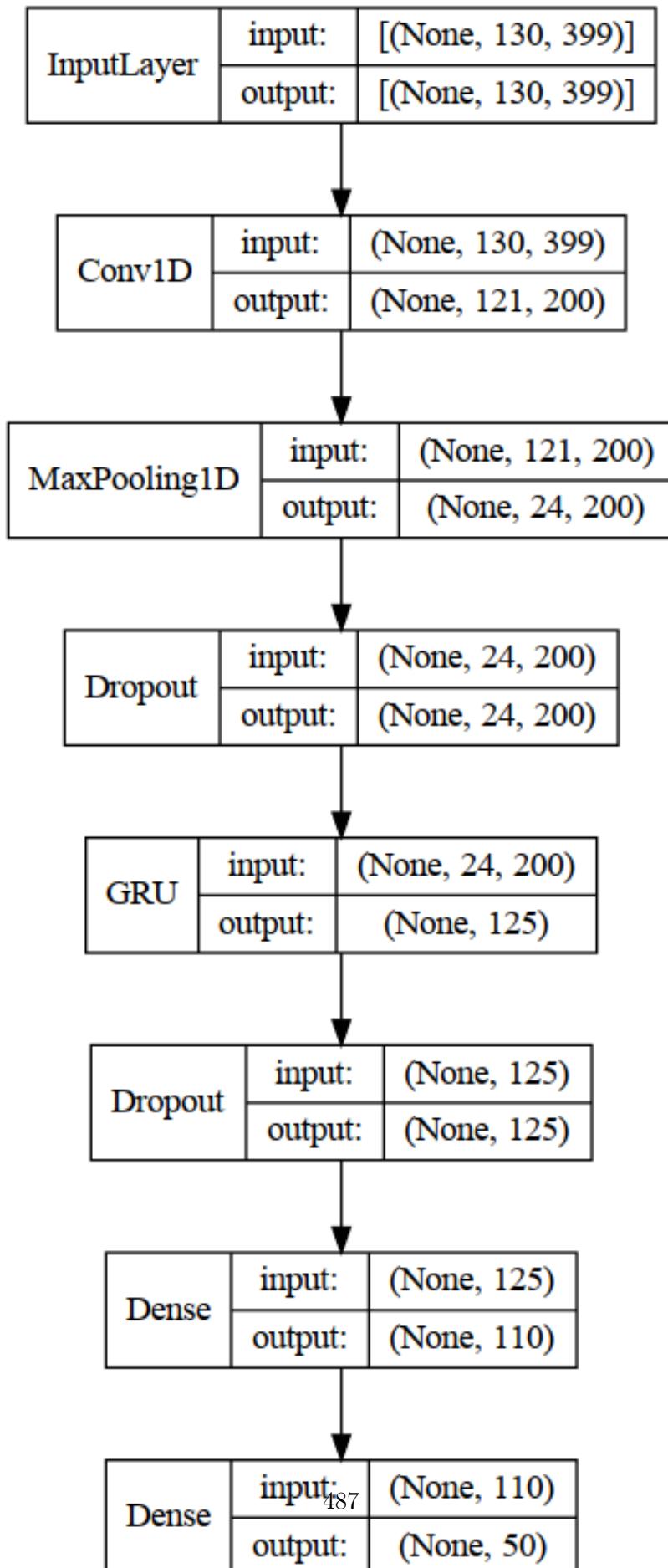
```
[127]: best_model.summary()
```

```
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
```

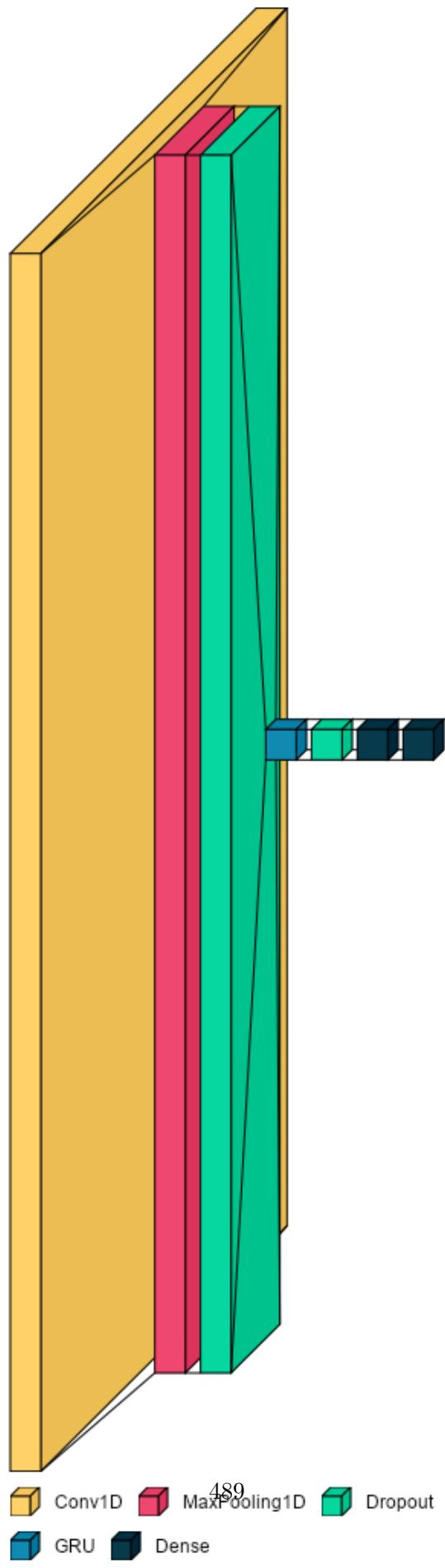
```
[128]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[128]:
```



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

```
[131]:
```



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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/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: 0.7247181534767151

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: 0.6989109516143799
```

```
Trial 0693 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: 100
tuner/initial_epoch: 34
tuner/bracket: 2
tuner/round: 1
tuner/trial_id: 0682
Score: 0.6800870001316071
```

```
Trial 0717 summary
Hyperparameters:
dense_activation: elu
filters_1: 125
kernel_1: 20
pool_1: 5
dropout_1: 0.7000000000000001
units_1: 125
regularizer: 0.0011397819243873977
dropout_2: 0.3000000000000004
units_2: 100
learning_rate: 0.0002178223003598895
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0708
Score: 0.6744606196880341
```

```
Trial 0715 summary
Hyperparameters:
dense_activation: relu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.15000000000000002
units_1: 200
regularizer: 0.0003995944477297615
dropout_2: 0.3000000000000004
```

```
units_2: 100
learning_rate: 0.0001455536401374643
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0707
Score: 0.6643707454204559
```

```
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: 0.6615362465381622
```

```
Trial 0670 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: 0668
Score: 0.6551189422607422
```

```
Trial 0598 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: 0597
Score: 0.6505350470542908
```

```
Trial 0426 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: 0423
Score: 0.643269807100296
```

```
Trial 0423 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: 0412
Score: 0.6367166936397552
```

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

11/11 [=====] - 1s 15ms/step - loss: 1.1993 - f1_score: 0.7247
```

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

84/84 [=====] - 1s 14ms/step - loss: 0.2019 - f1_score: 0.9818
```

```
[135]: 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	1.000	1.000	1.000	8
BACKPACK	0.750	1.000	0.857	6
BASKETBALL	0.769	1.000	0.870	10
BEE	0.429	0.300	0.353	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.750	0.857	8
BREAKFAST	0.600	0.500	0.545	6
CANCER	0.875	0.875	0.875	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	0.000	0.000	0.000	6
DECIDE	0.800	0.667	0.727	6
DEMAND	0.875	0.875	0.875	8
DEVELOP	0.800	0.667	0.727	6
DINNER	1.000	0.750	0.857	8
DOG	0.750	0.500	0.600	6
DOWNSIZE	0.800	1.000	0.889	8
DRAG	1.000	0.500	0.667	4
EAT	1.000	0.500	0.667	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.600	0.750	0.667	8
FINE	0.667	0.500	0.571	4

FLOAT	1.000	0.500	0.667	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.833	0.625	0.714	8
HALLOWEEN	1.000	1.000	1.000	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	0.625	0.625	0.625	8
LUNCH	1.000	0.500	0.667	8
MAPLE	0.750	0.750	0.750	4
MEAT	0.600	1.000	0.750	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.875	0.933	8
MOVIE	0.583	0.875	0.700	8
NOON	1.000	1.000	1.000	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.250	0.667	0.364	6
RAZOR	0.571	1.000	0.727	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.750	0.900	0.818	10
SINK	1.000	0.333	0.500	6
SQUEEZE	1.000	0.500	0.667	4
THEY	0.800	1.000	0.889	4
TWINS	0.636	0.875	0.737	8
WHATFOR	0.857	0.600	0.706	10
accuracy			0.741	324
macro avg	0.766	0.727	0.725	324
weighted avg	0.773	0.741	0.737	324

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

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

```
[138]: 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: 4.8994 - f1_score:  
0.0185  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
  
28/28 [=====] - 22s 630ms/step - loss: 4.8994 -  
f1_score: 0.0185 - val_loss: 4.7966 - val_f1_score: 0.0010  
Epoch 2/500  
28/28 [=====] - 3s 93ms/step - loss: 4.8424 - f1_score:  
0.0186 - val_loss: 4.7449 - val_f1_score: 7.4303e-04  
Epoch 3/500  
28/28 [=====] - 3s 91ms/step - loss: 4.7803 - f1_score:  
0.0197 - val_loss: 4.6997 - val_f1_score: 9.6970e-04  
Epoch 4/500  
28/28 [=====] - ETA: 0s - loss: 4.7368 - f1_score:  
0.0241  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
  
28/28 [=====] - 10s 376ms/step - loss: 4.7368 -  
f1_score: 0.0241 - val_loss: 4.6636 - val_f1_score: 0.0022  
Epoch 5/500  
28/28 [=====] - ETA: 0s - loss: 4.6995 - f1_score:  
0.0210  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
```

```
28/28 [=====] - 10s 365ms/step - loss: 4.6995 -  
f1_score: 0.0210 - val_loss: 4.6448 - val_f1_score: 0.0028  
Epoch 6/500  
28/28 [=====] - ETA: 0s - loss: 4.6681 - f1_score:  
0.0151  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
  
28/28 [=====] - 11s 390ms/step - loss: 4.6681 -  
f1_score: 0.0151 - val_loss: 4.5894 - val_f1_score: 0.0114  
Epoch 7/500  
28/28 [=====] - 3s 90ms/step - loss: 4.6282 - f1_score:  
0.0196 - val_loss: 4.5622 - val_f1_score: 0.0057  
Epoch 8/500  
28/28 [=====] - 2s 89ms/step - loss: 4.5797 - f1_score:  
0.0230 - val_loss: 4.5441 - val_f1_score: 9.6677e-04  
Epoch 9/500  
28/28 [=====] - 3s 93ms/step - loss: 4.5697 - f1_score:  
0.0162 - val_loss: 4.5227 - val_f1_score: 0.0021  
Epoch 10/500  
28/28 [=====] - 3s 90ms/step - loss: 4.5102 - f1_score:  
0.0228 - val_loss: 4.4672 - val_f1_score: 0.0086  
Epoch 11/500  
28/28 [=====] - 3s 90ms/step - loss: 4.4763 - f1_score:  
0.0270 - val_loss: 4.4306 - val_f1_score: 0.0086  
Epoch 12/500  
28/28 [=====] - 3s 91ms/step - loss: 4.4299 - f1_score:  
0.0268 - val_loss: 4.4217 - val_f1_score: 0.0013  
Epoch 13/500  
28/28 [=====] - 3s 92ms/step - loss: 4.3880 - f1_score:  
0.0268 - val_loss: 4.3224 - val_f1_score: 0.0098  
Epoch 14/500  
28/28 [=====] - 3s 91ms/step - loss: 4.3189 - f1_score:  
0.0282 - val_loss: 4.2375 - val_f1_score: 0.0103  
Epoch 15/500  
28/28 [=====] - 3s 92ms/step - loss: 4.2399 - f1_score:  
0.0346 - val_loss: 4.1724 - val_f1_score: 0.0084  
Epoch 16/500  
28/28 [=====] - ETA: 0s - loss: 4.1598 - f1_score:  
0.0369  
  
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 1DCNN + 1 GRU/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
```

```
28/28 [=====] - 12s 453ms/step - loss: 4.1598 -  
f1_score: 0.0369 - val_loss: 4.0779 - val_f1_score: 0.0168  
Epoch 17/500
```

```
28/28 [=====] - ETA: 0s - loss: 4.0710 - f1_score:  
0.0472
```

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 1DCNN + 1 GRU/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
```

```
28/28 [=====] - 10s 372ms/step - loss: 4.0710 -  
f1_score: 0.0472 - val_loss: 3.9928 - val_f1_score: 0.0295  
Epoch 18/500
```

```
28/28 [=====] - 2s 89ms/step - loss: 4.0115 - f1_score:  
0.0443 - val_loss: 3.9406 - val_f1_score: 0.0240  
Epoch 19/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.9558 - f1_score:  
0.0477
```

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 1DCNN + 1 GRU/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
```

```
28/28 [=====] - 11s 419ms/step - loss: 3.9558 -  
f1_score: 0.0477 - val_loss: 3.8552 - val_f1_score: 0.0528  
Epoch 20/500
```

```
28/28 [=====] - 3s 90ms/step - loss: 3.9009 - f1_score:  
0.0492 - val_loss: 3.8127 - val_f1_score: 0.0360  
Epoch 21/500
```

```
28/28 [=====] - 3s 91ms/step - loss: 3.8426 - f1_score:  
0.0603 - val_loss: 3.7217 - val_f1_score: 0.0325  
Epoch 22/500
```

```
28/28 [=====] - 3s 90ms/step - loss: 3.7664 - f1_score:  
0.0684 - val_loss: 3.6497 - val_f1_score: 0.0345  
Epoch 23/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.7037 - f1_score: 0.0717
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 13s 479ms/step - loss: 3.7037 - f1_score: 0.0717 - val_loss: 3.5743 - val_f1_score: 0.0835
Epoch 24/500
28/28 [=====] - 3s 90ms/step - loss: 3.6254 - f1_score: 0.0925 - val_loss: 3.5074 - val_f1_score: 0.0612
Epoch 25/500
28/28 [=====] - ETA: 0s - loss: 3.5483 - f1_score: 0.1043
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 416ms/step - loss: 3.5483 - f1_score: 0.1043 - val_loss: 3.4668 - val_f1_score: 0.0970
Epoch 26/500
28/28 [=====] - ETA: 0s - loss: 3.4776 - f1_score: 0.1165
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 424ms/step - loss: 3.4776 - f1_score: 0.1165 - val_loss: 3.3380 - val_f1_score: 0.1041
Epoch 27/500
28/28 [=====] - 3s 90ms/step - loss: 3.3907 - f1_score: 0.1309 - val_loss: 3.2979 - val_f1_score: 0.0901
Epoch 28/500
28/28 [=====] - 2s 89ms/step - loss: 3.3192 - f1_score: 0.1470 - val_loss: 3.2081 - val_f1_score: 0.0959
Epoch 29/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.2465 - f1_score: 0.1546
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 442ms/step - loss: 3.2465 -
f1_score: 0.1546 - val_loss: 3.1629 - val_f1_score: 0.1294
Epoch 30/500
28/28 [=====] - 3s 90ms/step - loss: 3.1683 - f1_score: 0.1680 -
val_loss: 3.1048 - val_f1_score: 0.1289
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 3.0842 - f1_score: 0.1771
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 415ms/step - loss: 3.0842 -
f1_score: 0.1771 - val_loss: 3.0136 - val_f1_score: 0.1395
Epoch 32/500
28/28 [=====] - ETA: 0s - loss: 3.0302 - f1_score: 0.1852
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 441ms/step - loss: 3.0302 -
f1_score: 0.1852 - val_loss: 3.0056 - val_f1_score: 0.1619
Epoch 33/500
28/28 [=====] - ETA: 0s - loss: 2.9637 - f1_score: 0.2090
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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 383ms/step - loss: 2.9637 -

f1\_score: 0.2090 - val\_loss: 2.9474 - val\_f1\_score: 0.1872

Epoch 34/500

28/28 [=====] - ETA: 0s - loss: 2.8942 - f1\_score:

0.2306

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 11s 395ms/step - loss: 2.8942 -

f1\_score: 0.2306 - val\_loss: 2.8600 - val\_f1\_score: 0.2141

Epoch 35/500

28/28 [=====] - 3s 90ms/step - loss: 2.8457 - f1\_score:

0.2464 - val\_loss: 2.8088 - val\_f1\_score: 0.2030

Epoch 36/500

28/28 [=====] - ETA: 0s - loss: 2.7835 - f1\_score:

0.2635

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 12s 426ms/step - loss: 2.7835 -

f1\_score: 0.2635 - val\_loss: 2.7615 - val\_f1\_score: 0.2380

Epoch 37/500

28/28 [=====] - ETA: 0s - loss: 2.7358 - f1\_score:

0.2726

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

```
28/28 [=====] - 13s 473ms/step - loss: 2.7358 -  
f1_score: 0.2726 - val_loss: 2.7578 - val_f1_score: 0.2384  
Epoch 38/500  
28/28 [=====] - ETA: 0s - loss: 2.6944 - f1_score:  
0.2800  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
28/28 [=====] - 11s 400ms/step - loss: 2.6944 -  
f1_score: 0.2800 - val_loss: 2.6723 - val_f1_score: 0.2717  
Epoch 39/500  
28/28 [=====] - 2s 89ms/step - loss: 2.6409 - f1_score:  
0.3021 - val_loss: 2.6603 - val_f1_score: 0.2568  
Epoch 40/500  
28/28 [=====] - ETA: 0s - loss: 2.6021 - f1_score:  
0.3098  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
28/28 [=====] - 12s 428ms/step - loss: 2.6021 -  
f1_score: 0.3098 - val_loss: 2.5786 - val_f1_score: 0.2854  
Epoch 41/500  
28/28 [=====] - ETA: 0s - loss: 2.5550 - f1_score:  
0.3220  
  
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 1DCNN + 1 GRU/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets  
28/28 [=====] - 10s 378ms/step - loss: 2.5550 -  
f1_score: 0.3220 - val_loss: 2.5385 - val_f1_score: 0.2952  
Epoch 42/500  
28/28 [=====] - ETA: 0s - loss: 2.5314 - f1_score:  
0.3288
```

```
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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 11s 396ms/step - loss: 2.5314 -
f1_score: 0.3288 - val_loss: 2.4998 - val_f1_score: 0.3119
Epoch 43/500

28/28 [=====] - ETA: 0s - loss: 2.4714 - f1_score:
0.3372

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 21s 777ms/step - loss: 2.4714 -
f1_score: 0.3372 - val_loss: 2.4579 - val_f1_score: 0.3431
Epoch 44/500

28/28 [=====] - 3s 89ms/step - loss: 2.4266 - f1_score:
0.3487 - val_loss: 2.4560 - val_f1_score: 0.3422
Epoch 45/500

28/28 [=====] - ETA: 0s - loss: 2.3818 - f1_score:
0.3633

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 366ms/step - loss: 2.3818 -
f1_score: 0.3633 - val_loss: 2.4058 - val_f1_score: 0.3792
Epoch 46/500

28/28 [=====] - 2s 89ms/step - loss: 2.3493 - f1_score:
0.3650 - val_loss: 2.4279 - val_f1_score: 0.3437
Epoch 47/500

28/28 [=====] - 2s 89ms/step - loss: 2.3168 - f1_score:
0.3833 - val_loss: 2.3424 - val_f1_score: 0.3575
Epoch 48/500

28/28 [=====] - 2s 89ms/step - loss: 2.2823 - f1_score:
0.3923 - val_loss: 2.3612 - val_f1_score: 0.3532
```

```
Epoch 49/500
28/28 [=====] - 2s 89ms/step - loss: 2.2528 - f1_score: 0.3953 - val_loss: 2.3447 - val_f1_score: 0.3531
Epoch 50/500
28/28 [=====] - ETA: 0s - loss: 2.2090 - f1_score: 0.3953

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 10s 376ms/step - loss: 2.2090 -
f1_score: 0.3953 - val_loss: 2.2806 - val_f1_score: 0.4143
Epoch 51/500
28/28 [=====] - 2s 89ms/step - loss: 2.1638 - f1_score: 0.4279 - val_loss: 2.3008 - val_f1_score: 0.3918
Epoch 52/500
28/28 [=====] - 3s 91ms/step - loss: 2.1484 - f1_score: 0.4249 - val_loss: 2.2632 - val_f1_score: 0.4081
Epoch 53/500
28/28 [=====] - ETA: 0s - loss: 2.1034 - f1_score: 0.4493

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 395ms/step - loss: 2.1034 -
f1_score: 0.4493 - val_loss: 2.2212 - val_f1_score: 0.4248
Epoch 54/500
28/28 [=====] - 2s 89ms/step - loss: 2.0735 - f1_score: 0.4577 - val_loss: 2.2314 - val_f1_score: 0.4110
Epoch 55/500
28/28 [=====] - ETA: 0s - loss: 2.0396 - f1_score: 0.4455

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 1DCNN + 1 GRU/assets
```

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INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 395ms/step - loss: 2.0396 -
f1_score: 0.4455 - val_loss: 2.1437 - val_f1_score: 0.4320
Epoch 56/500
28/28 [=====] - 2s 89ms/step - loss: 2.0049 - f1_score:
0.4747 - val_loss: 2.1697 - val_f1_score: 0.4310
Epoch 57/500
28/28 [=====] - 2s 89ms/step - loss: 2.0030 - f1_score:
0.4641 - val_loss: 2.1754 - val_f1_score: 0.4199
Epoch 58/500
28/28 [=====] - ETA: 0s - loss: 1.9357 - f1_score:
0.4909

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 404ms/step - loss: 1.9357 -
f1_score: 0.4909 - val_loss: 2.1244 - val_f1_score: 0.4684
Epoch 59/500
28/28 [=====] - 2s 89ms/step - loss: 1.9282 - f1_score:
0.4820 - val_loss: 2.0716 - val_f1_score: 0.4531
Epoch 60/500
28/28 [=====] - ETA: 0s - loss: 1.8881 - f1_score:
0.4963

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 402ms/step - loss: 1.8881 -
f1_score: 0.4963 - val_loss: 2.0375 - val_f1_score: 0.4889
Epoch 61/500
28/28 [=====] - 3s 89ms/step - loss: 1.8646 - f1_score:
0.5028 - val_loss: 2.0401 - val_f1_score: 0.4802
Epoch 62/500
28/28 [=====] - 2s 89ms/step - loss: 1.8434 - f1_score:
0.5101 - val_loss: 2.0235 - val_f1_score: 0.4756
Epoch 63/500
28/28 [=====] - 2s 89ms/step - loss: 1.7958 - f1_score:
0.5130 - val_loss: 2.0006 - val_f1_score: 0.4713
```

```
Epoch 64/500
28/28 [=====] - 2s 89ms/step - loss: 1.7778 - f1_score: 0.5382 - val_loss: 2.0715 - val_f1_score: 0.4629
Epoch 65/500
28/28 [=====] - ETA: 0s - loss: 1.7581 - f1_score: 0.5235

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 434ms/step - loss: 1.7581 -
f1_score: 0.5235 - val_loss: 1.9847 - val_f1_score: 0.4919
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 1.7223 - f1_score: 0.5453

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 9s 346ms/step - loss: 1.7223 -
f1_score: 0.5453 - val_loss: 1.9100 - val_f1_score: 0.5097
Epoch 67/500
28/28 [=====] - ETA: 0s - loss: 1.7162 - f1_score: 0.5376

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 403ms/step - loss: 1.7162 -
f1_score: 0.5376 - val_loss: 1.9041 - val_f1_score: 0.5113
Epoch 68/500
28/28 [=====] - 2s 89ms/step - loss: 1.6851 - f1_score: 0.5557 - val_loss: 1.9089 - val_f1_score: 0.5089
Epoch 69/500
28/28 [=====] - ETA: 0s - loss: 1.6525 - f1_score: 0.5769
```

```
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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 370ms/step - loss: 1.6525 -
f1_score: 0.5769 - val_loss: 1.8763 - val_f1_score: 0.5153
Epoch 70/500

28/28 [=====] - ETA: 0s - loss: 1.6103 - f1_score:
0.5660

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 353ms/step - loss: 1.6103 -
f1_score: 0.5660 - val_loss: 1.8543 - val_f1_score: 0.5185
Epoch 71/500

28/28 [=====] - ETA: 0s - loss: 1.5868 - f1_score:
0.5814

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 18s 677ms/step - loss: 1.5868 -
f1_score: 0.5814 - val_loss: 1.8458 - val_f1_score: 0.5413
Epoch 72/500

28/28 [=====] - 2s 89ms/step - loss: 1.5806 - f1_score:
0.5775 - val_loss: 1.8609 - val_f1_score: 0.5154
Epoch 73/500

28/28 [=====] - 2s 89ms/step - loss: 1.5624 - f1_score:
0.5801 - val_loss: 1.8127 - val_f1_score: 0.5221
Epoch 74/500

28/28 [=====] - 2s 89ms/step - loss: 1.5255 - f1_score:
0.5956 - val_loss: 1.8410 - val_f1_score: 0.5027
Epoch 75/500

28/28 [=====] - 2s 89ms/step - loss: 1.5199 - f1_score:
0.5965 - val_loss: 1.8075 - val_f1_score: 0.5146
```

```
Epoch 76/500
28/28 [=====] - ETA: 0s - loss: 1.5012 - f1_score: 0.6073

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 374ms/step - loss: 1.5012 -
f1_score: 0.6073 - val_loss: 1.7665 - val_f1_score: 0.5492
Epoch 77/500
28/28 [=====] - ETA: 0s - loss: 1.4945 - f1_score: 0.6063

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 359ms/step - loss: 1.4945 -
f1_score: 0.6063 - val_loss: 1.7179 - val_f1_score: 0.5633
Epoch 78/500
28/28 [=====] - 2s 89ms/step - loss: 1.4614 - f1_score: 0.6196 -
val_loss: 1.7193 - val_f1_score: 0.5410
Epoch 79/500
28/28 [=====] - 2s 89ms/step - loss: 1.4297 - f1_score: 0.6178 -
val_loss: 1.7158 - val_f1_score: 0.5451
Epoch 80/500
28/28 [=====] - 3s 90ms/step - loss: 1.4175 - f1_score: 0.6282 -
val_loss: 1.7385 - val_f1_score: 0.5622
Epoch 81/500
28/28 [=====] - ETA: 0s - loss: 1.3995 - f1_score: 0.6263

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 369ms/step - loss: 1.3995 -
f1_score: 0.6263 - val_loss: 1.6830 - val_f1_score: 0.5795
```

```
Epoch 82/500
28/28 [=====] - 2s 89ms/step - loss: 1.3754 - f1_score: 0.6292 - val_loss: 1.7231 - val_f1_score: 0.5554
Epoch 83/500
28/28 [=====] - 2s 89ms/step - loss: 1.3743 - f1_score: 0.6420 - val_loss: 1.6564 - val_f1_score: 0.5689
Epoch 84/500
28/28 [=====] - 3s 90ms/step - loss: 1.3561 - f1_score: 0.6365 - val_loss: 1.6857 - val_f1_score: 0.5658
Epoch 85/500
28/28 [=====] - 3s 90ms/step - loss: 1.3375 - f1_score: 0.6334 - val_loss: 1.6648 - val_f1_score: 0.5675
Epoch 86/500
28/28 [=====] - 3s 91ms/step - loss: 1.3198 - f1_score: 0.6553 - val_loss: 1.7025 - val_f1_score: 0.5495
Epoch 87/500
28/28 [=====] - ETA: 0s - loss: 1.3024 - f1_score: 0.6593

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 12s 454ms/step - loss: 1.3024 - f1_score: 0.6593 - val_loss: 1.5741 - val_f1_score: 0.5804
Epoch 88/500
28/28 [=====] - ETA: 0s - loss: 1.2849 - f1_score: 0.6682

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 354ms/step - loss: 1.2849 - f1_score: 0.6682 - val_loss: 1.6169 - val_f1_score: 0.6036
Epoch 89/500
28/28 [=====] - 2s 89ms/step - loss: 1.2669 - f1_score: 0.6630 - val_loss: 1.6304 - val_f1_score: 0.5803
Epoch 90/500
28/28 [=====] - 3s 90ms/step - loss: 1.2531 - f1_score: 0.6668 - val_loss: 1.5524 - val_f1_score: 0.5863
Epoch 91/500
```

```
28/28 [=====] - 2s 90ms/step - loss: 1.2454 - f1_score: 0.6707 - val_loss: 1.5454 - val_f1_score: 0.5993
Epoch 92/500
28/28 [=====] - 2s 89ms/step - loss: 1.2167 - f1_score: 0.6783 - val_loss: 1.5336 - val_f1_score: 0.5979
Epoch 93/500
28/28 [=====] - 3s 90ms/step - loss: 1.2249 - f1_score: 0.6720 - val_loss: 1.5250 - val_f1_score: 0.5945
Epoch 94/500
28/28 [=====] - 3s 91ms/step - loss: 1.2036 - f1_score: 0.6820 - val_loss: 1.5604 - val_f1_score: 0.5795
Epoch 95/500
28/28 [=====] - 3s 91ms/step - loss: 1.1677 - f1_score: 0.6887 - val_loss: 1.4899 - val_f1_score: 0.5995
Epoch 96/500
28/28 [=====] - 3s 91ms/step - loss: 1.1715 - f1_score: 0.6819 - val_loss: 1.5363 - val_f1_score: 0.5971
Epoch 97/500
28/28 [=====] - ETA: 0s - loss: 1.1678 - f1_score: 0.6931
```

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 13s 468ms/step - loss: 1.1678 - f1_score: 0.6931 - val_loss: 1.4790 - val_f1_score: 0.6175
Epoch 98/500
28/28 [=====] - 3s 90ms/step - loss: 1.1613 - f1_score: 0.6940 - val_loss: 1.5467 - val_f1_score: 0.5880
Epoch 99/500
28/28 [=====] - 3s 90ms/step - loss: 1.1203 - f1_score: 0.7065 - val_loss: 1.4947 - val_f1_score: 0.5983
Epoch 100/500
28/28 [=====] - 3s 90ms/step - loss: 1.1196 - f1_score: 0.7033 - val_loss: 1.4978 - val_f1_score: 0.6129
Epoch 101/500
28/28 [=====] - ETA: 0s - loss: 1.0962 - f1_score: 0.7083
```

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 1DCNN + 1 GRU/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 435ms/step - loss: 1.0962 -
f1_score: 0.7083 - val_loss: 1.4303 - val_f1_score: 0.6200
Epoch 102/500
28/28 [=====] - 3s 90ms/step - loss: 1.0832 - f1_score:
0.7075 - val_loss: 1.4965 - val_f1_score: 0.6168
Epoch 103/500
28/28 [=====] - ETA: 0s - loss: 1.0754 - f1_score:
0.7090

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 10s 383ms/step - loss: 1.0754 -
f1_score: 0.7090 - val_loss: 1.4380 - val_f1_score: 0.6356
Epoch 104/500
28/28 [=====] - 2s 89ms/step - loss: 1.0648 - f1_score:
0.7177 - val_loss: 1.4241 - val_f1_score: 0.6265
Epoch 105/500
28/28 [=====] - 3s 90ms/step - loss: 1.0475 - f1_score:
0.7175 - val_loss: 1.3988 - val_f1_score: 0.6344
Epoch 106/500
28/28 [=====] - ETA: 0s - loss: 1.0375 - f1_score:
0.7271

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 408ms/step - loss: 1.0375 -
f1_score: 0.7271 - val_loss: 1.4130 - val_f1_score: 0.6413
Epoch 107/500
28/28 [=====] - 2s 89ms/step - loss: 1.0268 - f1_score:
0.7373 - val_loss: 1.4159 - val_f1_score: 0.6327
Epoch 108/500
28/28 [=====] - 2s 89ms/step - loss: 1.0511 - f1_score:
0.7112 - val_loss: 1.4681 - val_f1_score: 0.6398
Epoch 109/500
28/28 [=====] - ETA: 0s - loss: 1.0139 - f1_score:
0.7303
```

```
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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 14s 513ms/step - loss: 1.0139 -
f1_score: 0.7303 - val_loss: 1.4040 - val_f1_score: 0.6427
Epoch 110/500
28/28 [=====] - 2s 89ms/step - loss: 1.0066 - f1_score:
0.7304 - val_loss: 1.3834 - val_f1_score: 0.6294
Epoch 111/500
28/28 [=====] - 2s 89ms/step - loss: 1.0013 - f1_score:
0.7385 - val_loss: 1.4196 - val_f1_score: 0.6268
Epoch 112/500
28/28 [=====] - 2s 89ms/step - loss: 0.9805 - f1_score:
0.7412 - val_loss: 1.4353 - val_f1_score: 0.6330
Epoch 113/500
28/28 [=====] - 3s 90ms/step - loss: 0.9554 - f1_score:
0.7496 - val_loss: 1.4745 - val_f1_score: 0.5990
Epoch 114/500
28/28 [=====] - ETA: 0s - loss: 0.9191 - f1_score:
0.7659

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 384ms/step - loss: 0.9191 -
f1_score: 0.7659 - val_loss: 1.3425 - val_f1_score: 0.6572
Epoch 115/500
28/28 [=====] - ETA: 0s - loss: 0.9269 - f1_score:
0.7470

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 10s 368ms/step - loss: 0.9269 -
f1_score: 0.7470 - val_loss: 1.3267 - val_f1_score: 0.6615
```

```
Epoch 116/500
28/28 [=====] - 2s 89ms/step - loss: 0.9246 - f1_score: 0.7593 - val_loss: 1.3589 - val_f1_score: 0.6251
Epoch 117/500
28/28 [=====] - 3s 91ms/step - loss: 0.9150 - f1_score: 0.7544 - val_loss: 1.3522 - val_f1_score: 0.6552
Epoch 118/500
28/28 [=====] - 2s 89ms/step - loss: 0.9219 - f1_score: 0.7472 - val_loss: 1.3607 - val_f1_score: 0.6486
Epoch 119/500
28/28 [=====] - 3s 91ms/step - loss: 0.8902 - f1_score: 0.7702 - val_loss: 1.3965 - val_f1_score: 0.6336
Epoch 120/500
28/28 [=====] - 3s 90ms/step - loss: 0.8782 - f1_score: 0.7718 - val_loss: 1.4099 - val_f1_score: 0.6294
Epoch 121/500
28/28 [=====] - ETA: 0s - loss: 0.8708 - f1_score: 0.7714

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 11s 397ms/step - loss: 0.8708 - f1_score: 0.7714 - val_loss: 1.3121 - val_f1_score: 0.6651
Epoch 122/500
28/28 [=====] - ETA: 0s - loss: 0.8921 - f1_score: 0.7665

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 11s 416ms/step - loss: 0.8921 - f1_score: 0.7665 - val_loss: 1.2719 - val_f1_score: 0.6752
Epoch 123/500
28/28 [=====] - 2s 89ms/step - loss: 0.8561 - f1_score: 0.7839 - val_loss: 1.3658 - val_f1_score: 0.6345
Epoch 124/500
28/28 [=====] - 3s 90ms/step - loss: 0.8555 - f1_score: 0.7785 - val_loss: 1.2706 - val_f1_score: 0.6554
Epoch 125/500
```

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28/28 [=====] - 2s 89ms/step - loss: 0.8262 - f1_score: 0.7819 - val_loss: 1.2509 - val_f1_score: 0.6715
Epoch 126/500
28/28 [=====] - ETA: 0s - loss: 0.8418 - f1_score: 0.7807

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 398ms/step - loss: 0.8418 - f1_score: 0.7807 - val_loss: 1.2661 - val_f1_score: 0.6795
Epoch 127/500
28/28 [=====] - 2s 89ms/step - loss: 0.8241 - f1_score: 0.7911 - val_loss: 1.2747 - val_f1_score: 0.6549
Epoch 128/500
28/28 [=====] - 3s 90ms/step - loss: 0.8168 - f1_score: 0.7863 - val_loss: 1.3639 - val_f1_score: 0.6389
Epoch 129/500
28/28 [=====] - 3s 90ms/step - loss: 0.8000 - f1_score: 0.7926 - val_loss: 1.3382 - val_f1_score: 0.6564
Epoch 130/500
28/28 [=====] - 3s 91ms/step - loss: 0.8082 - f1_score: 0.7880 - val_loss: 1.2406 - val_f1_score: 0.6752
Epoch 131/500
28/28 [=====] - 3s 90ms/step - loss: 0.7882 - f1_score: 0.7966 - val_loss: 1.3003 - val_f1_score: 0.6709
Epoch 132/500
28/28 [=====] - 3s 91ms/step - loss: 0.7882 - f1_score: 0.7867 - val_loss: 1.3779 - val_f1_score: 0.6391
Epoch 133/500
28/28 [=====] - 3s 91ms/step - loss: 0.7765 - f1_score: 0.8015 - val_loss: 1.3468 - val_f1_score: 0.6120
Epoch 134/500
28/28 [=====] - ETA: 0s - loss: 0.7673 - f1_score: 0.7981

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
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28/28 [=====] - 13s 462ms/step - loss: 0.7673 - f1_score: 0.7981 - val_loss: 1.2058 - val_f1_score: 0.7002
Epoch 135/500
28/28 [=====] - 3s 92ms/step - loss: 0.7731 - f1_score: 0.7978 - val_loss: 1.3053 - val_f1_score: 0.6661
Epoch 136/500
28/28 [=====] - 3s 90ms/step - loss: 0.7640 - f1_score: 0.7979 - val_loss: 1.2800 - val_f1_score: 0.6776
Epoch 137/500
28/28 [=====] - 3s 91ms/step - loss: 0.7473 - f1_score: 0.8105 - val_loss: 1.2420 - val_f1_score: 0.6900
Epoch 138/500
28/28 [=====] - 3s 91ms/step - loss: 0.7279 - f1_score: 0.8095 - val_loss: 1.2743 - val_f1_score: 0.6537
Epoch 139/500
28/28 [=====] - 3s 91ms/step - loss: 0.7245 - f1_score: 0.8225 - val_loss: 1.2804 - val_f1_score: 0.6640
Epoch 140/500
28/28 [=====] - 3s 92ms/step - loss: 0.7409 - f1_score: 0.8022 - val_loss: 1.2232 - val_f1_score: 0.6668
Epoch 141/500
28/28 [=====] - 3s 96ms/step - loss: 0.7214 - f1_score: 0.8066 - val_loss: 1.1937 - val_f1_score: 0.6795
Epoch 142/500
28/28 [=====] - 3s 92ms/step - loss: 0.7153 - f1_score: 0.8173 - val_loss: 1.2268 - val_f1_score: 0.6696
Epoch 143/500
28/28 [=====] - 3s 99ms/step - loss: 0.7113 - f1_score: 0.8176 - val_loss: 1.3200 - val_f1_score: 0.6633
Epoch 144/500
28/28 [=====] - ETA: 0s - loss: 0.6753 - f1_score: 0.8399

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 11s 417ms/step - loss: 0.6753 - f1_score: 0.8399 - val_loss: 1.2744 - val_f1_score: 0.7021
Epoch 145/500
28/28 [=====] - 3s 90ms/step - loss: 0.6710 - f1_score: 0.8363 - val_loss: 1.2174 - val_f1_score: 0.6916
Epoch 146/500
28/28 [=====] - 3s 90ms/step - loss: 0.6761 - f1_score: 0.8294 - val_loss: 1.2350 - val_f1_score: 0.6566

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Epoch 147/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6794 - f1\_score: 0.8307 - val\_loss: 1.2247 - val\_f1\_score: 0.6756  
Epoch 148/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6575 - f1\_score: 0.8349 - val\_loss: 1.2733 - val\_f1\_score: 0.6640  
Epoch 149/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6717 - f1\_score: 0.8240 - val\_loss: 1.2933 - val\_f1\_score: 0.6889  
Epoch 150/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6520 - f1\_score: 0.8342 - val\_loss: 1.2287 - val\_f1\_score: 0.6866  
Epoch 151/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6584 - f1\_score: 0.8347 - val\_loss: 1.3131 - val\_f1\_score: 0.6620  
Epoch 152/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6399 - f1\_score: 0.8364 - val\_loss: 1.3389 - val\_f1\_score: 0.6569  
Epoch 153/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6329 - f1\_score: 0.8443 - val\_loss: 1.2626 - val\_f1\_score: 0.6814  
Epoch 154/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6296 - f1\_score: 0.8366 - val\_loss: 1.3217 - val\_f1\_score: 0.6669  
Epoch 155/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6389 - f1\_score: 0.8345 - val\_loss: 1.3484 - val\_f1\_score: 0.6608  
Epoch 156/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6262 - f1\_score: 0.8478 - val\_loss: 1.3007 - val\_f1\_score: 0.6622  
Epoch 157/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6099 - f1\_score: 0.8505 - val\_loss: 1.2448 - val\_f1\_score: 0.6865  
Epoch 158/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6340 - f1\_score: 0.8368 - val\_loss: 1.2461 - val\_f1\_score: 0.6627  
Epoch 159/500  
28/28 [=====] - 3s 97ms/step - loss: 0.6131 - f1\_score: 0.8368 - val\_loss: 1.1732 - val\_f1\_score: 0.6891  
Epoch 160/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6289 - f1\_score: 0.8296 - val\_loss: 1.2130 - val\_f1\_score: 0.6790  
Epoch 161/500  
28/28 [=====] - 3s 94ms/step - loss: 0.6041 - f1\_score: 0.8423 - val\_loss: 1.2001 - val\_f1\_score: 0.6748  
Epoch 162/500  
28/28 [=====] - 3s 94ms/step - loss: 0.5819 - f1\_score: 0.8516 - val\_loss: 1.1696 - val\_f1\_score: 0.6725

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Epoch 163/500
28/28 [=====] - 3s 93ms/step - loss: 0.5773 - f1_score: 0.8540 - val_loss: 1.2607 - val_f1_score: 0.6725
Epoch 164/500
28/28 [=====] - 3s 95ms/step - loss: 0.5662 - f1_score: 0.8594 - val_loss: 1.1963 - val_f1_score: 0.6917
Epoch 165/500
28/28 [=====] - 3s 94ms/step - loss: 0.5752 - f1_score: 0.8565 - val_loss: 1.1892 - val_f1_score: 0.6922
Epoch 166/500
28/28 [=====] - 3s 94ms/step - loss: 0.5666 - f1_score: 0.8569 - val_loss: 1.2004 - val_f1_score: 0.6718
Epoch 167/500
28/28 [=====] - 3s 96ms/step - loss: 0.5688 - f1_score: 0.8581 - val_loss: 1.2255 - val_f1_score: 0.6747
Epoch 168/500
28/28 [=====] - 3s 93ms/step - loss: 0.5340 - f1_score: 0.8691 - val_loss: 1.1768 - val_f1_score: 0.6834
Epoch 169/500
28/28 [=====] - 3s 95ms/step - loss: 0.5518 - f1_score: 0.8550 - val_loss: 1.2118 - val_f1_score: 0.6978
Epoch 170/500
28/28 [=====] - 3s 95ms/step - loss: 0.5433 - f1_score: 0.8637 - val_loss: 1.1860 - val_f1_score: 0.6994
Epoch 171/500
28/28 [=====] - 3s 96ms/step - loss: 0.5222 - f1_score: 0.8729 - val_loss: 1.1585 - val_f1_score: 0.6895
Epoch 172/500
28/28 [=====] - 3s 95ms/step - loss: 0.5171 - f1_score: 0.8735 - val_loss: 1.2146 - val_f1_score: 0.6917
Epoch 173/500
28/28 [=====] - 3s 95ms/step - loss: 0.5383 - f1_score: 0.8647 - val_loss: 1.2286 - val_f1_score: 0.6719
Epoch 174/500
28/28 [=====] - 3s 94ms/step - loss: 0.5219 - f1_score: 0.8725 - val_loss: 1.1544 - val_f1_score: 0.6814
Epoch 175/500
28/28 [=====] - 3s 95ms/step - loss: 0.5350 - f1_score: 0.8678 - val_loss: 1.2080 - val_f1_score: 0.6962
Epoch 176/500
28/28 [=====] - 3s 93ms/step - loss: 0.5089 - f1_score: 0.8778 - val_loss: 1.2320 - val_f1_score: 0.6720
Epoch 177/500
28/28 [=====] - 3s 94ms/step - loss: 0.5131 - f1_score: 0.8701 - val_loss: 1.1469 - val_f1_score: 0.6841
Epoch 178/500
28/28 [=====] - ETA: 0s - loss: 0.4982 - f1_score: 0.8800
```

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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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 445ms/step - loss: 0.4982 - f1_score: 0.8800 - val_loss: 1.1927 - val_f1_score: 0.7147
Epoch 179/500
28/28 [=====] - 3s 91ms/step - loss: 0.5041 - f1_score: 0.8762 - val_loss: 1.2108 - val_f1_score: 0.6848
Epoch 180/500
28/28 [=====] - 3s 91ms/step - loss: 0.4797 - f1_score: 0.8895 - val_loss: 1.1776 - val_f1_score: 0.7101
Epoch 181/500
28/28 [=====] - 3s 92ms/step - loss: 0.4922 - f1_score: 0.8760 - val_loss: 1.2010 - val_f1_score: 0.6869
Epoch 182/500
28/28 [=====] - 3s 93ms/step - loss: 0.4969 - f1_score: 0.8726 - val_loss: 1.1689 - val_f1_score: 0.6965
Epoch 183/500
28/28 [=====] - 3s 92ms/step - loss: 0.4654 - f1_score: 0.8920 - val_loss: 1.2035 - val_f1_score: 0.6983
Epoch 184/500
28/28 [=====] - 3s 94ms/step - loss: 0.4800 - f1_score: 0.8826 - val_loss: 1.2205 - val_f1_score: 0.6688
Epoch 185/500
28/28 [=====] - 3s 93ms/step - loss: 0.4778 - f1_score: 0.8816 - val_loss: 1.2072 - val_f1_score: 0.6946
Epoch 186/500
28/28 [=====] - 3s 93ms/step - loss: 0.4692 - f1_score: 0.8874 - val_loss: 1.1676 - val_f1_score: 0.6896
Epoch 187/500
28/28 [=====] - 3s 95ms/step - loss: 0.4725 - f1_score: 0.8851 - val_loss: 1.1887 - val_f1_score: 0.6880
Epoch 188/500
28/28 [=====] - 3s 93ms/step - loss: 0.4530 - f1_score: 0.8953 - val_loss: 1.2048 - val_f1_score: 0.6846
Epoch 189/500
28/28 [=====] - 3s 96ms/step - loss: 0.4690 - f1_score: 0.8848 - val_loss: 1.2721 - val_f1_score: 0.6838
Epoch 190/500
28/28 [=====] - 3s 93ms/step - loss: 0.4425 - f1_score: 0.8898 - val_loss: 1.2864 - val_f1_score: 0.6808
Epoch 191/500
28/28 [=====] - 3s 93ms/step - loss: 0.4668 - f1_score:
```

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0.8870 - val_loss: 1.1921 - val_f1_score: 0.6793
Epoch 192/500
28/28 [=====] - 3s 94ms/step - loss: 0.4536 - f1_score:
0.8886 - val_loss: 1.1590 - val_f1_score: 0.7118
Epoch 193/500
28/28 [=====] - 3s 94ms/step - loss: 0.4342 - f1_score:
0.8990 - val_loss: 1.2774 - val_f1_score: 0.6948
Epoch 194/500
28/28 [=====] - 3s 93ms/step - loss: 0.4471 - f1_score:
0.8916 - val_loss: 1.1826 - val_f1_score: 0.7020
Epoch 195/500
28/28 [=====] - 3s 93ms/step - loss: 0.4439 - f1_score:
0.8970 - val_loss: 1.2042 - val_f1_score: 0.6947
Epoch 196/500
28/28 [=====] - 3s 93ms/step - loss: 0.4259 - f1_score:
0.8994 - val_loss: 1.1633 - val_f1_score: 0.6884
Epoch 197/500
28/28 [=====] - 3s 93ms/step - loss: 0.4349 - f1_score:
0.8945 - val_loss: 1.1595 - val_f1_score: 0.6896
Epoch 198/500
28/28 [=====] - 3s 94ms/step - loss: 0.4284 - f1_score:
0.8991 - val_loss: 1.1743 - val_f1_score: 0.6963
Epoch 199/500
28/28 [=====] - 3s 94ms/step - loss: 0.4248 - f1_score:
0.9037 - val_loss: 1.2667 - val_f1_score: 0.6881
Epoch 200/500
28/28 [=====] - 3s 96ms/step - loss: 0.4193 - f1_score:
0.8986 - val_loss: 1.1928 - val_f1_score: 0.6794
Epoch 201/500
28/28 [=====] - 3s 93ms/step - loss: 0.4115 - f1_score:
0.9071 - val_loss: 1.2625 - val_f1_score: 0.6857
Epoch 202/500
28/28 [=====] - 3s 93ms/step - loss: 0.3953 - f1_score:
0.9098 - val_loss: 1.2332 - val_f1_score: 0.6718
Epoch 203/500
28/28 [=====] - 3s 94ms/step - loss: 0.4178 - f1_score:
0.9027 - val_loss: 1.1923 - val_f1_score: 0.7019
Epoch 204/500
28/28 [=====] - 3s 94ms/step - loss: 0.4006 - f1_score:
0.9099 - val_loss: 1.3128 - val_f1_score: 0.6601
Epoch 205/500
28/28 [=====] - 3s 94ms/step - loss: 0.4098 - f1_score:
0.9074 - val_loss: 1.2858 - val_f1_score: 0.6733
Epoch 206/500
28/28 [=====] - 3s 94ms/step - loss: 0.3901 - f1_score:
0.9130 - val_loss: 1.2411 - val_f1_score: 0.6940
Epoch 207/500
28/28 [=====] - 3s 94ms/step - loss: 0.3869 - f1_score:
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0.9106 - val_loss: 1.2434 - val_f1_score: 0.6920
Epoch 208/500
28/28 [=====] - 3s 94ms/step - loss: 0.3934 - f1_score: 0.9080 - val_loss: 1.2033 - val_f1_score: 0.6747
Epoch 209/500
28/28 [=====] - 3s 94ms/step - loss: 0.3918 - f1_score: 0.9059 - val_loss: 1.2115 - val_f1_score: 0.7039
Epoch 210/500
28/28 [=====] - 3s 94ms/step - loss: 0.4041 - f1_score: 0.8999 - val_loss: 1.2434 - val_f1_score: 0.6966
Epoch 211/500
28/28 [=====] - 3s 95ms/step - loss: 0.3662 - f1_score: 0.9169 - val_loss: 1.2264 - val_f1_score: 0.6845
Epoch 212/500
28/28 [=====] - 3s 99ms/step - loss: 0.3725 - f1_score: 0.9139 - val_loss: 1.2376 - val_f1_score: 0.6924
Epoch 213/500
28/28 [=====] - ETA: 0s - loss: 0.3581 - f1_score: 0.9203

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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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 [=====] - 17s 637ms/step - loss: 0.3581 - f1_score: 0.9203 - val_loss: 1.1250 - val_f1_score: 0.7199
Epoch 214/500
28/28 [=====] - 3s 90ms/step - loss: 0.3784 - f1_score: 0.9170 - val_loss: 1.1897 - val_f1_score: 0.6986
Epoch 215/500
28/28 [=====] - 3s 90ms/step - loss: 0.3797 - f1_score: 0.9126 - val_loss: 1.2101 - val_f1_score: 0.7146
Epoch 216/500
28/28 [=====] - 3s 91ms/step - loss: 0.3657 - f1_score: 0.9188 - val_loss: 1.2673 - val_f1_score: 0.6970
Epoch 217/500
28/28 [=====] - 3s 91ms/step - loss: 0.3626 - f1_score: 0.9215 - val_loss: 1.2372 - val_f1_score: 0.6961
Epoch 218/500
28/28 [=====] - 3s 92ms/step - loss: 0.3466 - f1_score: 0.9263 - val_loss: 1.3243 - val_f1_score: 0.6877
Epoch 219/500
28/28 [=====] - 3s 92ms/step - loss: 0.3506 - f1_score: 0.9209 - val_loss: 1.1698 - val_f1_score: 0.7006
Epoch 220/500
```

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28/28 [=====] - 3s 92ms/step - loss: 0.3481 - f1_score: 0.9274 - val_loss: 1.2751 - val_f1_score: 0.6836
Epoch 221/500
28/28 [=====] - 3s 93ms/step - loss: 0.3419 - f1_score: 0.9266 - val_loss: 1.2473 - val_f1_score: 0.6816
Epoch 222/500
28/28 [=====] - 3s 93ms/step - loss: 0.3313 - f1_score: 0.9303 - val_loss: 1.2794 - val_f1_score: 0.6701
Epoch 223/500
28/28 [=====] - 3s 93ms/step - loss: 0.3572 - f1_score: 0.9216 - val_loss: 1.2798 - val_f1_score: 0.6859
Epoch 224/500
28/28 [=====] - 3s 93ms/step - loss: 0.3424 - f1_score: 0.9338 - val_loss: 1.2998 - val_f1_score: 0.6964
Epoch 225/500
28/28 [=====] - 3s 94ms/step - loss: 0.3262 - f1_score: 0.9269 - val_loss: 1.2846 - val_f1_score: 0.6973
Epoch 226/500
28/28 [=====] - 3s 95ms/step - loss: 0.3286 - f1_score: 0.9303 - val_loss: 1.2512 - val_f1_score: 0.6815
Epoch 227/500
28/28 [=====] - 3s 99ms/step - loss: 0.3356 - f1_score: 0.9268 - val_loss: 1.2612 - val_f1_score: 0.6933
Epoch 228/500
28/28 [=====] - 3s 95ms/step - loss: 0.3243 - f1_score: 0.9292 - val_loss: 1.3011 - val_f1_score: 0.6954
Epoch 229/500
28/28 [=====] - 3s 94ms/step - loss: 0.3242 - f1_score: 0.9298 - val_loss: 1.1996 - val_f1_score: 0.7128
Epoch 230/500
28/28 [=====] - 3s 96ms/step - loss: 0.3244 - f1_score: 0.9292 - val_loss: 1.2931 - val_f1_score: 0.6972
Epoch 231/500
28/28 [=====] - 3s 95ms/step - loss: 0.3142 - f1_score: 0.9373 - val_loss: 1.2085 - val_f1_score: 0.7004
Epoch 232/500
28/28 [=====] - 3s 94ms/step - loss: 0.3110 - f1_score: 0.9287 - val_loss: 1.2193 - val_f1_score: 0.7007
Epoch 233/500
28/28 [=====] - 3s 94ms/step - loss: 0.3446 - f1_score: 0.9206 - val_loss: 1.2071 - val_f1_score: 0.6831
Epoch 234/500
28/28 [=====] - 3s 97ms/step - loss: 0.3134 - f1_score: 0.9337 - val_loss: 1.2415 - val_f1_score: 0.7194
Epoch 235/500
28/28 [=====] - 3s 105ms/step - loss: 0.3108 - f1_score: 0.9259 - val_loss: 1.2815 - val_f1_score: 0.6928
Epoch 236/500
```

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28/28 [=====] - 3s 94ms/step - loss: 0.3153 - f1_score: 0.9344 - val_loss: 1.1923 - val_f1_score: 0.7026
Epoch 237/500
28/28 [=====] - 3s 95ms/step - loss: 0.3082 - f1_score: 0.9319 - val_loss: 1.3705 - val_f1_score: 0.6780
Epoch 238/500
28/28 [=====] - 3s 94ms/step - loss: 0.3036 - f1_score: 0.9328 - val_loss: 1.3112 - val_f1_score: 0.6754
Epoch 239/500
28/28 [=====] - 3s 97ms/step - loss: 0.2977 - f1_score: 0.9394 - val_loss: 1.2967 - val_f1_score: 0.6909
Epoch 240/500
28/28 [=====] - 3s 95ms/step - loss: 0.3026 - f1_score: 0.9341 - val_loss: 1.2092 - val_f1_score: 0.6965
Epoch 241/500
28/28 [=====] - 3s 95ms/step - loss: 0.2968 - f1_score: 0.9357 - val_loss: 1.2971 - val_f1_score: 0.6854
Epoch 242/500
28/28 [=====] - 3s 95ms/step - loss: 0.2867 - f1_score: 0.9459 - val_loss: 1.3936 - val_f1_score: 0.6921
Epoch 243/500
28/28 [=====] - 3s 95ms/step - loss: 0.3054 - f1_score: 0.9319 - val_loss: 1.3235 - val_f1_score: 0.6748
Epoch 244/500
28/28 [=====] - 3s 95ms/step - loss: 0.3100 - f1_score: 0.9305 - val_loss: 1.2562 - val_f1_score: 0.7159
Epoch 245/500
28/28 [=====] - 3s 96ms/step - loss: 0.3088 - f1_score: 0.9313 - val_loss: 1.3351 - val_f1_score: 0.6989
Epoch 246/500
28/28 [=====] - 3s 95ms/step - loss: 0.3143 - f1_score: 0.9291 - val_loss: 1.2169 - val_f1_score: 0.7127
Epoch 247/500
28/28 [=====] - 3s 95ms/step - loss: 0.2824 - f1_score: 0.9439 - val_loss: 1.3767 - val_f1_score: 0.6873
Epoch 248/500
28/28 [=====] - 3s 95ms/step - loss: 0.3068 - f1_score: 0.9295 - val_loss: 1.2207 - val_f1_score: 0.6949
Epoch 249/500
28/28 [=====] - 3s 96ms/step - loss: 0.2892 - f1_score: 0.9375 - val_loss: 1.2794 - val_f1_score: 0.7063
Epoch 250/500
28/28 [=====] - 3s 94ms/step - loss: 0.2782 - f1_score: 0.9417 - val_loss: 1.2592 - val_f1_score: 0.6801
Epoch 251/500
28/28 [=====] - 3s 97ms/step - loss: 0.2793 - f1_score: 0.9398 - val_loss: 1.2147 - val_f1_score: 0.6811
Epoch 252/500
```

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28/28 [=====] - 3s 96ms/step - loss: 0.2736 - f1_score: 0.9449 - val_loss: 1.1893 - val_f1_score: 0.6887
Epoch 253/500
28/28 [=====] - 3s 97ms/step - loss: 0.2737 - f1_score: 0.9439 - val_loss: 1.3267 - val_f1_score: 0.6983
Epoch 254/500
28/28 [=====] - 3s 95ms/step - loss: 0.2744 - f1_score: 0.9414 - val_loss: 1.2257 - val_f1_score: 0.7007
Epoch 255/500
28/28 [=====] - 3s 95ms/step - loss: 0.2734 - f1_score: 0.9399 - val_loss: 1.3911 - val_f1_score: 0.6942
Epoch 256/500
28/28 [=====] - 3s 95ms/step - loss: 0.2803 - f1_score: 0.9376 - val_loss: 1.3236 - val_f1_score: 0.6985
Epoch 257/500
28/28 [=====] - 3s 101ms/step - loss: 0.2548 - f1_score: 0.9500 - val_loss: 1.3345 - val_f1_score: 0.6795
Epoch 258/500
28/28 [=====] - 3s 95ms/step - loss: 0.2643 - f1_score: 0.9473 - val_loss: 1.2355 - val_f1_score: 0.6986
Epoch 259/500
28/28 [=====] - 3s 95ms/step - loss: 0.2726 - f1_score: 0.9430 - val_loss: 1.2404 - val_f1_score: 0.6948
Epoch 260/500
28/28 [=====] - 3s 94ms/step - loss: 0.2572 - f1_score: 0.9509 - val_loss: 1.2078 - val_f1_score: 0.7106
Epoch 261/500
28/28 [=====] - 3s 97ms/step - loss: 0.2635 - f1_score: 0.9445 - val_loss: 1.2970 - val_f1_score: 0.7036
Epoch 262/500
28/28 [=====] - 3s 94ms/step - loss: 0.2545 - f1_score: 0.9457 - val_loss: 1.2702 - val_f1_score: 0.7057
Epoch 263/500
28/28 [=====] - 3s 95ms/step - loss: 0.2520 - f1_score: 0.9499 - val_loss: 1.2631 - val_f1_score: 0.6949
Epoch 264/500
28/28 [=====] - 3s 95ms/step - loss: 0.2609 - f1_score: 0.9460 - val_loss: 1.2538 - val_f1_score: 0.6887
Epoch 265/500
28/28 [=====] - 3s 95ms/step - loss: 0.2466 - f1_score: 0.9550 - val_loss: 1.3061 - val_f1_score: 0.7140
Epoch 266/500
28/28 [=====] - 3s 96ms/step - loss: 0.2491 - f1_score: 0.9508 - val_loss: 1.2134 - val_f1_score: 0.7055
Epoch 267/500
28/28 [=====] - 3s 95ms/step - loss: 0.2424 - f1_score: 0.9547 - val_loss: 1.2472 - val_f1_score: 0.7009
Epoch 268/500
```

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28/28 [=====] - 3s 96ms/step - loss: 0.2491 - f1_score: 0.9501 - val_loss: 1.2901 - val_f1_score: 0.6956
Epoch 269/500
28/28 [=====] - 3s 95ms/step - loss: 0.2663 - f1_score: 0.9405 - val_loss: 1.3050 - val_f1_score: 0.6921
Epoch 270/500
28/28 [=====] - 3s 95ms/step - loss: 0.2634 - f1_score: 0.9459 - val_loss: 1.1893 - val_f1_score: 0.7148
Epoch 271/500
28/28 [=====] - 3s 95ms/step - loss: 0.2639 - f1_score: 0.9424 - val_loss: 1.3301 - val_f1_score: 0.6836
Epoch 272/500
28/28 [=====] - 3s 95ms/step - loss: 0.2529 - f1_score: 0.9470 - val_loss: 1.3303 - val_f1_score: 0.6844
Epoch 273/500
28/28 [=====] - 3s 95ms/step - loss: 0.2462 - f1_score: 0.9487 - val_loss: 1.2829 - val_f1_score: 0.6874
Epoch 274/500
28/28 [=====] - 3s 94ms/step - loss: 0.2449 - f1_score: 0.9557 - val_loss: 1.2268 - val_f1_score: 0.6879
Epoch 275/500
28/28 [=====] - 3s 98ms/step - loss: 0.2506 - f1_score: 0.9497 - val_loss: 1.2943 - val_f1_score: 0.6792
Epoch 276/500
28/28 [=====] - 3s 95ms/step - loss: 0.2470 - f1_score: 0.9533 - val_loss: 1.3132 - val_f1_score: 0.6921
Epoch 277/500
28/28 [=====] - 3s 95ms/step - loss: 0.2423 - f1_score: 0.9473 - val_loss: 1.3025 - val_f1_score: 0.6967
Epoch 278/500
28/28 [=====] - 3s 96ms/step - loss: 0.2147 - f1_score: 0.9652 - val_loss: 1.3122 - val_f1_score: 0.6907
Epoch 279/500
28/28 [=====] - ETA: 0s - loss: 0.2329 - f1_score: 0.9566
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 446ms/step - loss: 0.2329 - f1_score: 0.9566 - val_loss: 1.2660 - val_f1_score: 0.7200
Epoch 280/500
28/28 [=====] - 3s 90ms/step - loss: 0.2422 - f1_score: 0.9517 - val_loss: 1.2263 - val_f1_score: 0.6937
```

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Epoch 281/500
28/28 [=====] - 3s 92ms/step - loss: 0.2319 - f1_score: 0.9561 - val_loss: 1.2663 - val_f1_score: 0.6939
Epoch 282/500
28/28 [=====] - 3s 93ms/step - loss: 0.2394 - f1_score: 0.9568 - val_loss: 1.3473 - val_f1_score: 0.6748
Epoch 283/500
28/28 [=====] - 3s 93ms/step - loss: 0.2244 - f1_score: 0.9585 - val_loss: 1.2969 - val_f1_score: 0.6813
Epoch 284/500
28/28 [=====] - 3s 94ms/step - loss: 0.2228 - f1_score: 0.9562 - val_loss: 1.3196 - val_f1_score: 0.7114
Epoch 285/500
28/28 [=====] - 3s 93ms/step - loss: 0.2195 - f1_score: 0.9630 - val_loss: 1.2423 - val_f1_score: 0.6899
Epoch 286/500
28/28 [=====] - 3s 93ms/step - loss: 0.2241 - f1_score: 0.9594 - val_loss: 1.3090 - val_f1_score: 0.6911
Epoch 287/500
28/28 [=====] - 3s 98ms/step - loss: 0.2060 - f1_score: 0.9661 - val_loss: 1.3225 - val_f1_score: 0.6975
Epoch 288/500
28/28 [=====] - 3s 94ms/step - loss: 0.2065 - f1_score: 0.9679 - val_loss: 1.4396 - val_f1_score: 0.6786
Epoch 289/500
28/28 [=====] - 3s 94ms/step - loss: 0.2332 - f1_score: 0.9489 - val_loss: 1.4505 - val_f1_score: 0.6757
Epoch 290/500
28/28 [=====] - 3s 95ms/step - loss: 0.2318 - f1_score: 0.9516 - val_loss: 1.2742 - val_f1_score: 0.6855
Epoch 291/500
28/28 [=====] - 3s 96ms/step - loss: 0.2204 - f1_score: 0.9552 - val_loss: 1.2362 - val_f1_score: 0.6955
Epoch 292/500
28/28 [=====] - 3s 95ms/step - loss: 0.2057 - f1_score: 0.9641 - val_loss: 1.2749 - val_f1_score: 0.7098
Epoch 293/500
28/28 [=====] - 3s 95ms/step - loss: 0.2188 - f1_score: 0.9579 - val_loss: 1.3209 - val_f1_score: 0.6928
Epoch 294/500
28/28 [=====] - 3s 96ms/step - loss: 0.2131 - f1_score: 0.9575 - val_loss: 1.3139 - val_f1_score: 0.6782
Epoch 295/500
28/28 [=====] - 3s 94ms/step - loss: 0.2068 - f1_score: 0.9622 - val_loss: 1.3121 - val_f1_score: 0.6886
Epoch 296/500
28/28 [=====] - 3s 94ms/step - loss: 0.2141 - f1_score: 0.9569 - val_loss: 1.2959 - val_f1_score: 0.6879
```

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Epoch 297/500
28/28 [=====] - 3s 97ms/step - loss: 0.2087 - f1_score: 0.9607 - val_loss: 1.3344 - val_f1_score: 0.6899
Epoch 298/500
28/28 [=====] - ETA: 0s - loss: 0.2068 - f1_score: 0.9637

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 13s 491ms/step - loss: 0.2068 - f1_score: 0.9637 - val_loss: 1.2902 - val_f1_score: 0.7221
Epoch 299/500
28/28 [=====] - 3s 91ms/step - loss: 0.2179 - f1_score: 0.9555 - val_loss: 1.3079 - val_f1_score: 0.7013
Epoch 300/500
28/28 [=====] - 3s 91ms/step - loss: 0.1997 - f1_score: 0.9630 - val_loss: 1.2687 - val_f1_score: 0.7048
Epoch 301/500
28/28 [=====] - 3s 94ms/step - loss: 0.2038 - f1_score: 0.9643 - val_loss: 1.2542 - val_f1_score: 0.7019
Epoch 302/500
28/28 [=====] - 3s 96ms/step - loss: 0.2223 - f1_score: 0.9527 - val_loss: 1.3220 - val_f1_score: 0.6866
Epoch 303/500
28/28 [=====] - 3s 93ms/step - loss: 0.2091 - f1_score: 0.9573 - val_loss: 1.3135 - val_f1_score: 0.6984
Epoch 304/500
28/28 [=====] - 3s 92ms/step - loss: 0.1910 - f1_score: 0.9612 - val_loss: 1.3926 - val_f1_score: 0.6915
Epoch 305/500
28/28 [=====] - 3s 93ms/step - loss: 0.2122 - f1_score: 0.9569 - val_loss: 1.3375 - val_f1_score: 0.7065
Epoch 306/500
28/28 [=====] - 3s 94ms/step - loss: 0.2030 - f1_score: 0.9610 - val_loss: 1.2785 - val_f1_score: 0.7123
Epoch 307/500
28/28 [=====] - 3s 94ms/step - loss: 0.2154 - f1_score: 0.9615 - val_loss: 1.3654 - val_f1_score: 0.7117
Epoch 308/500
28/28 [=====] - 3s 94ms/step - loss: 0.2174 - f1_score: 0.9539 - val_loss: 1.3136 - val_f1_score: 0.6936
Epoch 309/500
28/28 [=====] - 3s 94ms/step - loss: 0.2018 - f1_score:
```

```
0.9620 - val_loss: 1.3549 - val_f1_score: 0.6860
Epoch 310/500
28/28 [=====] - 3s 95ms/step - loss: 0.1985 - f1_score:
0.9603 - val_loss: 1.2633 - val_f1_score: 0.7148
Epoch 311/500
28/28 [=====] - 3s 95ms/step - loss: 0.1887 - f1_score:
0.9673 - val_loss: 1.4667 - val_f1_score: 0.6710
Epoch 312/500
28/28 [=====] - 3s 98ms/step - loss: 0.1925 - f1_score:
0.9627 - val_loss: 1.2752 - val_f1_score: 0.6854
Epoch 313/500
28/28 [=====] - 3s 94ms/step - loss: 0.1913 - f1_score:
0.9672 - val_loss: 1.3848 - val_f1_score: 0.7004
Epoch 314/500
28/28 [=====] - 3s 95ms/step - loss: 0.1891 - f1_score:
0.9653 - val_loss: 1.3349 - val_f1_score: 0.6782
Epoch 315/500
28/28 [=====] - 3s 94ms/step - loss: 0.1961 - f1_score:
0.9589 - val_loss: 1.3080 - val_f1_score: 0.6904
Epoch 316/500
28/28 [=====] - 3s 95ms/step - loss: 0.1933 - f1_score:
0.9613 - val_loss: 1.4106 - val_f1_score: 0.6632
Epoch 317/500
28/28 [=====] - 3s 94ms/step - loss: 0.1931 - f1_score:
0.9638 - val_loss: 1.2973 - val_f1_score: 0.7061
Epoch 318/500
28/28 [=====] - 3s 94ms/step - loss: 0.1887 - f1_score:
0.9641 - val_loss: 1.4049 - val_f1_score: 0.6872
Epoch 319/500
28/28 [=====] - 3s 96ms/step - loss: 0.1965 - f1_score:
0.9637 - val_loss: 1.3961 - val_f1_score: 0.6884
Epoch 320/500
28/28 [=====] - 3s 95ms/step - loss: 0.2153 - f1_score:
0.9522 - val_loss: 1.4086 - val_f1_score: 0.6631
Epoch 321/500
28/28 [=====] - 3s 95ms/step - loss: 0.1858 - f1_score:
0.9646 - val_loss: 1.3748 - val_f1_score: 0.7213
Epoch 322/500
28/28 [=====] - 3s 94ms/step - loss: 0.1813 - f1_score:
0.9682 - val_loss: 1.3668 - val_f1_score: 0.7052
Epoch 323/500
28/28 [=====] - 3s 95ms/step - loss: 0.2019 - f1_score:
0.9571 - val_loss: 1.4496 - val_f1_score: 0.7002
Epoch 324/500
28/28 [=====] - 3s 95ms/step - loss: 0.1960 - f1_score:
0.9641 - val_loss: 1.2851 - val_f1_score: 0.7052
Epoch 325/500
28/28 [=====] - 3s 95ms/step - loss: 0.1814 - f1_score:
```

```
0.9699 - val_loss: 1.4904 - val_f1_score: 0.6593
Epoch 326/500
28/28 [=====] - 3s 94ms/step - loss: 0.1963 - f1_score: 0.9618 - val_loss: 1.3804 - val_f1_score: 0.6909
Epoch 327/500
28/28 [=====] - 3s 94ms/step - loss: 0.1753 - f1_score: 0.9691 - val_loss: 1.4389 - val_f1_score: 0.6927
Epoch 328/500
28/28 [=====] - 3s 94ms/step - loss: 0.1847 - f1_score: 0.9600 - val_loss: 1.3171 - val_f1_score: 0.6933
Epoch 329/500
28/28 [=====] - 3s 95ms/step - loss: 0.1675 - f1_score: 0.9680 - val_loss: 1.3708 - val_f1_score: 0.7049
Epoch 330/500
28/28 [=====] - 3s 104ms/step - loss: 0.1822 - f1_score: 0.9652 - val_loss: 1.3887 - val_f1_score: 0.7020
Epoch 331/500
28/28 [=====] - 3s 98ms/step - loss: 0.1699 - f1_score: 0.9726 - val_loss: 1.4167 - val_f1_score: 0.6970
Epoch 332/500
28/28 [=====] - 3s 96ms/step - loss: 0.1877 - f1_score: 0.9605 - val_loss: 1.3780 - val_f1_score: 0.6755
Epoch 333/500
28/28 [=====] - 3s 96ms/step - loss: 0.1719 - f1_score: 0.9721 - val_loss: 1.2847 - val_f1_score: 0.7075
Epoch 334/500
28/28 [=====] - 3s 96ms/step - loss: 0.1668 - f1_score: 0.9716 - val_loss: 1.3442 - val_f1_score: 0.6976
Epoch 335/500
28/28 [=====] - 3s 96ms/step - loss: 0.1806 - f1_score: 0.9678 - val_loss: 1.4491 - val_f1_score: 0.6898
Epoch 336/500
28/28 [=====] - 3s 95ms/step - loss: 0.1675 - f1_score: 0.9694 - val_loss: 1.4204 - val_f1_score: 0.6987
Epoch 337/500
28/28 [=====] - 3s 95ms/step - loss: 0.1756 - f1_score: 0.9667 - val_loss: 1.4460 - val_f1_score: 0.6903
Epoch 338/500
28/28 [=====] - 3s 95ms/step - loss: 0.1704 - f1_score: 0.9702 - val_loss: 1.2708 - val_f1_score: 0.7132
Epoch 339/500
28/28 [=====] - 3s 95ms/step - loss: 0.1620 - f1_score: 0.9722 - val_loss: 1.3369 - val_f1_score: 0.6993
Epoch 340/500
28/28 [=====] - 3s 96ms/step - loss: 0.1587 - f1_score: 0.9753 - val_loss: 1.3537 - val_f1_score: 0.7037
Epoch 341/500
28/28 [=====] - 3s 96ms/step - loss: 0.1638 - f1_score:
```

```
0.9702 - val_loss: 1.4101 - val_f1_score: 0.6705
Epoch 342/500
28/28 [=====] - 3s 95ms/step - loss: 0.1744 - f1_score: 0.9644 - val_loss: 1.4952 - val_f1_score: 0.6831
Epoch 343/500
28/28 [=====] - 3s 95ms/step - loss: 0.1733 - f1_score: 0.9704 - val_loss: 1.3709 - val_f1_score: 0.6943
Epoch 344/500
28/28 [=====] - 3s 95ms/step - loss: 0.1633 - f1_score: 0.9738 - val_loss: 1.3394 - val_f1_score: 0.6944
Epoch 345/500
28/28 [=====] - 3s 95ms/step - loss: 0.1759 - f1_score: 0.9640 - val_loss: 1.4071 - val_f1_score: 0.6897
Epoch 346/500
28/28 [=====] - 3s 95ms/step - loss: 0.1579 - f1_score: 0.9749 - val_loss: 1.3730 - val_f1_score: 0.7067
Epoch 347/500
28/28 [=====] - 3s 98ms/step - loss: 0.1553 - f1_score: 0.9779 - val_loss: 1.4196 - val_f1_score: 0.6827
Epoch 348/500
28/28 [=====] - 3s 95ms/step - loss: 0.1704 - f1_score: 0.9666 - val_loss: 1.5088 - val_f1_score: 0.6574
Epoch 349/500
28/28 [=====] - 3s 97ms/step - loss: 0.1685 - f1_score: 0.9689 - val_loss: 1.3233 - val_f1_score: 0.7097
Epoch 350/500
28/28 [=====] - 3s 95ms/step - loss: 0.1627 - f1_score: 0.9675 - val_loss: 1.4864 - val_f1_score: 0.6554
Epoch 351/500
28/28 [=====] - 3s 95ms/step - loss: 0.1416 - f1_score: 0.9805 - val_loss: 1.3712 - val_f1_score: 0.7004
Epoch 352/500
28/28 [=====] - 3s 95ms/step - loss: 0.1503 - f1_score: 0.9782 - val_loss: 1.3309 - val_f1_score: 0.7051
Epoch 353/500
28/28 [=====] - 3s 94ms/step - loss: 0.1629 - f1_score: 0.9688 - val_loss: 1.3821 - val_f1_score: 0.6877
Epoch 354/500
28/28 [=====] - 3s 95ms/step - loss: 0.1598 - f1_score: 0.9689 - val_loss: 1.3990 - val_f1_score: 0.7209
Epoch 355/500
28/28 [=====] - 3s 95ms/step - loss: 0.1686 - f1_score: 0.9653 - val_loss: 1.4924 - val_f1_score: 0.6837
Epoch 356/500
28/28 [=====] - 3s 94ms/step - loss: 0.1696 - f1_score: 0.9633 - val_loss: 1.4205 - val_f1_score: 0.7023
Epoch 357/500
28/28 [=====] - 3s 97ms/step - loss: 0.1626 - f1_score:
```

```
0.9708 - val_loss: 1.4655 - val_f1_score: 0.6678
Epoch 358/500
28/28 [=====] - 3s 95ms/step - loss: 0.1720 - f1_score:
0.9662 - val_loss: 1.4072 - val_f1_score: 0.6854
Epoch 359/500
28/28 [=====] - 3s 95ms/step - loss: 0.1569 - f1_score:
0.9746 - val_loss: 1.3902 - val_f1_score: 0.6970
Epoch 360/500
28/28 [=====] - 3s 95ms/step - loss: 0.1481 - f1_score:
0.9758 - val_loss: 1.3546 - val_f1_score: 0.7144
Epoch 361/500
28/28 [=====] - 3s 95ms/step - loss: 0.1715 - f1_score:
0.9630 - val_loss: 1.3423 - val_f1_score: 0.7101
Epoch 362/500
28/28 [=====] - 3s 98ms/step - loss: 0.1556 - f1_score:
0.9703 - val_loss: 1.3423 - val_f1_score: 0.6974
Epoch 363/500
28/28 [=====] - 3s 96ms/step - loss: 0.1682 - f1_score:
0.9704 - val_loss: 1.3906 - val_f1_score: 0.6838
Epoch 364/500
28/28 [=====] - 3s 95ms/step - loss: 0.1483 - f1_score:
0.9753 - val_loss: 1.3978 - val_f1_score: 0.6813
Epoch 365/500
28/28 [=====] - 3s 95ms/step - loss: 0.1469 - f1_score:
0.9761 - val_loss: 1.4029 - val_f1_score: 0.6813
Epoch 366/500
28/28 [=====] - 3s 95ms/step - loss: 0.1550 - f1_score:
0.9714 - val_loss: 1.3658 - val_f1_score: 0.6871
Epoch 367/500
28/28 [=====] - 3s 95ms/step - loss: 0.1652 - f1_score:
0.9683 - val_loss: 1.3367 - val_f1_score: 0.7069
Epoch 368/500
28/28 [=====] - 3s 95ms/step - loss: 0.1507 - f1_score:
0.9769 - val_loss: 1.4124 - val_f1_score: 0.6827
Epoch 369/500
28/28 [=====] - 3s 94ms/step - loss: 0.1538 - f1_score:
0.9721 - val_loss: 1.3301 - val_f1_score: 0.7037
Epoch 370/500
28/28 [=====] - 3s 95ms/step - loss: 0.1654 - f1_score:
0.9693 - val_loss: 1.3531 - val_f1_score: 0.7143
Epoch 371/500
28/28 [=====] - 3s 96ms/step - loss: 0.1426 - f1_score:
0.9773 - val_loss: 1.4464 - val_f1_score: 0.6743
Epoch 372/500
28/28 [=====] - 3s 95ms/step - loss: 0.1524 - f1_score:
0.9728 - val_loss: 1.5404 - val_f1_score: 0.6654
Epoch 373/500
28/28 [=====] - 3s 96ms/step - loss: 0.1452 - f1_score:
```

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0.9744 - val_loss: 1.4790 - val_f1_score: 0.7090
Epoch 374/500
28/28 [=====] - 3s 95ms/step - loss: 0.1422 - f1_score:
0.9746 - val_loss: 1.4643 - val_f1_score: 0.6972
Epoch 375/500
28/28 [=====] - 3s 95ms/step - loss: 0.1443 - f1_score:
0.9793 - val_loss: 1.2918 - val_f1_score: 0.7077
Epoch 376/500
28/28 [=====] - 3s 96ms/step - loss: 0.1318 - f1_score:
0.9855 - val_loss: 1.3820 - val_f1_score: 0.6975
Epoch 377/500
28/28 [=====] - 3s 98ms/step - loss: 0.1374 - f1_score:
0.9777 - val_loss: 1.3790 - val_f1_score: 0.6917
Epoch 378/500
28/28 [=====] - 3s 98ms/step - loss: 0.1368 - f1_score:
0.9775 - val_loss: 1.3751 - val_f1_score: 0.6915
Epoch 379/500
28/28 [=====] - 3s 95ms/step - loss: 0.1614 - f1_score:
0.9647 - val_loss: 1.4241 - val_f1_score: 0.6784
Epoch 380/500
28/28 [=====] - 3s 97ms/step - loss: 0.1469 - f1_score:
0.9708 - val_loss: 1.3889 - val_f1_score: 0.6986
Epoch 381/500
28/28 [=====] - 3s 95ms/step - loss: 0.1384 - f1_score:
0.9786 - val_loss: 1.4160 - val_f1_score: 0.6928
Epoch 382/500
28/28 [=====] - 3s 95ms/step - loss: 0.1527 - f1_score:
0.9743 - val_loss: 1.4753 - val_f1_score: 0.6838
Epoch 383/500
28/28 [=====] - 3s 95ms/step - loss: 0.1423 - f1_score:
0.9720 - val_loss: 1.3607 - val_f1_score: 0.7110
Epoch 384/500
28/28 [=====] - 3s 95ms/step - loss: 0.1447 - f1_score:
0.9741 - val_loss: 1.3373 - val_f1_score: 0.6881
Epoch 385/500
28/28 [=====] - 3s 96ms/step - loss: 0.1341 - f1_score:
0.9816 - val_loss: 1.4773 - val_f1_score: 0.6941
Epoch 386/500
28/28 [=====] - 3s 94ms/step - loss: 0.1399 - f1_score:
0.9743 - val_loss: 1.4568 - val_f1_score: 0.6928
Epoch 387/500
28/28 [=====] - 3s 95ms/step - loss: 0.1509 - f1_score:
0.9703 - val_loss: 1.4475 - val_f1_score: 0.6845
Epoch 388/500
28/28 [=====] - 3s 97ms/step - loss: 0.1436 - f1_score:
0.9732 - val_loss: 1.3967 - val_f1_score: 0.6908
Epoch 389/500
28/28 [=====] - 3s 95ms/step - loss: 0.1313 - f1_score:
```

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0.9798 - val_loss: 1.3769 - val_f1_score: 0.6874
Epoch 390/500
28/28 [=====] - 3s 95ms/step - loss: 0.1337 - f1_score: 0.9784 - val_loss: 1.3676 - val_f1_score: 0.6881
Epoch 391/500
28/28 [=====] - 3s 95ms/step - loss: 0.1315 - f1_score: 0.9784 - val_loss: 1.4087 - val_f1_score: 0.6761
Epoch 392/500
28/28 [=====] - 3s 95ms/step - loss: 0.1343 - f1_score: 0.9767 - val_loss: 1.4603 - val_f1_score: 0.6755
Epoch 393/500
28/28 [=====] - 3s 96ms/step - loss: 0.1354 - f1_score: 0.9747 - val_loss: 1.4215 - val_f1_score: 0.7002
Epoch 394/500
28/28 [=====] - 3s 96ms/step - loss: 0.1489 - f1_score: 0.9733 - val_loss: 1.5060 - val_f1_score: 0.6782
Epoch 395/500
28/28 [=====] - 3s 96ms/step - loss: 0.1428 - f1_score: 0.9733 - val_loss: 1.3972 - val_f1_score: 0.7019
Epoch 396/500
28/28 [=====] - 3s 95ms/step - loss: 0.1392 - f1_score: 0.9737 - val_loss: 1.4942 - val_f1_score: 0.7158
Epoch 397/500
28/28 [=====] - 3s 95ms/step - loss: 0.1312 - f1_score: 0.9805 - val_loss: 1.4702 - val_f1_score: 0.7108
Epoch 398/500
28/28 [=====] - 3s 97ms/step - loss: 0.1275 - f1_score: 0.9802 - val_loss: 1.5954 - val_f1_score: 0.6692
Epoch 399/500
28/28 [=====] - 3s 95ms/step - loss: 0.1288 - f1_score: 0.9792 - val_loss: 1.4508 - val_f1_score: 0.6987
Epoch 400/500
28/28 [=====] - 3s 95ms/step - loss: 0.1293 - f1_score: 0.9796 - val_loss: 1.4796 - val_f1_score: 0.6843
Epoch 401/500
28/28 [=====] - 3s 96ms/step - loss: 0.1235 - f1_score: 0.9795 - val_loss: 1.4111 - val_f1_score: 0.6673
Epoch 402/500
28/28 [=====] - 3s 95ms/step - loss: 0.1311 - f1_score: 0.9770 - val_loss: 1.5382 - val_f1_score: 0.6513
Epoch 403/500
28/28 [=====] - 3s 97ms/step - loss: 0.1403 - f1_score: 0.9744 - val_loss: 1.4620 - val_f1_score: 0.6745
Epoch 404/500
28/28 [=====] - 3s 95ms/step - loss: 0.1333 - f1_score: 0.9756 - val_loss: 1.3664 - val_f1_score: 0.6882
Epoch 405/500
28/28 [=====] - 3s 97ms/step - loss: 0.1261 - f1_score:
```

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0.9799 - val_loss: 1.3474 - val_f1_score: 0.6930
Epoch 406/500
28/28 [=====] - 3s 95ms/step - loss: 0.1227 - f1_score:
0.9813 - val_loss: 1.4571 - val_f1_score: 0.6917
Epoch 407/500
28/28 [=====] - 3s 95ms/step - loss: 0.1123 - f1_score:
0.9845 - val_loss: 1.5380 - val_f1_score: 0.6783
Epoch 408/500
28/28 [=====] - 3s 96ms/step - loss: 0.1428 - f1_score:
0.9729 - val_loss: 1.4586 - val_f1_score: 0.6938
Epoch 409/500
28/28 [=====] - 3s 95ms/step - loss: 0.1258 - f1_score:
0.9815 - val_loss: 1.3434 - val_f1_score: 0.7100
Epoch 410/500
28/28 [=====] - 3s 97ms/step - loss: 0.1175 - f1_score:
0.9859 - val_loss: 1.5155 - val_f1_score: 0.6843
Epoch 411/500
28/28 [=====] - 3s 96ms/step - loss: 0.1316 - f1_score:
0.9775 - val_loss: 1.3849 - val_f1_score: 0.6871
Epoch 412/500
28/28 [=====] - 3s 94ms/step - loss: 0.1290 - f1_score:
0.9771 - val_loss: 1.3883 - val_f1_score: 0.7055
Epoch 413/500
28/28 [=====] - 3s 95ms/step - loss: 0.1372 - f1_score:
0.9775 - val_loss: 1.4968 - val_f1_score: 0.6965
Epoch 414/500
28/28 [=====] - 3s 94ms/step - loss: 0.1325 - f1_score:
0.9764 - val_loss: 1.3472 - val_f1_score: 0.7055
Epoch 415/500
28/28 [=====] - 3s 94ms/step - loss: 0.1120 - f1_score:
0.9860 - val_loss: 1.4687 - val_f1_score: 0.6995
Epoch 416/500
28/28 [=====] - 3s 96ms/step - loss: 0.1259 - f1_score:
0.9790 - val_loss: 1.5681 - val_f1_score: 0.6827
Epoch 417/500
28/28 [=====] - 3s 94ms/step - loss: 0.1303 - f1_score:
0.9803 - val_loss: 1.3978 - val_f1_score: 0.6956
Epoch 418/500
28/28 [=====] - 3s 95ms/step - loss: 0.1152 - f1_score:
0.9807 - val_loss: 1.4110 - val_f1_score: 0.6902
Epoch 419/500
28/28 [=====] - 3s 96ms/step - loss: 0.1231 - f1_score:
0.9810 - val_loss: 1.4925 - val_f1_score: 0.6813
Epoch 420/500
28/28 [=====] - 3s 95ms/step - loss: 0.1138 - f1_score:
0.9832 - val_loss: 1.4873 - val_f1_score: 0.7003
Epoch 421/500
28/28 [=====] - 3s 97ms/step - loss: 0.1425 - f1_score:
```

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0.9743 - val_loss: 1.5047 - val_f1_score: 0.6783
Epoch 422/500
28/28 [=====] - 3s 95ms/step - loss: 0.1243 - f1_score: 0.9796 - val_loss: 1.4204 - val_f1_score: 0.7032
Epoch 423/500
28/28 [=====] - ETA: 0s - loss: 0.1173 - f1_score: 0.9825

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 13s 463ms/step - loss: 0.1173 - f1_score: 0.9825 - val_loss: 1.3709 - val_f1_score: 0.7228
Epoch 424/500
28/28 [=====] - 3s 91ms/step - loss: 0.1199 - f1_score: 0.9800 - val_loss: 1.4624 - val_f1_score: 0.7132
Epoch 425/500
28/28 [=====] - 3s 92ms/step - loss: 0.1350 - f1_score: 0.9733 - val_loss: 1.5554 - val_f1_score: 0.6786
Epoch 426/500
28/28 [=====] - 3s 92ms/step - loss: 0.1351 - f1_score: 0.9745 - val_loss: 1.4077 - val_f1_score: 0.6999
Epoch 427/500
28/28 [=====] - 3s 93ms/step - loss: 0.1112 - f1_score: 0.9836 - val_loss: 1.4783 - val_f1_score: 0.6813
Epoch 428/500
28/28 [=====] - 3s 94ms/step - loss: 0.1163 - f1_score: 0.9777 - val_loss: 1.4742 - val_f1_score: 0.6951
Epoch 429/500
28/28 [=====] - 3s 99ms/step - loss: 0.1242 - f1_score: 0.9789 - val_loss: 1.5131 - val_f1_score: 0.6874
Epoch 430/500
28/28 [=====] - 3s 94ms/step - loss: 0.1407 - f1_score: 0.9710 - val_loss: 1.4983 - val_f1_score: 0.6950
Epoch 431/500
28/28 [=====] - 3s 94ms/step - loss: 0.1225 - f1_score: 0.9782 - val_loss: 1.4176 - val_f1_score: 0.6893
Epoch 432/500
28/28 [=====] - 3s 94ms/step - loss: 0.1174 - f1_score: 0.9806 - val_loss: 1.4962 - val_f1_score: 0.6895
Epoch 433/500
28/28 [=====] - 3s 95ms/step - loss: 0.1224 - f1_score: 0.9795 - val_loss: 1.4614 - val_f1_score: 0.6989
Epoch 434/500
```

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28/28 [=====] - 3s 94ms/step - loss: 0.1199 - f1_score: 0.9825 - val_loss: 1.5126 - val_f1_score: 0.6890
Epoch 435/500
28/28 [=====] - 3s 95ms/step - loss: 0.1311 - f1_score: 0.9745 - val_loss: 1.5176 - val_f1_score: 0.6936
Epoch 436/500
28/28 [=====] - 3s 94ms/step - loss: 0.1217 - f1_score: 0.9787 - val_loss: 1.4542 - val_f1_score: 0.7107
Epoch 437/500
28/28 [=====] - 3s 96ms/step - loss: 0.1159 - f1_score: 0.9839 - val_loss: 1.5915 - val_f1_score: 0.6830
Epoch 438/500
28/28 [=====] - 3s 96ms/step - loss: 0.1144 - f1_score: 0.9799 - val_loss: 1.5450 - val_f1_score: 0.6811
Epoch 439/500
28/28 [=====] - 3s 95ms/step - loss: 0.1090 - f1_score: 0.9835 - val_loss: 1.4301 - val_f1_score: 0.7030
Epoch 440/500
28/28 [=====] - 3s 95ms/step - loss: 0.1218 - f1_score: 0.9805 - val_loss: 1.3647 - val_f1_score: 0.6970
Epoch 441/500
28/28 [=====] - 3s 94ms/step - loss: 0.1125 - f1_score: 0.9821 - val_loss: 1.4138 - val_f1_score: 0.6963
Epoch 442/500
28/28 [=====] - 3s 95ms/step - loss: 0.1101 - f1_score: 0.9867 - val_loss: 1.4338 - val_f1_score: 0.7052
Epoch 443/500
28/28 [=====] - 3s 96ms/step - loss: 0.1203 - f1_score: 0.9788 - val_loss: 1.6229 - val_f1_score: 0.6771
Epoch 444/500
28/28 [=====] - 3s 100ms/step - loss: 0.1373 - f1_score: 0.9715 - val_loss: 1.4928 - val_f1_score: 0.6863
Epoch 445/500
28/28 [=====] - 3s 95ms/step - loss: 0.1206 - f1_score: 0.9791 - val_loss: 1.6419 - val_f1_score: 0.6664
Epoch 446/500
28/28 [=====] - 3s 95ms/step - loss: 0.1442 - f1_score: 0.9735 - val_loss: 1.6403 - val_f1_score: 0.6692
Epoch 447/500
28/28 [=====] - 3s 95ms/step - loss: 0.1219 - f1_score: 0.9785 - val_loss: 1.4723 - val_f1_score: 0.6864
Epoch 448/500
28/28 [=====] - 3s 96ms/step - loss: 0.1128 - f1_score: 0.9820 - val_loss: 1.4107 - val_f1_score: 0.7016
Epoch 449/500
28/28 [=====] - 3s 95ms/step - loss: 0.1175 - f1_score: 0.9813 - val_loss: 1.4906 - val_f1_score: 0.6885
Epoch 450/500
```

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28/28 [=====] - 3s 95ms/step - loss: 0.1098 - f1_score: 0.9826 - val_loss: 1.4283 - val_f1_score: 0.6948
Epoch 451/500
28/28 [=====] - 3s 95ms/step - loss: 0.1006 - f1_score: 0.9872 - val_loss: 1.4851 - val_f1_score: 0.6801
Epoch 452/500
28/28 [=====] - 3s 95ms/step - loss: 0.1296 - f1_score: 0.9764 - val_loss: 1.4532 - val_f1_score: 0.7000
Epoch 453/500
28/28 [=====] - 3s 94ms/step - loss: 0.1054 - f1_score: 0.9855 - val_loss: 1.4520 - val_f1_score: 0.6896
Epoch 454/500
28/28 [=====] - 3s 95ms/step - loss: 0.1065 - f1_score: 0.9855 - val_loss: 1.4678 - val_f1_score: 0.6975
Epoch 455/500
28/28 [=====] - 3s 95ms/step - loss: 0.1040 - f1_score: 0.9867 - val_loss: 1.4822 - val_f1_score: 0.6929
Epoch 456/500
28/28 [=====] - 3s 96ms/step - loss: 0.1289 - f1_score: 0.9755 - val_loss: 1.4746 - val_f1_score: 0.7099
Epoch 457/500
28/28 [=====] - 3s 95ms/step - loss: 0.1104 - f1_score: 0.9800 - val_loss: 1.5294 - val_f1_score: 0.6932
Epoch 458/500
28/28 [=====] - 3s 95ms/step - loss: 0.1200 - f1_score: 0.9764 - val_loss: 1.5577 - val_f1_score: 0.6870
Epoch 459/500
28/28 [=====] - 3s 95ms/step - loss: 0.1146 - f1_score: 0.9821 - val_loss: 1.5689 - val_f1_score: 0.6938
Epoch 460/500
28/28 [=====] - 3s 95ms/step - loss: 0.1171 - f1_score: 0.9794 - val_loss: 1.5914 - val_f1_score: 0.6825
Epoch 461/500
28/28 [=====] - 3s 95ms/step - loss: 0.1091 - f1_score: 0.9831 - val_loss: 1.6246 - val_f1_score: 0.6972
Epoch 462/500
28/28 [=====] - 3s 95ms/step - loss: 0.1063 - f1_score: 0.9833 - val_loss: 1.4345 - val_f1_score: 0.7082
Epoch 463/500
28/28 [=====] - 3s 95ms/step - loss: 0.1180 - f1_score: 0.9767 - val_loss: 1.5041 - val_f1_score: 0.6800
Epoch 464/500
28/28 [=====] - 3s 95ms/step - loss: 0.1154 - f1_score: 0.9806 - val_loss: 1.6715 - val_f1_score: 0.6657
Epoch 465/500
28/28 [=====] - 3s 95ms/step - loss: 0.1142 - f1_score: 0.9834 - val_loss: 1.5010 - val_f1_score: 0.7041
Epoch 466/500
```

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28/28 [=====] - 3s 96ms/step - loss: 0.1070 - f1_score: 0.9799 - val_loss: 1.3789 - val_f1_score: 0.7056
Epoch 467/500
28/28 [=====] - 3s 95ms/step - loss: 0.1206 - f1_score: 0.9791 - val_loss: 1.5396 - val_f1_score: 0.6665
Epoch 468/500
28/28 [=====] - 3s 97ms/step - loss: 0.1159 - f1_score: 0.9808 - val_loss: 1.4223 - val_f1_score: 0.7134
Epoch 469/500
28/28 [=====] - 3s 96ms/step - loss: 0.1066 - f1_score: 0.9817 - val_loss: 1.4321 - val_f1_score: 0.6817
Epoch 470/500
28/28 [=====] - 3s 95ms/step - loss: 0.1152 - f1_score: 0.9796 - val_loss: 1.3746 - val_f1_score: 0.7108
Epoch 471/500
28/28 [=====] - 3s 96ms/step - loss: 0.1096 - f1_score: 0.9822 - val_loss: 1.5051 - val_f1_score: 0.7034
Epoch 472/500
28/28 [=====] - 3s 95ms/step - loss: 0.1026 - f1_score: 0.9821 - val_loss: 1.5210 - val_f1_score: 0.6762
Epoch 473/500
28/28 [=====] - 3s 95ms/step - loss: 0.1051 - f1_score: 0.9822 - val_loss: 1.5194 - val_f1_score: 0.7058
Epoch 474/500
28/28 [=====] - 3s 96ms/step - loss: 0.1102 - f1_score: 0.9834 - val_loss: 1.4778 - val_f1_score: 0.6711
Epoch 475/500
28/28 [=====] - ETA: 0s - loss: 0.1282 - f1_score: 0.9733
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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 457ms/step - loss: 0.1282 - f1_score: 0.9733 - val_loss: 1.3580 - val_f1_score: 0.7251
Epoch 476/500
28/28 [=====] - 3s 90ms/step - loss: 0.1215 - f1_score: 0.9776 - val_loss: 1.4365 - val_f1_score: 0.6920
Epoch 477/500
28/28 [=====] - 3s 92ms/step - loss: 0.1094 - f1_score: 0.9791 - val_loss: 1.5335 - val_f1_score: 0.7135
Epoch 478/500
28/28 [=====] - 3s 93ms/step - loss: 0.1170 - f1_score: 0.9787 - val_loss: 1.5715 - val_f1_score: 0.6794
```

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Epoch 479/500
28/28 [=====] - 3s 93ms/step - loss: 0.1015 - f1_score: 0.9862 - val_loss: 1.5042 - val_f1_score: 0.6992
Epoch 480/500
28/28 [=====] - 3s 93ms/step - loss: 0.1031 - f1_score: 0.9853 - val_loss: 1.5121 - val_f1_score: 0.6883
Epoch 481/500
28/28 [=====] - 3s 93ms/step - loss: 0.1071 - f1_score: 0.9814 - val_loss: 1.6943 - val_f1_score: 0.6786
Epoch 482/500
28/28 [=====] - 3s 93ms/step - loss: 0.1043 - f1_score: 0.9832 - val_loss: 1.5683 - val_f1_score: 0.6848
Epoch 483/500
28/28 [=====] - 3s 96ms/step - loss: 0.1094 - f1_score: 0.9812 - val_loss: 1.4615 - val_f1_score: 0.7005
Epoch 484/500
28/28 [=====] - 3s 95ms/step - loss: 0.1079 - f1_score: 0.9781 - val_loss: 1.4362 - val_f1_score: 0.6919
Epoch 485/500
28/28 [=====] - 3s 100ms/step - loss: 0.1156 - f1_score: 0.9808 - val_loss: 1.4688 - val_f1_score: 0.6926
Epoch 486/500
28/28 [=====] - 3s 94ms/step - loss: 0.1025 - f1_score: 0.9842 - val_loss: 1.6548 - val_f1_score: 0.6875
Epoch 487/500
28/28 [=====] - 3s 95ms/step - loss: 0.0958 - f1_score: 0.9857 - val_loss: 1.7151 - val_f1_score: 0.6958
Epoch 488/500
28/28 [=====] - 3s 94ms/step - loss: 0.1100 - f1_score: 0.9811 - val_loss: 1.5069 - val_f1_score: 0.6985
Epoch 489/500
28/28 [=====] - 3s 95ms/step - loss: 0.0968 - f1_score: 0.9835 - val_loss: 1.6047 - val_f1_score: 0.7011
Epoch 490/500
28/28 [=====] - 3s 97ms/step - loss: 0.0986 - f1_score: 0.9840 - val_loss: 1.5087 - val_f1_score: 0.6885
Epoch 491/500
28/28 [=====] - ETA: 0s - loss: 0.0996 - f1_score: 0.9818

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 1DCNN + 1 GRU/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets
28/28 [=====] - 12s 436ms/step - loss: 0.0996 -
```

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f1_score: 0.9818 - val_loss: 1.4032 - val_f1_score: 0.7278
Epoch 492/500
28/28 [=====] - ETA: 0s - loss: 0.0993 - f1_score: 0.9849

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 1DCNN + 1 GRU/assets

INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU/assets

28/28 [=====] - 11s 415ms/step - loss: 0.0993 -
f1_score: 0.9849 - val_loss: 1.4189 - val_f1_score: 0.7323
Epoch 493/500
28/28 [=====] - 3s 90ms/step - loss: 0.0978 - f1_score: 0.9872 - val_loss: 1.5138 - val_f1_score: 0.6905
Epoch 494/500
28/28 [=====] - 3s 91ms/step - loss: 0.0961 - f1_score: 0.9838 - val_loss: 1.4464 - val_f1_score: 0.6963
Epoch 495/500
28/28 [=====] - 3s 92ms/step - loss: 0.0973 - f1_score: 0.9850 - val_loss: 1.5624 - val_f1_score: 0.7017
Epoch 496/500
28/28 [=====] - 3s 92ms/step - loss: 0.0985 - f1_score: 0.9864 - val_loss: 1.6496 - val_f1_score: 0.6918
Epoch 497/500
28/28 [=====] - 3s 93ms/step - loss: 0.0959 - f1_score: 0.9869 - val_loss: 1.5582 - val_f1_score: 0.6952
Epoch 498/500
28/28 [=====] - 3s 92ms/step - loss: 0.1077 - f1_score: 0.9814 - val_loss: 1.4970 - val_f1_score: 0.7014
Epoch 499/500
28/28 [=====] - 3s 93ms/step - loss: 0.1238 - f1_score: 0.9743 - val_loss: 1.5731 - val_f1_score: 0.7005
Epoch 500/500
28/28 [=====] - 3s 93ms/step - loss: 0.1347 - f1_score: 0.9715 - val_loss: 1.5502 - val_f1_score: 0.6914

```

```
[139]: 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	1.000	1.000	8
BACKPACK	0.667	0.667	0.667	6
BASKETBALL	0.800	0.800	0.800	10
BEE	0.500	0.500	0.500	10
BELT	0.500	1.000	0.667	4
BITE	1.000	0.750	0.857	8
BREAKFAST	0.600	0.500	0.545	6
CANCER	0.778	0.875	0.824	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.500	0.167	0.250	6
DARK	0.800	1.000	0.889	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	0.667	0.333	0.444	6
DINNER	0.667	1.000	0.800	8
DOG	0.571	0.667	0.615	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	0.500	0.500	0.500	4
EAT	0.750	0.500	0.600	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.467	0.875	0.609	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	1.000	0.625	0.769	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	1.000	0.500	0.667	4
LOCK	0.600	0.750	0.667	8
LUNCH	0.857	0.750	0.800	8
MAPLE	1.000	0.500	0.667	4
MEAT	0.750	1.000	0.857	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.250	0.400	8
MOVIE	0.700	0.875	0.778	8
NOON	1.000	1.000	1.000	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.231	0.500	0.316	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.600	1.000	0.750	6
ROCKINGCHAIR	0.889	1.000	0.941	8
SHAVE	0.529	0.900	0.667	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.250	0.250	0.250	4
THEY	0.667	1.000	0.800	4

TWINS	0.857	0.750	0.800	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.710	324
macro avg	0.753	0.694	0.691	324
weighted avg	0.764	0.710	0.706	324

```
[140]: # 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)
```

```
[141]: hist_df = pd.read_csv('1 1DCNN + 1 GRU/history.csv', index_col=0)
hist_df.tail()
```

```
[141]:      loss  f1_score  val_loss  val_f1_score
495  0.098530  0.986375  1.649600      0.691757
496  0.095876  0.986925  1.558238      0.695197
497  0.107656  0.981361  1.496966      0.701357
498  0.123752  0.974290  1.573127      0.700450
499  0.134656  0.971496  1.550224      0.691417
```

```
[142]: # 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()

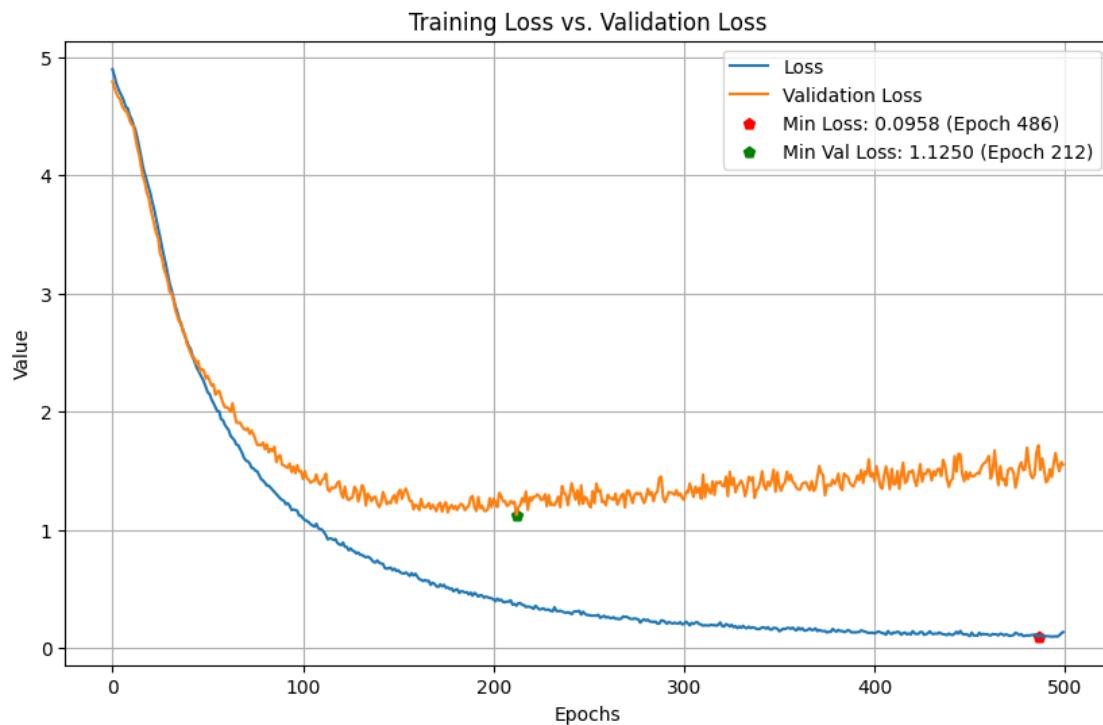
min_loss = hist_df['loss'][min_loss_epoch]
min_val_loss = hist_df['val_loss'][min_val_loss_epoch]

# 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()

```



```

[143]: # 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',

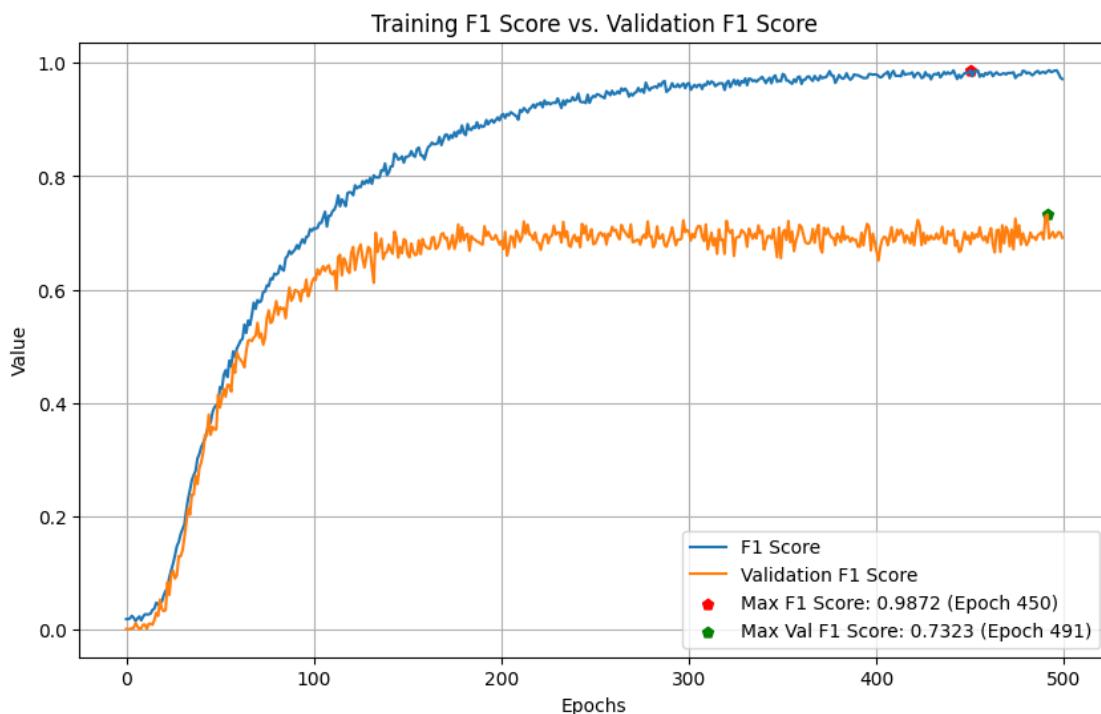
```

```

        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("1 1DCNN + 1 GRU")

2023-09-11 23:39:18.847371: 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 23:39:18.925735: I
tensorflow/core/common_runtime/gpu/gpu_device.cc:1616] Created device
/job:localhost/replica:0/task:0/device:GPU:0 with 1425 MB memory: -> device: 0,
name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1
```

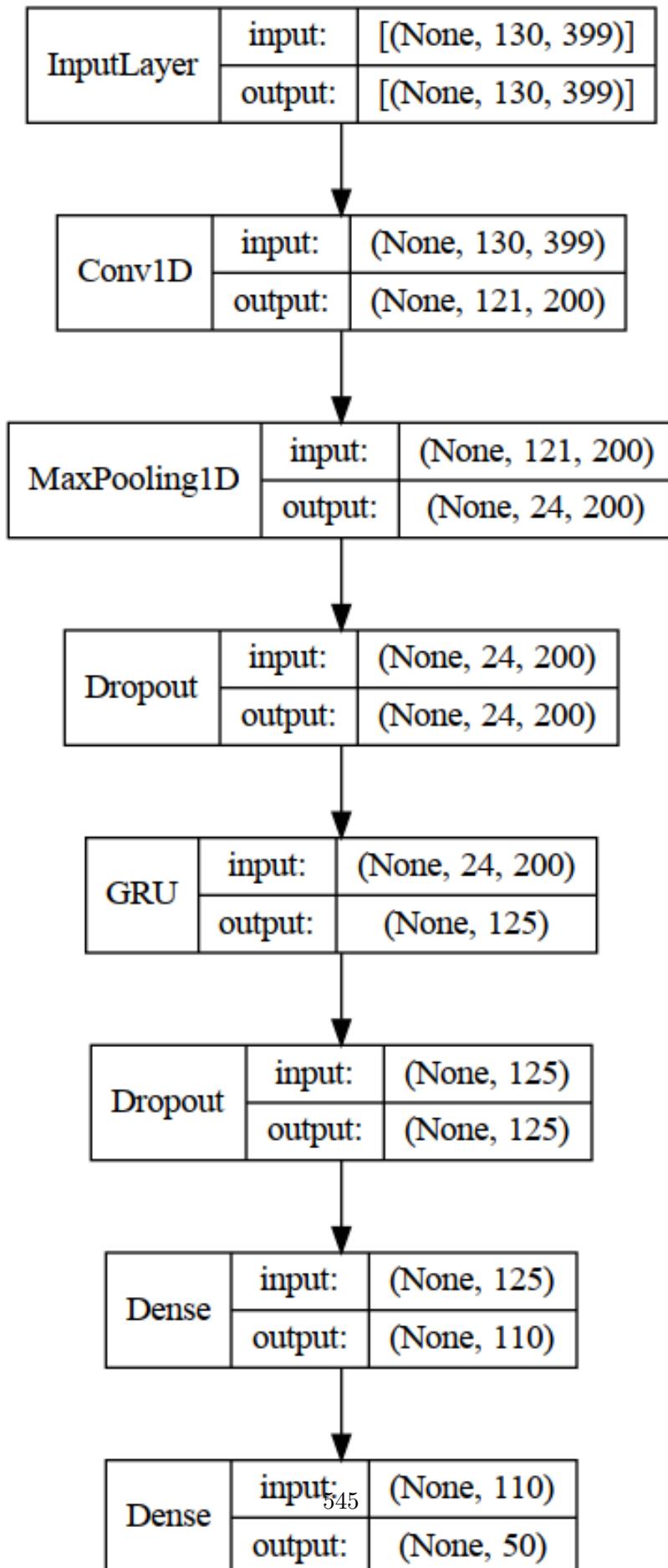
```
[120]: reconstructed_model.summary()
```

```
Model: "sequential_1"
```

Layer (type)	Output Shape	Param #
conv1d_1 (Conv1D)	(None, 121, 200)	798200
max_pooling1d_1 (MaxPooling 1D)	(None, 24, 200)	0
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
<hr/>		
Total params:	940,235	
Trainable params:	940,235	
Non-trainable params:	0	

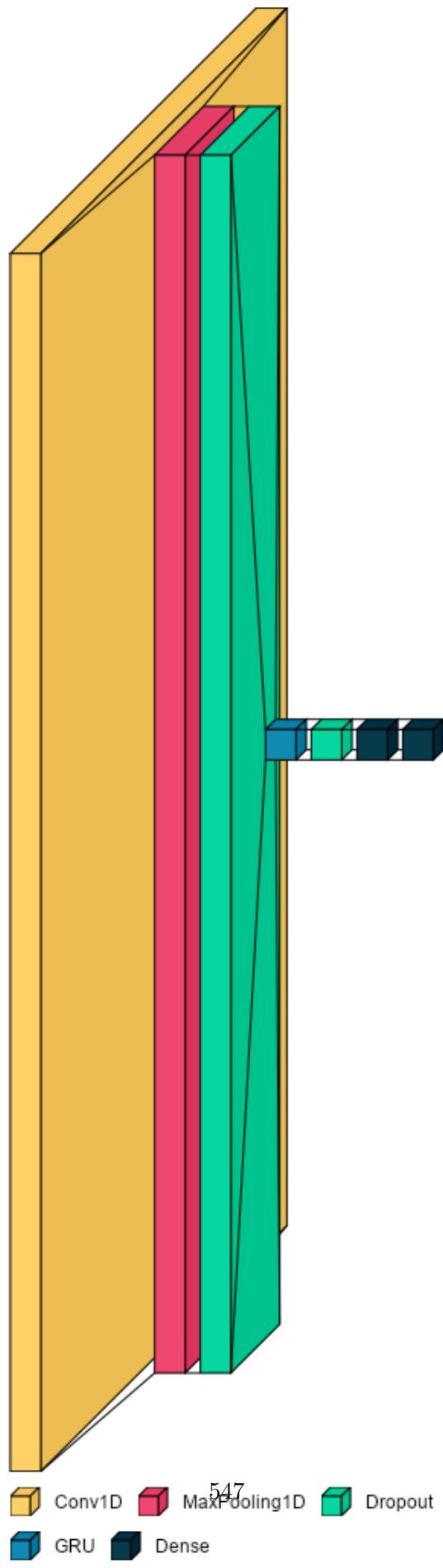
```
[121]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

```
[121]:
```



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

```
[122]:
```



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

2023-09-11 23:39:32.340471: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700

11/11 [=====] - 1s 15ms/step - loss: 1.4189 - f1_score: 0.7323
```

[123]: [1.418906331062317, 0.7323073744773865]

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

84/84 [=====] - 1s 14ms/step - loss: 0.0487 - f1_score: 1.0000
```

[124]: [0.0486634187400341, 1.0]

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

	precision	recall	f1-score	support
AXE	1.000	1.000	1.000	8
BACKPACK	0.571	0.667	0.615	6
BASKETBALL	0.833	1.000	0.909	10
BEE	0.500	0.500	0.500	10
BELT	1.000	1.000	1.000	4
BITE	0.833	0.625	0.714	8
BREAKFAST	0.667	0.667	0.667	6
CANCER	0.778	0.875	0.824	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	1.000	0.500	0.667	6
DARK	0.800	1.000	0.889	4
DEAF	0.400	0.333	0.364	6
DECIDE	1.000	1.000	1.000	6
DEMAND	0.875	0.875	0.875	8
DEVELOP	1.000	0.333	0.500	6
DINNER	0.800	1.000	0.889	8
DOG	0.571	0.667	0.615	6
DOWNSIZE	1.000	0.875	0.933	8
DRAG	1.000	0.750	0.857	4
EAT	0.600	0.500	0.545	6
EDIT	0.857	1.000	0.923	6

ELEVATOR	0.500	1.000	0.667	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	1.000	0.750	0.857	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	1.000	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.556	0.625	0.588	8
LUNCH	0.857	0.750	0.800	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	0.625	0.769	8
MOVIE	0.700	0.875	0.778	8
NOON	1.000	1.000	1.000	8
PARTY	0.600	0.750	0.667	8
PATIENT	0.200	0.333	0.250	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.600	1.000	0.750	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.643	0.900	0.750	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.500	0.500	0.500	4
THEY	0.800	1.000	0.889	4
TWINS	0.727	1.000	0.842	8
WHATFOR	1.000	0.600	0.750	10
accuracy			0.753	324
macro avg	0.781	0.733	0.732	324
weighted avg	0.784	0.753	0.745	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))

```

```
predicted samples. Use `zero_division` parameter to control this behavior.  
_warn_prf(average, modifier, msg_start, len(result))
```

```
[122]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(  
    filepath='1 1DCNN + 1 GRU Mish/',  
    monitor='val_f1_score',  
    mode='max',  
    save_best_only=True)
```

```
[124]: 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 1D)	(None, 24, 200)	0

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

```

2023-09-17 11:31:35.652690: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384] Loaded cuDNN version 8700
2023-09-17 11:31:36.164462: I tensorflow/compiler/xla/service/service.cc:173] XLA service 0x7fe37c413850 initialized for platform CUDA (this does not guarantee that XLA will be used). Devices:
2023-09-17 11:31:36.164491: I tensorflow/compiler/xla/service/service.cc:181] StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-17 11:31:36.174346: I tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-17 11:31:36.319291: 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: 4.8315 - f1_score: 0.0190

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 18s 523ms/step - loss: 4.8315 - f1_score: 0.0190 - val_loss: 4.7655 - val_f1_score: 9.6386e-04
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 4.7582 - f1_score: 0.0143

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 315ms/step - loss: 4.7582 - f1_score: 0.0143 - val_loss: 4.7022 - val_f1_score: 0.0011
Epoch 3/500
28/28 [=====] - 3s 91ms/step - loss: 4.6937 - f1_score: 0.0154 - val_loss: 4.6575 - val_f1_score: 9.6386e-04
Epoch 4/500
28/28 [=====] - ETA: 0s - loss: 4.6407 - f1_score: 0.0134

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 385ms/step - loss: 4.6407 - f1_score: 0.0134 - val_loss: 4.6026 - val_f1_score: 0.0011
Epoch 5/500
28/28 [=====] - 3s 92ms/step - loss: 4.5884 - f1_score: 0.0144 - val_loss: 4.5527 - val_f1_score: 9.6386e-04
Epoch 6/500
28/28 [=====] - ETA: 0s - loss: 4.5359 - f1_score: 0.0163

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 367ms/step - loss: 4.5359 - f1_score: 0.0163 - val_loss: 4.5107 - val_f1_score: 0.0031
Epoch 7/500
28/28 [=====] - 3s 91ms/step - loss: 4.4951 - f1_score: 0.0151 - val_loss: 4.4628 - val_f1_score: 0.0031
Epoch 8/500
28/28 [=====] - 3s 91ms/step - loss: 4.4493 - f1_score: 0.0147 - val_loss: 4.4362 - val_f1_score: 0.0025
Epoch 9/500
```

```
28/28 [=====] - ETA: 0s - loss: 4.4138 - f1_score: 0.0146
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 360ms/step - loss: 4.4138 - f1_score: 0.0146 - val_loss: 4.3903 - val_f1_score: 0.0041
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 4.3728 - f1_score: 0.0150
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 353ms/step - loss: 4.3728 - f1_score: 0.0150 - val_loss: 4.3574 - val_f1_score: 0.0061
Epoch 11/500
28/28 [=====] - ETA: 0s - loss: 4.3371 - f1_score: 0.0162
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 335ms/step - loss: 4.3371 - f1_score: 0.0162 - val_loss: 4.3261 - val_f1_score: 0.0165
Epoch 12/500
28/28 [=====] - 3s 92ms/step - loss: 4.3042 - f1_score: 0.0148 - val_loss: 4.3009 - val_f1_score: 0.0100
Epoch 13/500
28/28 [=====] - 3s 91ms/step - loss: 4.2677 - f1_score: 0.0187 - val_loss: 4.2553 - val_f1_score: 0.0084
Epoch 14/500
28/28 [=====] - 3s 92ms/step - loss: 4.2211 - f1_score: 0.0242 - val_loss: 4.2028 - val_f1_score: 0.0144
Epoch 15/500
```

```
28/28 [=====] - ETA: 0s - loss: 4.1622 - f1_score: 0.0223
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 361ms/step - loss: 4.1622 - f1_score: 0.0223 - val_loss: 4.0997 - val_f1_score: 0.0173
Epoch 16/500
28/28 [=====] - 3s 92ms/step - loss: 4.0576 - f1_score: 0.0193 - val_loss: 3.9665 - val_f1_score: 0.0085
Epoch 17/500
28/28 [=====] - 3s 92ms/step - loss: 3.9402 - f1_score: 0.0177 - val_loss: 3.8626 - val_f1_score: 0.0171
Epoch 18/500
28/28 [=====] - 3s 93ms/step - loss: 3.8588 - f1_score: 0.0201 - val_loss: 3.8017 - val_f1_score: 0.0112
Epoch 19/500
28/28 [=====] - ETA: 0s - loss: 3.8023 - f1_score: 0.0278
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 376ms/step - loss: 3.8023 - f1_score: 0.0278 - val_loss: 3.7447 - val_f1_score: 0.0244
Epoch 20/500
28/28 [=====] - 3s 92ms/step - loss: 3.7579 - f1_score: 0.0376 - val_loss: 3.7055 - val_f1_score: 0.0215
Epoch 21/500
28/28 [=====] - ETA: 0s - loss: 3.7026 - f1_score: 0.0394
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
```

```
28/28 [=====] - 10s 349ms/step - loss: 3.7026 -
f1_score: 0.0394 - val_loss: 3.6555 - val_f1_score: 0.0288
Epoch 22/500
28/28 [=====] - 3s 92ms/step - loss: 3.6720 - f1_score:
0.0445 - val_loss: 3.6300 - val_f1_score: 0.0281
Epoch 23/500
28/28 [=====] - ETA: 0s - loss: 3.6252 - f1_score:
0.0519

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 395ms/step - loss: 3.6252 -
f1_score: 0.0519 - val_loss: 3.5758 - val_f1_score: 0.0325
Epoch 24/500
28/28 [=====] - ETA: 0s - loss: 3.5847 - f1_score:
0.0478

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 338ms/step - loss: 3.5847 -
f1_score: 0.0478 - val_loss: 3.4784 - val_f1_score: 0.0451
Epoch 25/500
28/28 [=====] - 3s 92ms/step - loss: 3.5332 - f1_score:
0.0537 - val_loss: 3.4363 - val_f1_score: 0.0328
Epoch 26/500
28/28 [=====] - ETA: 0s - loss: 3.4681 - f1_score:
0.0594

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 421ms/step - loss: 3.4681 -
f1_score: 0.0594 - val_loss: 3.3647 - val_f1_score: 0.0554
Epoch 27/500
```

```
28/28 [=====] - 3s 93ms/step - loss: 3.4092 - f1_score: 0.0707 - val_loss: 3.3288 - val_f1_score: 0.0370
Epoch 28/500
28/28 [=====] - 3s 92ms/step - loss: 3.3474 - f1_score: 0.0706 - val_loss: 3.2801 - val_f1_score: 0.0489
Epoch 29/500
28/28 [=====] - 3s 92ms/step - loss: 3.2897 - f1_score: 0.0805 - val_loss: 3.2134 - val_f1_score: 0.0547
Epoch 30/500
28/28 [=====] - ETA: 0s - loss: 3.2427 - f1_score: 0.0892

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 384ms/step - loss: 3.2427 - f1_score: 0.0892 - val_loss: 3.1597 - val_f1_score: 0.0803
Epoch 31/500
28/28 [=====] - 3s 92ms/step - loss: 3.2026 - f1_score: 0.0894 - val_loss: 3.1305 - val_f1_score: 0.0621
Epoch 32/500
28/28 [=====] - 3s 92ms/step - loss: 3.1244 - f1_score: 0.1046 - val_loss: 3.1799 - val_f1_score: 0.0653
Epoch 33/500
28/28 [=====] - 3s 92ms/step - loss: 3.0894 - f1_score: 0.1124 - val_loss: 3.0400 - val_f1_score: 0.0787
Epoch 34/500
28/28 [=====] - ETA: 0s - loss: 3.0205 - f1_score: 0.1245

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 373ms/step - loss: 3.0205 - f1_score: 0.1245 - val_loss: 2.9340 - val_f1_score: 0.1050
Epoch 35/500
28/28 [=====] - 3s 92ms/step - loss: 2.9558 - f1_score: 0.1470 - val_loss: 2.8721 - val_f1_score: 0.1019
Epoch 36/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.8840 - f1_score: 0.1683
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 350ms/step - loss: 2.8840 - f1_score: 0.1683 - val_loss: 2.8244 - val_f1_score: 0.1168
Epoch 37/500
28/28 [=====] - 3s 93ms/step - loss: 2.8559 - f1_score: 0.1619 - val_loss: 2.8827 - val_f1_score: 0.1063
Epoch 38/500
28/28 [=====] - ETA: 0s - loss: 2.7828 - f1_score: 0.1762
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 457ms/step - loss: 2.7828 - f1_score: 0.1762 - val_loss: 2.7233 - val_f1_score: 0.1461
Epoch 39/500
28/28 [=====] - ETA: 0s - loss: 2.7247 - f1_score: 0.1971
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 22s 820ms/step - loss: 2.7247 - f1_score: 0.1971 - val_loss: 2.7285 - val_f1_score: 0.1505
Epoch 40/500
28/28 [=====] - ETA: 0s - loss: 2.6744 - f1_score: 0.2019
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 323ms/step - loss: 2.6744 -
f1_score: 0.2019 - val_loss: 2.6136 - val_f1_score: 0.1879
Epoch 41/500
28/28 [=====] - ETA: 0s - loss: 2.6277 - f1_score:
0.2141

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 356ms/step - loss: 2.6277 -
f1_score: 0.2141 - val_loss: 2.5694 - val_f1_score: 0.1929
Epoch 42/500
28/28 [=====] - ETA: 0s - loss: 2.5832 - f1_score:
0.2226

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 363ms/step - loss: 2.5832 -
f1_score: 0.2226 - val_loss: 2.5096 - val_f1_score: 0.2042
Epoch 43/500
28/28 [=====] - 3s 92ms/step - loss: 2.5190 - f1_score:
0.2441 - val_loss: 2.5107 - val_f1_score: 0.1944
Epoch 44/500
28/28 [=====] - ETA: 0s - loss: 2.4814 - f1_score:
0.2495

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
```

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28/28 [=====] - 11s 411ms/step - loss: 2.4814 -  
f1_score: 0.2495 - val_loss: 2.4993 - val_f1_score: 0.2327  
Epoch 45/500  
28/28 [=====] - ETA: 0s - loss: 2.4455 - f1_score:  
0.2603  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 380ms/step - loss: 2.4455 -  
f1_score: 0.2603 - val_loss: 2.4546 - val_f1_score: 0.2455  
Epoch 46/500  
28/28 [=====] - 3s 93ms/step - loss: 2.4125 - f1_score:  
0.2652 - val_loss: 2.4650 - val_f1_score: 0.2114  
Epoch 47/500  
28/28 [=====] - ETA: 0s - loss: 2.3581 - f1_score:  
0.2798  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 363ms/step - loss: 2.3581 -  
f1_score: 0.2798 - val_loss: 2.3360 - val_f1_score: 0.2860  
Epoch 48/500  
28/28 [=====] - 3s 92ms/step - loss: 2.3420 - f1_score:  
0.2901 - val_loss: 2.3354 - val_f1_score: 0.2645  
Epoch 49/500  
28/28 [=====] - 3s 92ms/step - loss: 2.2937 - f1_score:  
0.3004 - val_loss: 2.3393 - val_f1_score: 0.2744  
Epoch 50/500  
28/28 [=====] - ETA: 0s - loss: 2.2750 - f1_score:  
0.2986  
  
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 1DCNN + 1 GRU Mish/assets  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
```

```
28/28 [=====] - 10s 364ms/step - loss: 2.2750 -  
f1_score: 0.2986 - val_loss: 2.3177 - val_f1_score: 0.3202  
Epoch 51/500  
28/28 [=====] - 3s 92ms/step - loss: 2.2222 - f1_score:  
0.3250 - val_loss: 2.3421 - val_f1_score: 0.3190  
Epoch 52/500  
28/28 [=====] - ETA: 0s - loss: 2.1985 - f1_score:  
0.3293  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 11s 409ms/step - loss: 2.1985 -  
f1_score: 0.3293 - val_loss: 2.3007 - val_f1_score: 0.3248  
Epoch 53/500  
28/28 [=====] - ETA: 0s - loss: 2.1678 - f1_score:  
0.3323  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 370ms/step - loss: 2.1678 -  
f1_score: 0.3323 - val_loss: 2.2264 - val_f1_score: 0.3682  
Epoch 54/500  
28/28 [=====] - 3s 92ms/step - loss: 2.1257 - f1_score:  
0.3505 - val_loss: 2.2599 - val_f1_score: 0.3393  
Epoch 55/500  
28/28 [=====] - ETA: 0s - loss: 2.1035 - f1_score:  
0.3496  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 358ms/step - loss: 2.1035 -  
f1_score: 0.3496 - val_loss: 2.1663 - val_f1_score: 0.3769  
Epoch 56/500
```

```
28/28 [=====] - 3s 92ms/step - loss: 2.0896 - f1_score: 0.3572 - val_loss: 2.2131 - val_f1_score: 0.3302
Epoch 57/500
28/28 [=====] - 3s 92ms/step - loss: 2.0686 - f1_score: 0.3510 - val_loss: 2.1654 - val_f1_score: 0.3641
Epoch 58/500
28/28 [=====] - ETA: 0s - loss: 2.0204 - f1_score: 0.3856

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 374ms/step - loss: 2.0204 - f1_score: 0.3856 - val_loss: 2.1133 - val_f1_score: 0.3987
Epoch 59/500
28/28 [=====] - ETA: 0s - loss: 2.0119 - f1_score: 0.3753

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 327ms/step - loss: 2.0119 - f1_score: 0.3753 - val_loss: 2.0613 - val_f1_score: 0.4216
Epoch 60/500
28/28 [=====] - 3s 93ms/step - loss: 1.9729 - f1_score: 0.3970 - val_loss: 2.1044 - val_f1_score: 0.3904
Epoch 61/500
28/28 [=====] - 3s 93ms/step - loss: 1.9334 - f1_score: 0.3995 - val_loss: 2.0450 - val_f1_score: 0.4166
Epoch 62/500
28/28 [=====] - ETA: 0s - loss: 1.9173 - f1_score: 0.4064

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
```

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28/28 [=====] - 11s 418ms/step - loss: 1.9173 -  
f1_score: 0.4064 - val_loss: 2.0320 - val_f1_score: 0.4332  
Epoch 63/500  
28/28 [=====] - 3s 92ms/step - loss: 1.9124 - f1_score:  
0.4129 - val_loss: 2.0301 - val_f1_score: 0.4235  
Epoch 64/500  
28/28 [=====] - 3s 93ms/step - loss: 1.8693 - f1_score:  
0.4203 - val_loss: 2.0899 - val_f1_score: 0.3963  
Epoch 65/500  
28/28 [=====] - 3s 92ms/step - loss: 1.8423 - f1_score:  
0.4340 - val_loss: 1.9306 - val_f1_score: 0.4296  
Epoch 66/500  
28/28 [=====] - ETA: 0s - loss: 1.8147 - f1_score:  
0.4374  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 349ms/step - loss: 1.8147 -  
f1_score: 0.4374 - val_loss: 1.9142 - val_f1_score: 0.4443  
Epoch 67/500  
28/28 [=====] - 3s 92ms/step - loss: 1.7957 - f1_score:  
0.4454 - val_loss: 1.9262 - val_f1_score: 0.4403  
Epoch 68/500  
28/28 [=====] - 3s 92ms/step - loss: 1.7735 - f1_score:  
0.4500 - val_loss: 2.0074 - val_f1_score: 0.4333  
Epoch 69/500  
28/28 [=====] - ETA: 0s - loss: 1.7595 - f1_score:  
0.4612  
  
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 1DCNN + 1 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 353ms/step - loss: 1.7595 -  
f1_score: 0.4612 - val_loss: 1.8898 - val_f1_score: 0.4660  
Epoch 70/500  
28/28 [=====] - ETA: 0s - loss: 1.7356 - f1_score:  
0.4697  
  
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 377ms/step - loss: 1.7356 -
f1_score: 0.4697 - val_loss: 1.8961 - val_f1_score: 0.4700
Epoch 71/500
28/28 [=====] - ETA: 0s - loss: 1.7121 - f1_score:
0.4705
```

```
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 333ms/step - loss: 1.7121 -
f1_score: 0.4705 - val_loss: 1.9341 - val_f1_score: 0.4828
Epoch 72/500
28/28 [=====] - 3s 92ms/step - loss: 1.6988 - f1_score:
0.4829 - val_loss: 1.9329 - val_f1_score: 0.4659
Epoch 73/500
28/28 [=====] - 3s 92ms/step - loss: 1.6928 - f1_score:
0.4841 - val_loss: 1.8843 - val_f1_score: 0.4708
Epoch 74/500
28/28 [=====] - 3s 93ms/step - loss: 1.6708 - f1_score:
0.4909 - val_loss: 1.8594 - val_f1_score: 0.4782
Epoch 75/500
28/28 [=====] - 3s 92ms/step - loss: 1.6326 - f1_score:
0.4985 - val_loss: 1.8588 - val_f1_score: 0.4737
Epoch 76/500
28/28 [=====] - ETA: 0s - loss: 1.6292 - f1_score:
0.5074
```

```
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 375ms/step - loss: 1.6292 -
f1_score: 0.5074 - val_loss: 1.8582 - val_f1_score: 0.5028
Epoch 77/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.6059 - f1_score: 0.5058
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 392ms/step - loss: 1.6059 - f1_score: 0.5058 - val_loss: 1.7919 - val_f1_score: 0.5099
Epoch 78/500
28/28 [=====] - ETA: 0s - loss: 1.5903 - f1_score: 0.5372
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 336ms/step - loss: 1.5903 - f1_score: 0.5372 - val_loss: 1.7114 - val_f1_score: 0.5211
Epoch 79/500
28/28 [=====] - 3s 92ms/step - loss: 1.5623 - f1_score: 0.5260 - val_loss: 1.7560 - val_f1_score: 0.4796
Epoch 80/500
28/28 [=====] - ETA: 0s - loss: 1.5544 - f1_score: 0.5292
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 347ms/step - loss: 1.5544 - f1_score: 0.5292 - val_loss: 1.7027 - val_f1_score: 0.5546
Epoch 81/500
28/28 [=====] - 3s 92ms/step - loss: 1.5330 - f1_score: 0.5292 - val_loss: 1.7247 - val_f1_score: 0.5165
Epoch 82/500
28/28 [=====] - 3s 92ms/step - loss: 1.5314 - f1_score: 0.5287 - val_loss: 1.7115 - val_f1_score: 0.5272
Epoch 83/500
```

```
28/28 [=====] - 3s 93ms/step - loss: 1.5204 - f1_score: 0.5374 - val_loss: 1.7127 - val_f1_score: 0.4951
Epoch 84/500
28/28 [=====] - 3s 92ms/step - loss: 1.5179 - f1_score: 0.5401 - val_loss: 1.7466 - val_f1_score: 0.5327
Epoch 85/500
28/28 [=====] - 3s 92ms/step - loss: 1.4861 - f1_score: 0.5554 - val_loss: 1.6856 - val_f1_score: 0.5446
Epoch 86/500
28/28 [=====] - ETA: 0s - loss: 1.4844 - f1_score: 0.5403

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 13s 463ms/step - loss: 1.4844 - f1_score: 0.5403 - val_loss: 1.6344 - val_f1_score: 0.5550
Epoch 87/500
28/28 [=====] - ETA: 0s - loss: 1.4517 - f1_score: 0.5582

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 357ms/step - loss: 1.4517 - f1_score: 0.5582 - val_loss: 1.6221 - val_f1_score: 0.5743
Epoch 88/500
28/28 [=====] - 3s 92ms/step - loss: 1.4458 - f1_score: 0.5648 - val_loss: 1.6834 - val_f1_score: 0.5368
Epoch 89/500
28/28 [=====] - 3s 92ms/step - loss: 1.4242 - f1_score: 0.5680 - val_loss: 1.6354 - val_f1_score: 0.5517
Epoch 90/500
28/28 [=====] - 3s 93ms/step - loss: 1.4035 - f1_score: 0.5713 - val_loss: 1.6290 - val_f1_score: 0.5545
Epoch 91/500
28/28 [=====] - 3s 92ms/step - loss: 1.3981 - f1_score: 0.5839 - val_loss: 1.6502 - val_f1_score: 0.5474
Epoch 92/500
28/28 [=====] - 3s 92ms/step - loss: 1.3965 - f1_score:
```

```
0.5852 - val_loss: 1.6393 - val_f1_score: 0.5462
Epoch 93/500
28/28 [=====] - 3s 93ms/step - loss: 1.3785 - f1_score: 0.5840 - val_loss: 1.6149 - val_f1_score: 0.5622
Epoch 94/500
28/28 [=====] - 3s 92ms/step - loss: 1.3682 - f1_score: 0.5930 - val_loss: 1.6033 - val_f1_score: 0.5496
Epoch 95/500
28/28 [=====] - ETA: 0s - loss: 1.3433 - f1_score: 0.5991

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 10s 379ms/step - loss: 1.3433 - f1_score: 0.5991 - val_loss: 1.5800 - val_f1_score: 0.5783
Epoch 96/500
28/28 [=====] - ETA: 0s - loss: 1.3168 - f1_score: 0.6071

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 423ms/step - loss: 1.3168 - f1_score: 0.6071 - val_loss: 1.5636 - val_f1_score: 0.5924
Epoch 97/500
28/28 [=====] - 3s 92ms/step - loss: 1.3245 - f1_score: 0.6061 - val_loss: 1.5611 - val_f1_score: 0.5741
Epoch 98/500
28/28 [=====] - 3s 93ms/step - loss: 1.3136 - f1_score: 0.6068 - val_loss: 1.5652 - val_f1_score: 0.5671
Epoch 99/500
28/28 [=====] - 3s 93ms/step - loss: 1.3072 - f1_score: 0.6032 - val_loss: 1.5794 - val_f1_score: 0.5472
Epoch 100/500
28/28 [=====] - 3s 92ms/step - loss: 1.2793 - f1_score: 0.6098 - val_loss: 1.5745 - val_f1_score: 0.5798
Epoch 101/500
28/28 [=====] - 3s 93ms/step - loss: 1.2914 - f1_score: 0.6038 - val_loss: 1.5377 - val_f1_score: 0.5755
```

```
Epoch 102/500
28/28 [=====] - 3s 93ms/step - loss: 1.2966 - f1_score: 0.6103 - val_loss: 1.6460 - val_f1_score: 0.5374
Epoch 103/500
28/28 [=====] - 3s 94ms/step - loss: 1.2670 - f1_score: 0.6225 - val_loss: 1.5530 - val_f1_score: 0.5753
Epoch 104/500
28/28 [=====] - ETA: 0s - loss: 1.2492 - f1_score: 0.6316

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 375ms/step - loss: 1.2492 - f1_score: 0.6316 - val_loss: 1.4966 - val_f1_score: 0.6273
Epoch 105/500
28/28 [=====] - 3s 92ms/step - loss: 1.2494 - f1_score: 0.6127 - val_loss: 1.4715 - val_f1_score: 0.5973
Epoch 106/500
28/28 [=====] - 3s 93ms/step - loss: 1.2337 - f1_score: 0.6290 - val_loss: 1.5517 - val_f1_score: 0.5546
Epoch 107/500
28/28 [=====] - 3s 93ms/step - loss: 1.2102 - f1_score: 0.6272 - val_loss: 1.4912 - val_f1_score: 0.5932
Epoch 108/500
28/28 [=====] - 3s 93ms/step - loss: 1.2079 - f1_score: 0.6371 - val_loss: 1.5059 - val_f1_score: 0.5900
Epoch 109/500
28/28 [=====] - 3s 94ms/step - loss: 1.2086 - f1_score: 0.6405 - val_loss: 1.4763 - val_f1_score: 0.6022
Epoch 110/500
28/28 [=====] - 3s 94ms/step - loss: 1.2021 - f1_score: 0.6402 - val_loss: 1.5797 - val_f1_score: 0.5500
Epoch 111/500
28/28 [=====] - 3s 95ms/step - loss: 1.1841 - f1_score: 0.6385 - val_loss: 1.4861 - val_f1_score: 0.5893
Epoch 112/500
28/28 [=====] - 3s 94ms/step - loss: 1.1884 - f1_score: 0.6543 - val_loss: 1.4939 - val_f1_score: 0.5829
Epoch 113/500
28/28 [=====] - 3s 95ms/step - loss: 1.1550 - f1_score: 0.6573 - val_loss: 1.5113 - val_f1_score: 0.5803
Epoch 114/500
28/28 [=====] - 3s 95ms/step - loss: 1.1570 - f1_score:
```

```
0.6527 - val_loss: 1.4787 - val_f1_score: 0.5575
Epoch 115/500
28/28 [=====] - 3s 95ms/step - loss: 1.1617 - f1_score: 0.6449 - val_loss: 1.4591 - val_f1_score: 0.5880
Epoch 116/500
28/28 [=====] - 3s 95ms/step - loss: 1.1274 - f1_score: 0.6649 - val_loss: 1.4625 - val_f1_score: 0.5944
Epoch 117/500
28/28 [=====] - 3s 95ms/step - loss: 1.1385 - f1_score: 0.6624 - val_loss: 1.5024 - val_f1_score: 0.5858
Epoch 118/500
28/28 [=====] - 3s 95ms/step - loss: 1.1179 - f1_score: 0.6637 - val_loss: 1.4557 - val_f1_score: 0.5872
Epoch 119/500
28/28 [=====] - 3s 95ms/step - loss: 1.1155 - f1_score: 0.6596 - val_loss: 1.4739 - val_f1_score: 0.5794
Epoch 120/500
28/28 [=====] - 3s 95ms/step - loss: 1.1306 - f1_score: 0.6576 - val_loss: 1.4526 - val_f1_score: 0.5885
Epoch 121/500
28/28 [=====] - 3s 95ms/step - loss: 1.0973 - f1_score: 0.6702 - val_loss: 1.4535 - val_f1_score: 0.5831
Epoch 122/500
28/28 [=====] - 3s 95ms/step - loss: 1.1048 - f1_score: 0.6636 - val_loss: 1.4617 - val_f1_score: 0.5946
Epoch 123/500
28/28 [=====] - 3s 96ms/step - loss: 1.0963 - f1_score: 0.6755 - val_loss: 1.4642 - val_f1_score: 0.5734
Epoch 124/500
28/28 [=====] - ETA: 0s - loss: 1.0837 - f1_score: 0.6759
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 444ms/step - loss: 1.0837 - f1_score: 0.6759 - val_loss: 1.4355 - val_f1_score: 0.6280
Epoch 125/500
28/28 [=====] - 3s 92ms/step - loss: 1.0790 - f1_score: 0.6631 - val_loss: 1.4325 - val_f1_score: 0.6140
Epoch 126/500
28/28 [=====] - 3s 93ms/step - loss: 1.0629 - f1_score: 0.6797 - val_loss: 1.4561 - val_f1_score: 0.5935
Epoch 127/500
```

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28/28 [=====] - 3s 94ms/step - loss: 1.0549 - f1_score: 0.6790 - val_loss: 1.4311 - val_f1_score: 0.5731
Epoch 128/500
28/28 [=====] - 3s 94ms/step - loss: 1.0345 - f1_score: 0.6843 - val_loss: 1.4352 - val_f1_score: 0.6042
Epoch 129/500
28/28 [=====] - 3s 94ms/step - loss: 1.0462 - f1_score: 0.6830 - val_loss: 1.4761 - val_f1_score: 0.5950
Epoch 130/500
28/28 [=====] - 3s 95ms/step - loss: 1.0274 - f1_score: 0.6880 - val_loss: 1.3804 - val_f1_score: 0.6064
Epoch 131/500
28/28 [=====] - 3s 95ms/step - loss: 1.0314 - f1_score: 0.6875 - val_loss: 1.4912 - val_f1_score: 0.5993
Epoch 132/500
28/28 [=====] - ETA: 0s - loss: 1.0206 - f1_score: 0.6877

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 460ms/step - loss: 1.0206 - f1_score: 0.6877 - val_loss: 1.3937 - val_f1_score: 0.6359
Epoch 133/500
28/28 [=====] - 3s 93ms/step - loss: 1.0036 - f1_score: 0.6970 - val_loss: 1.4391 - val_f1_score: 0.5971
Epoch 134/500
28/28 [=====] - 3s 93ms/step - loss: 0.9932 - f1_score: 0.6975 - val_loss: 1.3782 - val_f1_score: 0.6106
Epoch 135/500
28/28 [=====] - 3s 94ms/step - loss: 0.9883 - f1_score: 0.7061 - val_loss: 1.3943 - val_f1_score: 0.6185
Epoch 136/500
28/28 [=====] - 3s 95ms/step - loss: 0.9812 - f1_score: 0.7078 - val_loss: 1.4002 - val_f1_score: 0.6098
Epoch 137/500
28/28 [=====] - 3s 94ms/step - loss: 0.9959 - f1_score: 0.7010 - val_loss: 1.3881 - val_f1_score: 0.6075
Epoch 138/500
28/28 [=====] - 3s 95ms/step - loss: 0.9577 - f1_score: 0.7171 - val_loss: 1.3886 - val_f1_score: 0.5912
Epoch 139/500
28/28 [=====] - 3s 95ms/step - loss: 0.9706 - f1_score: 0.6993 - val_loss: 1.3792 - val_f1_score: 0.6199
```

Epoch 140/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9584 - f1\_score: 0.7108 - val\_loss: 1.3702 - val\_f1\_score: 0.6150  
Epoch 141/500  
28/28 [=====] - 3s 95ms/step - loss: 0.9965 - f1\_score: 0.6974 - val\_loss: 1.3827 - val\_f1\_score: 0.6245  
Epoch 142/500  
28/28 [=====] - 3s 95ms/step - loss: 0.9603 - f1\_score: 0.7042 - val\_loss: 1.4356 - val\_f1\_score: 0.5962  
Epoch 143/500  
28/28 [=====] - 3s 95ms/step - loss: 0.9537 - f1\_score: 0.7088 - val\_loss: 1.3729 - val\_f1\_score: 0.6347  
Epoch 144/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9322 - f1\_score: 0.7252 - val\_loss: 1.3778 - val\_f1\_score: 0.5978  
Epoch 145/500  
28/28 [=====] - 3s 95ms/step - loss: 0.9451 - f1\_score: 0.7153 - val\_loss: 1.4305 - val\_f1\_score: 0.5797  
Epoch 146/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9158 - f1\_score: 0.7205 - val\_loss: 1.3977 - val\_f1\_score: 0.6126  
Epoch 147/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9037 - f1\_score: 0.7314 - val\_loss: 1.3879 - val\_f1\_score: 0.6009  
Epoch 148/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9168 - f1\_score: 0.7273 - val\_loss: 1.3870 - val\_f1\_score: 0.5981  
Epoch 149/500  
28/28 [=====] - 3s 98ms/step - loss: 0.9050 - f1\_score: 0.7312 - val\_loss: 1.4047 - val\_f1\_score: 0.6027  
Epoch 150/500  
28/28 [=====] - 3s 99ms/step - loss: 0.8945 - f1\_score: 0.7246 - val\_loss: 1.4124 - val\_f1\_score: 0.6096  
Epoch 151/500  
28/28 [=====] - 3s 98ms/step - loss: 0.8898 - f1\_score: 0.7265 - val\_loss: 1.4012 - val\_f1\_score: 0.6033  
Epoch 152/500  
28/28 [=====] - 3s 96ms/step - loss: 0.9007 - f1\_score: 0.7191 - val\_loss: 1.4072 - val\_f1\_score: 0.6085  
Epoch 153/500  
28/28 [=====] - 3s 97ms/step - loss: 0.8809 - f1\_score: 0.7275 - val\_loss: 1.3733 - val\_f1\_score: 0.6115  
Epoch 154/500  
28/28 [=====] - 3s 96ms/step - loss: 0.8716 - f1\_score: 0.7416 - val\_loss: 1.3680 - val\_f1\_score: 0.6061  
Epoch 155/500  
28/28 [=====] - 3s 96ms/step - loss: 0.8678 - f1\_score: 0.7489 - val\_loss: 1.4282 - val\_f1\_score: 0.5868

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Epoch 156/500
28/28 [=====] - 3s 96ms/step - loss: 0.8825 - f1_score: 0.7370 - val_loss: 1.3805 - val_f1_score: 0.6208
Epoch 157/500
28/28 [=====] - 3s 97ms/step - loss: 0.8766 - f1_score: 0.7306 - val_loss: 1.3036 - val_f1_score: 0.6275
Epoch 158/500
28/28 [=====] - 3s 98ms/step - loss: 0.8636 - f1_score: 0.7319 - val_loss: 1.3881 - val_f1_score: 0.6158
Epoch 159/500
28/28 [=====] - 3s 97ms/step - loss: 0.8502 - f1_score: 0.7478 - val_loss: 1.3392 - val_f1_score: 0.6095
Epoch 160/500
28/28 [=====] - 3s 96ms/step - loss: 0.8538 - f1_score: 0.7458 - val_loss: 1.3352 - val_f1_score: 0.6229
Epoch 161/500
28/28 [=====] - 3s 96ms/step - loss: 0.8379 - f1_score: 0.7427 - val_loss: 1.3779 - val_f1_score: 0.6264
Epoch 162/500
28/28 [=====] - 3s 97ms/step - loss: 0.8369 - f1_score: 0.7460 - val_loss: 1.3935 - val_f1_score: 0.6071
Epoch 163/500
28/28 [=====] - 3s 97ms/step - loss: 0.8522 - f1_score: 0.7480 - val_loss: 1.4086 - val_f1_score: 0.6073
Epoch 164/500
28/28 [=====] - 3s 96ms/step - loss: 0.8273 - f1_score: 0.7562 - val_loss: 1.4376 - val_f1_score: 0.6059
Epoch 165/500
28/28 [=====] - 3s 99ms/step - loss: 0.8339 - f1_score: 0.7503 - val_loss: 1.3518 - val_f1_score: 0.6046
Epoch 166/500
28/28 [=====] - ETA: 0s - loss: 0.8176 - f1_score: 0.7610

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 13s 479ms/step - loss: 0.8176 - f1_score: 0.7610 - val_loss: 1.2978 - val_f1_score: 0.6474
Epoch 167/500
28/28 [=====] - 3s 93ms/step - loss: 0.8245 - f1_score: 0.7460 - val_loss: 1.3536 - val_f1_score: 0.6131
Epoch 168/500
28/28 [=====] - 3s 94ms/step - loss: 0.7900 - f1_score:
```

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0.7670 - val_loss: 1.3064 - val_f1_score: 0.6425
Epoch 169/500
28/28 [=====] - 3s 94ms/step - loss: 0.8124 - f1_score: 0.7474 - val_loss: 1.3275 - val_f1_score: 0.6323
Epoch 170/500
28/28 [=====] - 3s 95ms/step - loss: 0.7802 - f1_score: 0.7738 - val_loss: 1.4029 - val_f1_score: 0.6207
Epoch 171/500
28/28 [=====] - 3s 95ms/step - loss: 0.7897 - f1_score: 0.7662 - val_loss: 1.3618 - val_f1_score: 0.6268
Epoch 172/500
28/28 [=====] - 3s 95ms/step - loss: 0.7839 - f1_score: 0.7626 - val_loss: 1.3621 - val_f1_score: 0.6429
Epoch 173/500
28/28 [=====] - 3s 95ms/step - loss: 0.7803 - f1_score: 0.7609 - val_loss: 1.3826 - val_f1_score: 0.6234
Epoch 174/500
28/28 [=====] - 3s 96ms/step - loss: 0.7820 - f1_score: 0.7627 - val_loss: 1.3107 - val_f1_score: 0.6345
Epoch 175/500
28/28 [=====] - 3s 96ms/step - loss: 0.8042 - f1_score: 0.7497 - val_loss: 1.3913 - val_f1_score: 0.6163
Epoch 176/500
28/28 [=====] - 3s 96ms/step - loss: 0.7576 - f1_score: 0.7826 - val_loss: 1.3732 - val_f1_score: 0.6177
Epoch 177/500
28/28 [=====] - 3s 96ms/step - loss: 0.7627 - f1_score: 0.7768 - val_loss: 1.3829 - val_f1_score: 0.6189
Epoch 178/500
28/28 [=====] - ETA: 0s - loss: 0.7410 - f1_score: 0.7747
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 443ms/step - loss: 0.7410 - f1_score: 0.7747 - val_loss: 1.2891 - val_f1_score: 0.6491
Epoch 179/500
28/28 [=====] - 3s 92ms/step - loss: 0.7408 - f1_score: 0.7845 - val_loss: 1.3295 - val_f1_score: 0.6260
Epoch 180/500
28/28 [=====] - 3s 94ms/step - loss: 0.7196 - f1_score: 0.7943 - val_loss: 1.4165 - val_f1_score: 0.5940
Epoch 181/500
```

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28/28 [=====] - 3s 95ms/step - loss: 0.7420 - f1_score: 0.7810 - val_loss: 1.3601 - val_f1_score: 0.6379
Epoch 182/500
28/28 [=====] - 3s 96ms/step - loss: 0.7550 - f1_score: 0.7699 - val_loss: 1.3263 - val_f1_score: 0.6376
Epoch 183/500
28/28 [=====] - 3s 95ms/step - loss: 0.7373 - f1_score: 0.7732 - val_loss: 1.3389 - val_f1_score: 0.6443
Epoch 184/500
28/28 [=====] - 3s 95ms/step - loss: 0.7183 - f1_score: 0.7810 - val_loss: 1.3495 - val_f1_score: 0.6239
Epoch 185/500
28/28 [=====] - 3s 96ms/step - loss: 0.7244 - f1_score: 0.7837 - val_loss: 1.3839 - val_f1_score: 0.6287
Epoch 186/500
28/28 [=====] - 3s 95ms/step - loss: 0.7127 - f1_score: 0.7798 - val_loss: 1.3068 - val_f1_score: 0.6277
Epoch 187/500
28/28 [=====] - 3s 97ms/step - loss: 0.7233 - f1_score: 0.7901 - val_loss: 1.3451 - val_f1_score: 0.6119
Epoch 188/500
28/28 [=====] - 3s 96ms/step - loss: 0.7059 - f1_score: 0.7908 - val_loss: 1.3448 - val_f1_score: 0.6365
Epoch 189/500
28/28 [=====] - 3s 96ms/step - loss: 0.7378 - f1_score: 0.7755 - val_loss: 1.3320 - val_f1_score: 0.6309
Epoch 190/500
28/28 [=====] - 3s 96ms/step - loss: 0.7152 - f1_score: 0.7870 - val_loss: 1.3819 - val_f1_score: 0.6300
Epoch 191/500
28/28 [=====] - 3s 96ms/step - loss: 0.6875 - f1_score: 0.7962 - val_loss: 1.3500 - val_f1_score: 0.6436
Epoch 192/500
28/28 [=====] - ETA: 0s - loss: 0.7218 - f1_score: 0.7840
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 443ms/step - loss: 0.7218 - f1_score: 0.7840 - val_loss: 1.2808 - val_f1_score: 0.6634
Epoch 193/500
28/28 [=====] - 3s 93ms/step - loss: 0.7012 - f1_score: 0.7819 - val_loss: 1.3356 - val_f1_score: 0.6407
```

Epoch 194/500  
28/28 [=====] - 3s 94ms/step - loss: 0.6941 - f1\_score: 0.7999 - val\_loss: 1.3143 - val\_f1\_score: 0.6360  
Epoch 195/500  
28/28 [=====] - 3s 95ms/step - loss: 0.6812 - f1\_score: 0.7868 - val\_loss: 1.3969 - val\_f1\_score: 0.6529  
Epoch 196/500  
28/28 [=====] - 3s 95ms/step - loss: 0.6926 - f1\_score: 0.7888 - val\_loss: 1.3920 - val\_f1\_score: 0.6302  
Epoch 197/500  
28/28 [=====] - 3s 95ms/step - loss: 0.6777 - f1\_score: 0.7950 - val\_loss: 1.3521 - val\_f1\_score: 0.6488  
Epoch 198/500  
28/28 [=====] - 3s 96ms/step - loss: 0.6708 - f1\_score: 0.7961 - val\_loss: 1.4057 - val\_f1\_score: 0.6084  
Epoch 199/500  
28/28 [=====] - 3s 95ms/step - loss: 0.6713 - f1\_score: 0.7916 - val\_loss: 1.3681 - val\_f1\_score: 0.6441  
Epoch 200/500  
28/28 [=====] - 3s 95ms/step - loss: 0.6417 - f1\_score: 0.8077 - val\_loss: 1.3152 - val\_f1\_score: 0.6535  
Epoch 201/500  
28/28 [=====] - 3s 96ms/step - loss: 0.6502 - f1\_score: 0.8092 - val\_loss: 1.3257 - val\_f1\_score: 0.6374  
Epoch 202/500  
28/28 [=====] - 3s 96ms/step - loss: 0.6608 - f1\_score: 0.8017 - val\_loss: 1.3441 - val\_f1\_score: 0.6378  
Epoch 203/500  
28/28 [=====] - 3s 96ms/step - loss: 0.6587 - f1\_score: 0.8025 - val\_loss: 1.3596 - val\_f1\_score: 0.6421  
Epoch 204/500  
28/28 [=====] - 3s 96ms/step - loss: 0.6619 - f1\_score: 0.8012 - val\_loss: 1.3649 - val\_f1\_score: 0.6393  
Epoch 205/500  
28/28 [=====] - 3s 97ms/step - loss: 0.6386 - f1\_score: 0.8112 - val\_loss: 1.3757 - val\_f1\_score: 0.6345  
Epoch 206/500  
28/28 [=====] - 3s 99ms/step - loss: 0.6268 - f1\_score: 0.8153 - val\_loss: 1.3664 - val\_f1\_score: 0.6367  
Epoch 207/500  
28/28 [=====] - 3s 99ms/step - loss: 0.6367 - f1\_score: 0.8139 - val\_loss: 1.3806 - val\_f1\_score: 0.6412  
Epoch 208/500  
28/28 [=====] - 3s 97ms/step - loss: 0.6480 - f1\_score: 0.7983 - val\_loss: 1.3343 - val\_f1\_score: 0.6433  
Epoch 209/500  
28/28 [=====] - 3s 97ms/step - loss: 0.6216 - f1\_score: 0.8192 - val\_loss: 1.3598 - val\_f1\_score: 0.6469

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Epoch 210/500
28/28 [=====] - 3s 96ms/step - loss: 0.6387 - f1_score: 0.8066 - val_loss: 1.3470 - val_f1_score: 0.6356
Epoch 211/500
28/28 [=====] - 3s 96ms/step - loss: 0.6172 - f1_score: 0.8133 - val_loss: 1.4562 - val_f1_score: 0.5937
Epoch 212/500
28/28 [=====] - 3s 97ms/step - loss: 0.6190 - f1_score: 0.8137 - val_loss: 1.3505 - val_f1_score: 0.6532
Epoch 213/500
28/28 [=====] - 3s 96ms/step - loss: 0.6169 - f1_score: 0.8137 - val_loss: 1.4227 - val_f1_score: 0.6339
Epoch 214/500
28/28 [=====] - 3s 96ms/step - loss: 0.6221 - f1_score: 0.8149 - val_loss: 1.4109 - val_f1_score: 0.5964
Epoch 215/500
28/28 [=====] - 3s 96ms/step - loss: 0.6107 - f1_score: 0.8239 - val_loss: 1.3103 - val_f1_score: 0.6332
Epoch 216/500
28/28 [=====] - 3s 96ms/step - loss: 0.6128 - f1_score: 0.8156 - val_loss: 1.3929 - val_f1_score: 0.6071
Epoch 217/500
28/28 [=====] - 3s 96ms/step - loss: 0.6025 - f1_score: 0.8281 - val_loss: 1.3392 - val_f1_score: 0.6377
Epoch 218/500
28/28 [=====] - 3s 96ms/step - loss: 0.6092 - f1_score: 0.8196 - val_loss: 1.4090 - val_f1_score: 0.6338
Epoch 219/500
28/28 [=====] - 3s 97ms/step - loss: 0.6038 - f1_score: 0.8256 - val_loss: 1.3515 - val_f1_score: 0.6345
Epoch 220/500
28/28 [=====] - 3s 96ms/step - loss: 0.5800 - f1_score: 0.8268 - val_loss: 1.3508 - val_f1_score: 0.6464
Epoch 221/500
28/28 [=====] - 3s 97ms/step - loss: 0.5951 - f1_score: 0.8258 - val_loss: 1.3539 - val_f1_score: 0.6547
Epoch 222/500
28/28 [=====] - 3s 97ms/step - loss: 0.5766 - f1_score: 0.8351 - val_loss: 1.3429 - val_f1_score: 0.6300
Epoch 223/500
28/28 [=====] - 3s 97ms/step - loss: 0.5677 - f1_score: 0.8347 - val_loss: 1.3788 - val_f1_score: 0.6225
Epoch 224/500
28/28 [=====] - 3s 97ms/step - loss: 0.6100 - f1_score: 0.8231 - val_loss: 1.3622 - val_f1_score: 0.6339
Epoch 225/500
28/28 [=====] - 3s 96ms/step - loss: 0.5824 - f1_score: 0.8328 - val_loss: 1.3249 - val_f1_score: 0.6394
```

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Epoch 226/500
28/28 [=====] - 3s 97ms/step - loss: 0.5707 - f1_score: 0.8312 - val_loss: 1.3435 - val_f1_score: 0.6400
Epoch 227/500
28/28 [=====] - 3s 97ms/step - loss: 0.5649 - f1_score: 0.8368 - val_loss: 1.3090 - val_f1_score: 0.6569
Epoch 228/500
28/28 [=====] - 3s 96ms/step - loss: 0.5552 - f1_score: 0.8476 - val_loss: 1.4180 - val_f1_score: 0.6328
Epoch 229/500
28/28 [=====] - 3s 97ms/step - loss: 0.5642 - f1_score: 0.8235 - val_loss: 1.3555 - val_f1_score: 0.6181
Epoch 230/500
28/28 [=====] - 3s 97ms/step - loss: 0.5610 - f1_score: 0.8393 - val_loss: 1.4080 - val_f1_score: 0.6134
Epoch 231/500
28/28 [=====] - 3s 97ms/step - loss: 0.5576 - f1_score: 0.8357 - val_loss: 1.3854 - val_f1_score: 0.6155
Epoch 232/500
28/28 [=====] - 3s 97ms/step - loss: 0.5648 - f1_score: 0.8385 - val_loss: 1.3224 - val_f1_score: 0.6425
Epoch 233/500
28/28 [=====] - ETA: 0s - loss: 0.5375 - f1_score: 0.8459

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 427ms/step - loss: 0.5375 - f1_score: 0.8459 - val_loss: 1.3468 - val_f1_score: 0.6644
Epoch 234/500
28/28 [=====] - 3s 93ms/step - loss: 0.5528 - f1_score: 0.8429 - val_loss: 1.3853 - val_f1_score: 0.6266
Epoch 235/500
28/28 [=====] - 3s 95ms/step - loss: 0.5285 - f1_score: 0.8482 - val_loss: 1.3770 - val_f1_score: 0.6482
Epoch 236/500
28/28 [=====] - 3s 95ms/step - loss: 0.5554 - f1_score: 0.8358 - val_loss: 1.4336 - val_f1_score: 0.6051
Epoch 237/500
28/28 [=====] - 3s 95ms/step - loss: 0.5476 - f1_score: 0.8438 - val_loss: 1.4291 - val_f1_score: 0.6518
Epoch 238/500
28/28 [=====] - 3s 96ms/step - loss: 0.5514 - f1_score:
```

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0.8369 - val_loss: 1.3640 - val_f1_score: 0.6281
Epoch 239/500
28/28 [=====] - 3s 95ms/step - loss: 0.5452 - f1_score: 0.8368 - val_loss: 1.3645 - val_f1_score: 0.6465
Epoch 240/500
28/28 [=====] - 3s 96ms/step - loss: 0.5227 - f1_score: 0.8451 - val_loss: 1.3589 - val_f1_score: 0.6551
Epoch 241/500
28/28 [=====] - 3s 96ms/step - loss: 0.5202 - f1_score: 0.8459 - val_loss: 1.3568 - val_f1_score: 0.6258
Epoch 242/500
28/28 [=====] - 3s 96ms/step - loss: 0.5290 - f1_score: 0.8450 - val_loss: 1.3920 - val_f1_score: 0.6433
Epoch 243/500
28/28 [=====] - 3s 96ms/step - loss: 0.5266 - f1_score: 0.8472 - val_loss: 1.4208 - val_f1_score: 0.6344
Epoch 244/500
28/28 [=====] - 3s 96ms/step - loss: 0.5295 - f1_score: 0.8483 - val_loss: 1.4106 - val_f1_score: 0.6232
Epoch 245/500
28/28 [=====] - 3s 96ms/step - loss: 0.5289 - f1_score: 0.8505 - val_loss: 1.3634 - val_f1_score: 0.6578
Epoch 246/500
28/28 [=====] - 3s 96ms/step - loss: 0.5135 - f1_score: 0.8524 - val_loss: 1.3566 - val_f1_score: 0.6460
Epoch 247/500
28/28 [=====] - 3s 96ms/step - loss: 0.5175 - f1_score: 0.8460 - val_loss: 1.3844 - val_f1_score: 0.6325
Epoch 248/500
28/28 [=====] - 3s 96ms/step - loss: 0.5087 - f1_score: 0.8514 - val_loss: 1.3946 - val_f1_score: 0.6555
Epoch 249/500
28/28 [=====] - 3s 96ms/step - loss: 0.5358 - f1_score: 0.8483 - val_loss: 1.4155 - val_f1_score: 0.6261
Epoch 250/500
28/28 [=====] - 3s 96ms/step - loss: 0.5029 - f1_score: 0.8564 - val_loss: 1.3904 - val_f1_score: 0.6322
Epoch 251/500
28/28 [=====] - 3s 96ms/step - loss: 0.5199 - f1_score: 0.8508 - val_loss: 1.4098 - val_f1_score: 0.6259
Epoch 252/500
28/28 [=====] - 3s 97ms/step - loss: 0.5076 - f1_score: 0.8535 - val_loss: 1.3953 - val_f1_score: 0.6174
Epoch 253/500
28/28 [=====] - 3s 97ms/step - loss: 0.5050 - f1_score: 0.8567 - val_loss: 1.4157 - val_f1_score: 0.6347
Epoch 254/500
28/28 [=====] - 3s 97ms/step - loss: 0.5054 - f1_score:
```

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0.8533 - val_loss: 1.3446 - val_f1_score: 0.6540
Epoch 255/500
28/28 [=====] - 3s 96ms/step - loss: 0.4857 - f1_score: 0.8573 - val_loss: 1.4352 - val_f1_score: 0.6643
Epoch 256/500
28/28 [=====] - 3s 97ms/step - loss: 0.4849 - f1_score: 0.8629 - val_loss: 1.4526 - val_f1_score: 0.6412
Epoch 257/500
28/28 [=====] - 3s 97ms/step - loss: 0.4982 - f1_score: 0.8562 - val_loss: 1.3468 - val_f1_score: 0.6604
Epoch 258/500
28/28 [=====] - 3s 96ms/step - loss: 0.4975 - f1_score: 0.8620 - val_loss: 1.3568 - val_f1_score: 0.6592
Epoch 259/500
28/28 [=====] - 3s 96ms/step - loss: 0.4729 - f1_score: 0.8624 - val_loss: 1.3567 - val_f1_score: 0.6558
Epoch 260/500
28/28 [=====] - 3s 99ms/step - loss: 0.4763 - f1_score: 0.8607 - val_loss: 1.4298 - val_f1_score: 0.6269
Epoch 261/500
28/28 [=====] - 3s 99ms/step - loss: 0.4714 - f1_score: 0.8636 - val_loss: 1.3722 - val_f1_score: 0.6474
Epoch 262/500
28/28 [=====] - 3s 100ms/step - loss: 0.4777 - f1_score: 0.8555 - val_loss: 1.4042 - val_f1_score: 0.6395
Epoch 263/500
28/28 [=====] - 3s 98ms/step - loss: 0.4711 - f1_score: 0.8618 - val_loss: 1.3166 - val_f1_score: 0.6532
Epoch 264/500
28/28 [=====] - 3s 100ms/step - loss: 0.4587 - f1_score: 0.8661 - val_loss: 1.4231 - val_f1_score: 0.6078
Epoch 265/500
28/28 [=====] - 3s 98ms/step - loss: 0.4669 - f1_score: 0.8719 - val_loss: 1.3950 - val_f1_score: 0.6365
Epoch 266/500
28/28 [=====] - 3s 99ms/step - loss: 0.4787 - f1_score: 0.8624 - val_loss: 1.4662 - val_f1_score: 0.6221
Epoch 267/500
28/28 [=====] - 3s 99ms/step - loss: 0.4774 - f1_score: 0.8632 - val_loss: 1.3877 - val_f1_score: 0.6227
Epoch 268/500
28/28 [=====] - 3s 96ms/step - loss: 0.4659 - f1_score: 0.8741 - val_loss: 1.4354 - val_f1_score: 0.6341
Epoch 269/500
28/28 [=====] - 3s 100ms/step - loss: 0.4583 - f1_score: 0.8784 - val_loss: 1.4413 - val_f1_score: 0.6482
Epoch 270/500
28/28 [=====] - 3s 100ms/step - loss: 0.4578 -
```

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f1_score: 0.8764 - val_loss: 1.3432 - val_f1_score: 0.6490
Epoch 271/500
28/28 [=====] - 3s 101ms/step - loss: 0.4677 -
f1_score: 0.8626 - val_loss: 1.4151 - val_f1_score: 0.6450
Epoch 272/500
28/28 [=====] - 3s 99ms/step - loss: 0.4786 - f1_score:
0.8558 - val_loss: 1.3932 - val_f1_score: 0.6368
Epoch 273/500
28/28 [=====] - 3s 97ms/step - loss: 0.4548 - f1_score:
0.8742 - val_loss: 1.4355 - val_f1_score: 0.6270
Epoch 274/500
28/28 [=====] - 3s 98ms/step - loss: 0.4467 - f1_score:
0.8734 - val_loss: 1.4280 - val_f1_score: 0.6288
Epoch 275/500
28/28 [=====] - 3s 97ms/step - loss: 0.4486 - f1_score:
0.8713 - val_loss: 1.4605 - val_f1_score: 0.6481
Epoch 276/500
28/28 [=====] - 3s 97ms/step - loss: 0.4322 - f1_score:
0.8771 - val_loss: 1.3827 - val_f1_score: 0.6444
Epoch 277/500
28/28 [=====] - ETA: 0s - loss: 0.4445 - f1_score:
0.8783

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 440ms/step - loss: 0.4445 -
f1_score: 0.8783 - val_loss: 1.4354 - val_f1_score: 0.6646
Epoch 278/500
28/28 [=====] - ETA: 0s - loss: 0.4302 - f1_score:
0.8828

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 399ms/step - loss: 0.4302 -
f1_score: 0.8828 - val_loss: 1.3761 - val_f1_score: 0.6672
Epoch 279/500
28/28 [=====] - 3s 93ms/step - loss: 0.4181 - f1_score:
0.8960 - val_loss: 1.3919 - val_f1_score: 0.6399
```

Epoch 280/500  
28/28 [=====] - 3s 94ms/step - loss: 0.4348 - f1\_score: 0.8824 - val\_loss: 1.3992 - val\_f1\_score: 0.6363  
Epoch 281/500  
28/28 [=====] - 3s 95ms/step - loss: 0.4471 - f1\_score: 0.8720 - val\_loss: 1.4561 - val\_f1\_score: 0.6211  
Epoch 282/500  
28/28 [=====] - 3s 95ms/step - loss: 0.4481 - f1\_score: 0.8726 - val\_loss: 1.3469 - val\_f1\_score: 0.6521  
Epoch 283/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4237 - f1\_score: 0.8839 - val\_loss: 1.3819 - val\_f1\_score: 0.6556  
Epoch 284/500  
28/28 [=====] - 3s 95ms/step - loss: 0.4305 - f1\_score: 0.8721 - val\_loss: 1.4093 - val\_f1\_score: 0.6472  
Epoch 285/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4309 - f1\_score: 0.8769 - val\_loss: 1.4084 - val\_f1\_score: 0.6492  
Epoch 286/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4038 - f1\_score: 0.8935 - val\_loss: 1.4112 - val\_f1\_score: 0.6604  
Epoch 287/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4349 - f1\_score: 0.8802 - val\_loss: 1.4467 - val\_f1\_score: 0.6306  
Epoch 288/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4151 - f1\_score: 0.8799 - val\_loss: 1.3988 - val\_f1\_score: 0.6533  
Epoch 289/500  
28/28 [=====] - 3s 96ms/step - loss: 0.3953 - f1\_score: 0.8892 - val\_loss: 1.4732 - val\_f1\_score: 0.6389  
Epoch 290/500  
28/28 [=====] - 3s 96ms/step - loss: 0.4273 - f1\_score: 0.8802 - val\_loss: 1.4298 - val\_f1\_score: 0.6503  
Epoch 291/500  
28/28 [=====] - 3s 96ms/step - loss: 0.3938 - f1\_score: 0.8980 - val\_loss: 1.3915 - val\_f1\_score: 0.6480  
Epoch 292/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3920 - f1\_score: 0.8998 - val\_loss: 1.3715 - val\_f1\_score: 0.6499  
Epoch 293/500  
28/28 [=====] - 3s 96ms/step - loss: 0.3975 - f1\_score: 0.8879 - val\_loss: 1.4142 - val\_f1\_score: 0.6426  
Epoch 294/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3919 - f1\_score: 0.8913 - val\_loss: 1.4414 - val\_f1\_score: 0.6241  
Epoch 295/500  
28/28 [=====] - 3s 97ms/step - loss: 0.4071 - f1\_score: 0.8816 - val\_loss: 1.3963 - val\_f1\_score: 0.6640

Epoch 296/500  
28/28 [=====] - 3s 97ms/step - loss: 0.4046 - f1\_score: 0.8877 - val\_loss: 1.3882 - val\_f1\_score: 0.6462  
Epoch 297/500  
28/28 [=====] - 3s 97ms/step - loss: 0.4117 - f1\_score: 0.8882 - val\_loss: 1.3923 - val\_f1\_score: 0.6535  
Epoch 298/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3844 - f1\_score: 0.8999 - val\_loss: 1.4055 - val\_f1\_score: 0.6482  
Epoch 299/500  
28/28 [=====] - 3s 97ms/step - loss: 0.4053 - f1\_score: 0.8887 - val\_loss: 1.4589 - val\_f1\_score: 0.6493  
Epoch 300/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3988 - f1\_score: 0.8947 - val\_loss: 1.4056 - val\_f1\_score: 0.6547  
Epoch 301/500  
28/28 [=====] - 3s 97ms/step - loss: 0.4080 - f1\_score: 0.8834 - val\_loss: 1.3992 - val\_f1\_score: 0.6381  
Epoch 302/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3901 - f1\_score: 0.8992 - val\_loss: 1.4663 - val\_f1\_score: 0.6488  
Epoch 303/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3946 - f1\_score: 0.8937 - val\_loss: 1.4333 - val\_f1\_score: 0.6416  
Epoch 304/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3731 - f1\_score: 0.9025 - val\_loss: 1.4862 - val\_f1\_score: 0.6170  
Epoch 305/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3744 - f1\_score: 0.8965 - val\_loss: 1.4679 - val\_f1\_score: 0.6397  
Epoch 306/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3642 - f1\_score: 0.9053 - val\_loss: 1.3599 - val\_f1\_score: 0.6491  
Epoch 307/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3975 - f1\_score: 0.8879 - val\_loss: 1.4665 - val\_f1\_score: 0.6428  
Epoch 308/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3885 - f1\_score: 0.8848 - val\_loss: 1.3994 - val\_f1\_score: 0.6365  
Epoch 309/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3850 - f1\_score: 0.8919 - val\_loss: 1.4860 - val\_f1\_score: 0.6366  
Epoch 310/500  
28/28 [=====] - 3s 99ms/step - loss: 0.3606 - f1\_score: 0.8986 - val\_loss: 1.4777 - val\_f1\_score: 0.6510  
Epoch 311/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3744 - f1\_score: 0.8975 - val\_loss: 1.4200 - val\_f1\_score: 0.6464

Epoch 312/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3533 - f1\_score: 0.9091 - val\_loss: 1.4686 - val\_f1\_score: 0.6615  
Epoch 313/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3701 - f1\_score: 0.8950 - val\_loss: 1.4685 - val\_f1\_score: 0.6597  
Epoch 314/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3576 - f1\_score: 0.9111 - val\_loss: 1.4430 - val\_f1\_score: 0.6463  
Epoch 315/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3532 - f1\_score: 0.9051 - val\_loss: 1.4446 - val\_f1\_score: 0.6351  
Epoch 316/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3786 - f1\_score: 0.8947 - val\_loss: 1.4454 - val\_f1\_score: 0.6433  
Epoch 317/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3601 - f1\_score: 0.8999 - val\_loss: 1.5074 - val\_f1\_score: 0.6369  
Epoch 318/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3552 - f1\_score: 0.9038 - val\_loss: 1.4733 - val\_f1\_score: 0.6397  
Epoch 319/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3588 - f1\_score: 0.9041 - val\_loss: 1.4485 - val\_f1\_score: 0.6477  
Epoch 320/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3595 - f1\_score: 0.9024 - val\_loss: 1.4219 - val\_f1\_score: 0.6635  
Epoch 321/500  
28/28 [=====] - 3s 98ms/step - loss: 0.3455 - f1\_score: 0.9083 - val\_loss: 1.4671 - val\_f1\_score: 0.6540  
Epoch 322/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3438 - f1\_score: 0.9082 - val\_loss: 1.4619 - val\_f1\_score: 0.6476  
Epoch 323/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3612 - f1\_score: 0.9052 - val\_loss: 1.4728 - val\_f1\_score: 0.6379  
Epoch 324/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3936 - f1\_score: 0.8946 - val\_loss: 1.5321 - val\_f1\_score: 0.6338  
Epoch 325/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3586 - f1\_score: 0.9017 - val\_loss: 1.4856 - val\_f1\_score: 0.6310  
Epoch 326/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3148 - f1\_score: 0.9241 - val\_loss: 1.4529 - val\_f1\_score: 0.6457  
Epoch 327/500  
28/28 [=====] - 3s 97ms/step - loss: 0.3618 - f1\_score: 0.9020 - val\_loss: 1.5174 - val\_f1\_score: 0.6501

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Epoch 328/500
28/28 [=====] - 3s 97ms/step - loss: 0.3489 - f1_score: 0.9082 - val_loss: 1.4757 - val_f1_score: 0.6533
Epoch 329/500
28/28 [=====] - 3s 101ms/step - loss: 0.3627 - f1_score: 0.9014 - val_loss: 1.4712 - val_f1_score: 0.6663
Epoch 330/500
28/28 [=====] - 3s 102ms/step - loss: 0.3472 - f1_score: 0.9043 - val_loss: 1.4901 - val_f1_score: 0.6527
Epoch 331/500
28/28 [=====] - 3s 100ms/step - loss: 0.3525 - f1_score: 0.9040 - val_loss: 1.5087 - val_f1_score: 0.6375
Epoch 332/500
28/28 [=====] - 3s 98ms/step - loss: 0.3418 - f1_score: 0.9116 - val_loss: 1.4611 - val_f1_score: 0.6388
Epoch 333/500
28/28 [=====] - 3s 97ms/step - loss: 0.3632 - f1_score: 0.9035 - val_loss: 1.5215 - val_f1_score: 0.6469
Epoch 334/500
28/28 [=====] - 3s 97ms/step - loss: 0.3530 - f1_score: 0.9070 - val_loss: 1.5028 - val_f1_score: 0.6516
Epoch 335/500
28/28 [=====] - 3s 98ms/step - loss: 0.3377 - f1_score: 0.9117 - val_loss: 1.5300 - val_f1_score: 0.6419
Epoch 336/500
28/28 [=====] - 3s 97ms/step - loss: 0.3276 - f1_score: 0.9157 - val_loss: 1.4482 - val_f1_score: 0.6489
Epoch 337/500
28/28 [=====] - 3s 97ms/step - loss: 0.3124 - f1_score: 0.9209 - val_loss: 1.5032 - val_f1_score: 0.6392
Epoch 338/500
28/28 [=====] - ETA: 0s - loss: 0.3150 - f1_score: 0.9192
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 427ms/step - loss: 0.3150 - f1_score: 0.9192 - val_loss: 1.4685 - val_f1_score: 0.6679
Epoch 339/500
28/28 [=====] - ETA: 0s - loss: 0.3039 - f1_score: 0.9239
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
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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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 384ms/step - loss: 0.3039 -
f1_score: 0.9239 - val_loss: 1.4364 - val_f1_score: 0.6686
Epoch 340/500
28/28 [=====] - 3s 93ms/step - loss: 0.3118 - f1_score:
0.9203 - val_loss: 1.4907 - val_f1_score: 0.6577
Epoch 341/500
28/28 [=====] - 3s 94ms/step - loss: 0.3137 - f1_score:
0.9206 - val_loss: 1.5561 - val_f1_score: 0.6371
Epoch 342/500
28/28 [=====] - 3s 95ms/step - loss: 0.3344 - f1_score:
0.9075 - val_loss: 1.5240 - val_f1_score: 0.6397
Epoch 343/500
28/28 [=====] - 3s 95ms/step - loss: 0.3301 - f1_score:
0.9081 - val_loss: 1.5137 - val_f1_score: 0.6510
Epoch 344/500
28/28 [=====] - 3s 96ms/step - loss: 0.3109 - f1_score:
0.9181 - val_loss: 1.5462 - val_f1_score: 0.6274
Epoch 345/500
28/28 [=====] - ETA: 0s - loss: 0.3406 - f1_score:
0.9057

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 13s 466ms/step - loss: 0.3406 -
f1_score: 0.9057 - val_loss: 1.4357 - val_f1_score: 0.6715
Epoch 346/500
28/28 [=====] - 3s 93ms/step - loss: 0.3525 - f1_score:
0.9033 - val_loss: 1.4981 - val_f1_score: 0.6439
Epoch 347/500
28/28 [=====] - 3s 94ms/step - loss: 0.3197 - f1_score:
0.9159 - val_loss: 1.5735 - val_f1_score: 0.6307
Epoch 348/500
28/28 [=====] - 3s 94ms/step - loss: 0.3264 - f1_score:
0.9183 - val_loss: 1.5205 - val_f1_score: 0.6441
Epoch 349/500
28/28 [=====] - 3s 95ms/step - loss: 0.3231 - f1_score:
```

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0.9101 - val_loss: 1.5046 - val_f1_score: 0.6353
Epoch 350/500
28/28 [=====] - 3s 96ms/step - loss: 0.3065 - f1_score:
0.9202 - val_loss: 1.4539 - val_f1_score: 0.6527
Epoch 351/500
28/28 [=====] - 3s 95ms/step - loss: 0.3196 - f1_score:
0.9166 - val_loss: 1.4696 - val_f1_score: 0.6447
Epoch 352/500
28/28 [=====] - 3s 96ms/step - loss: 0.3051 - f1_score:
0.9172 - val_loss: 1.5392 - val_f1_score: 0.6453
Epoch 353/500
28/28 [=====] - 3s 96ms/step - loss: 0.3402 - f1_score:
0.9095 - val_loss: 1.5533 - val_f1_score: 0.6070
Epoch 354/500
28/28 [=====] - 3s 96ms/step - loss: 0.3120 - f1_score:
0.9224 - val_loss: 1.4336 - val_f1_score: 0.6635
Epoch 355/500
28/28 [=====] - 3s 96ms/step - loss: 0.3153 - f1_score:
0.9218 - val_loss: 1.5514 - val_f1_score: 0.6513
Epoch 356/500
28/28 [=====] - 3s 97ms/step - loss: 0.2848 - f1_score:
0.9357 - val_loss: 1.5186 - val_f1_score: 0.6479
Epoch 357/500
28/28 [=====] - 3s 96ms/step - loss: 0.3103 - f1_score:
0.9215 - val_loss: 1.5571 - val_f1_score: 0.6345
Epoch 358/500
28/28 [=====] - 3s 99ms/step - loss: 0.3141 - f1_score:
0.9176 - val_loss: 1.5356 - val_f1_score: 0.6622
Epoch 359/500
28/28 [=====] - 3s 96ms/step - loss: 0.3112 - f1_score:
0.9188 - val_loss: 1.4490 - val_f1_score: 0.6564
Epoch 360/500
28/28 [=====] - 3s 97ms/step - loss: 0.3322 - f1_score:
0.9140 - val_loss: 1.4544 - val_f1_score: 0.6466
Epoch 361/500
28/28 [=====] - 3s 97ms/step - loss: 0.3040 - f1_score:
0.9231 - val_loss: 1.5105 - val_f1_score: 0.6477
Epoch 362/500
28/28 [=====] - 3s 96ms/step - loss: 0.2918 - f1_score:
0.9282 - val_loss: 1.5242 - val_f1_score: 0.6582
Epoch 363/500
28/28 [=====] - 3s 97ms/step - loss: 0.3012 - f1_score:
0.9204 - val_loss: 1.5481 - val_f1_score: 0.6319
Epoch 364/500
28/28 [=====] - 3s 97ms/step - loss: 0.2980 - f1_score:
0.9295 - val_loss: 1.5066 - val_f1_score: 0.6360
Epoch 365/500
28/28 [=====] - 3s 98ms/step - loss: 0.2932 - f1_score:
```

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0.9242 - val_loss: 1.5751 - val_f1_score: 0.6360
Epoch 366/500
28/28 [=====] - 3s 99ms/step - loss: 0.2995 - f1_score:
0.9272 - val_loss: 1.5776 - val_f1_score: 0.6551
Epoch 367/500
28/28 [=====] - 3s 97ms/step - loss: 0.2958 - f1_score:
0.9229 - val_loss: 1.5395 - val_f1_score: 0.6625
Epoch 368/500
28/28 [=====] - 3s 98ms/step - loss: 0.2695 - f1_score:
0.9358 - val_loss: 1.5280 - val_f1_score: 0.6568
Epoch 369/500
28/28 [=====] - 3s 97ms/step - loss: 0.3020 - f1_score:
0.9265 - val_loss: 1.4527 - val_f1_score: 0.6523
Epoch 370/500
28/28 [=====] - 3s 98ms/step - loss: 0.2809 - f1_score:
0.9257 - val_loss: 1.5570 - val_f1_score: 0.6387
Epoch 371/500
28/28 [=====] - 3s 103ms/step - loss: 0.2838 -
f1_score: 0.9284 - val_loss: 1.5223 - val_f1_score: 0.6381
Epoch 372/500
28/28 [=====] - 3s 103ms/step - loss: 0.3174 -
f1_score: 0.9145 - val_loss: 1.5096 - val_f1_score: 0.6576
Epoch 373/500
28/28 [=====] - 3s 101ms/step - loss: 0.2962 -
f1_score: 0.9208 - val_loss: 1.5080 - val_f1_score: 0.6712
Epoch 374/500
28/28 [=====] - 3s 100ms/step - loss: 0.2674 -
f1_score: 0.9331 - val_loss: 1.5705 - val_f1_score: 0.6317
Epoch 375/500
28/28 [=====] - 3s 99ms/step - loss: 0.2851 - f1_score:
0.9311 - val_loss: 1.5587 - val_f1_score: 0.6446
Epoch 376/500
28/28 [=====] - 3s 100ms/step - loss: 0.3101 -
f1_score: 0.9196 - val_loss: 1.5675 - val_f1_score: 0.6338
Epoch 377/500
28/28 [=====] - 3s 98ms/step - loss: 0.2898 - f1_score:
0.9270 - val_loss: 1.4935 - val_f1_score: 0.6596
Epoch 378/500
28/28 [=====] - 3s 98ms/step - loss: 0.2776 - f1_score:
0.9307 - val_loss: 1.5694 - val_f1_score: 0.6633
Epoch 379/500
28/28 [=====] - 3s 97ms/step - loss: 0.3034 - f1_score:
0.9175 - val_loss: 1.5757 - val_f1_score: 0.6423
Epoch 380/500
28/28 [=====] - 3s 97ms/step - loss: 0.3012 - f1_score:
0.9213 - val_loss: 1.5474 - val_f1_score: 0.6396
Epoch 381/500
28/28 [=====] - 3s 97ms/step - loss: 0.2857 - f1_score:
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0.9289 - val_loss: 1.4787 - val_f1_score: 0.6353
Epoch 382/500
28/28 [=====] - 3s 99ms/step - loss: 0.2813 - f1_score:
0.9312 - val_loss: 1.5882 - val_f1_score: 0.6376
Epoch 383/500
28/28 [=====] - 3s 99ms/step - loss: 0.2791 - f1_score:
0.9279 - val_loss: 1.5282 - val_f1_score: 0.6605
Epoch 384/500
28/28 [=====] - 3s 97ms/step - loss: 0.2749 - f1_score:
0.9388 - val_loss: 1.5066 - val_f1_score: 0.6675
Epoch 385/500
28/28 [=====] - 3s 101ms/step - loss: 0.2965 -
f1_score: 0.9193 - val_loss: 1.4500 - val_f1_score: 0.6519
Epoch 386/500
28/28 [=====] - 3s 104ms/step - loss: 0.2741 -
f1_score: 0.9299 - val_loss: 1.5973 - val_f1_score: 0.6501
Epoch 387/500
28/28 [=====] - 3s 109ms/step - loss: 0.2726 -
f1_score: 0.9294 - val_loss: 1.5613 - val_f1_score: 0.6456
Epoch 388/500
28/28 [=====] - 3s 99ms/step - loss: 0.2667 - f1_score:
0.9365 - val_loss: 1.5494 - val_f1_score: 0.6265
Epoch 389/500
28/28 [=====] - 3s 98ms/step - loss: 0.2487 - f1_score:
0.9407 - val_loss: 1.5178 - val_f1_score: 0.6479
Epoch 390/500
28/28 [=====] - 3s 97ms/step - loss: 0.2491 - f1_score:
0.9434 - val_loss: 1.6850 - val_f1_score: 0.6132
Epoch 391/500
28/28 [=====] - 3s 97ms/step - loss: 0.2583 - f1_score:
0.9412 - val_loss: 1.5939 - val_f1_score: 0.6349
Epoch 392/500
28/28 [=====] - 3s 97ms/step - loss: 0.2674 - f1_score:
0.9328 - val_loss: 1.5794 - val_f1_score: 0.6416
Epoch 393/500
28/28 [=====] - 3s 97ms/step - loss: 0.2923 - f1_score:
0.9250 - val_loss: 1.6832 - val_f1_score: 0.6297
Epoch 394/500
28/28 [=====] - 3s 97ms/step - loss: 0.2746 - f1_score:
0.9338 - val_loss: 1.5736 - val_f1_score: 0.6699
Epoch 395/500
28/28 [=====] - 3s 97ms/step - loss: 0.2542 - f1_score:
0.9407 - val_loss: 1.6018 - val_f1_score: 0.6474
Epoch 396/500
28/28 [=====] - 3s 99ms/step - loss: 0.2522 - f1_score:
0.9352 - val_loss: 1.5786 - val_f1_score: 0.6445
Epoch 397/500
28/28 [=====] - 3s 97ms/step - loss: 0.2724 - f1_score:
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0.9334 - val_loss: 1.5951 - val_f1_score: 0.6677
Epoch 398/500
28/28 [=====] - 3s 97ms/step - loss: 0.2615 - f1_score: 0.9412 - val_loss: 1.6555 - val_f1_score: 0.6205
Epoch 399/500
28/28 [=====] - 3s 98ms/step - loss: 0.2923 - f1_score: 0.9250 - val_loss: 1.5876 - val_f1_score: 0.6671
Epoch 400/500
28/28 [=====] - 3s 97ms/step - loss: 0.2585 - f1_score: 0.9381 - val_loss: 1.5978 - val_f1_score: 0.6286
Epoch 401/500
28/28 [=====] - 3s 97ms/step - loss: 0.2509 - f1_score: 0.9360 - val_loss: 1.6460 - val_f1_score: 0.6399
Epoch 402/500
28/28 [=====] - 3s 97ms/step - loss: 0.2559 - f1_score: 0.9405 - val_loss: 1.6715 - val_f1_score: 0.6316
Epoch 403/500
28/28 [=====] - ETA: 0s - loss: 0.2650 - f1_score: 0.9342

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 446ms/step - loss: 0.2650 - f1_score: 0.9342 - val_loss: 1.5644 - val_f1_score: 0.6767
Epoch 404/500
28/28 [=====] - 3s 93ms/step - loss: 0.2556 - f1_score: 0.9336 - val_loss: 1.5798 - val_f1_score: 0.6357
Epoch 405/500
28/28 [=====] - 3s 95ms/step - loss: 0.2690 - f1_score: 0.9318 - val_loss: 1.5868 - val_f1_score: 0.6319
Epoch 406/500
28/28 [=====] - 3s 95ms/step - loss: 0.2601 - f1_score: 0.9443 - val_loss: 1.5124 - val_f1_score: 0.6628
Epoch 407/500
28/28 [=====] - 3s 96ms/step - loss: 0.2549 - f1_score: 0.9367 - val_loss: 1.6213 - val_f1_score: 0.6573
Epoch 408/500
28/28 [=====] - 3s 96ms/step - loss: 0.2431 - f1_score: 0.9387 - val_loss: 1.6168 - val_f1_score: 0.6496
Epoch 409/500
28/28 [=====] - 3s 96ms/step - loss: 0.2573 - f1_score: 0.9401 - val_loss: 1.5855 - val_f1_score: 0.6433
Epoch 410/500
```

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28/28 [=====] - 3s 96ms/step - loss: 0.2527 - f1_score: 0.9393 - val_loss: 1.5640 - val_f1_score: 0.6663
Epoch 411/500
28/28 [=====] - 3s 96ms/step - loss: 0.2691 - f1_score: 0.9369 - val_loss: 1.5550 - val_f1_score: 0.6416
Epoch 412/500
28/28 [=====] - 3s 97ms/step - loss: 0.2452 - f1_score: 0.9430 - val_loss: 1.5709 - val_f1_score: 0.6462
Epoch 413/500
28/28 [=====] - 3s 96ms/step - loss: 0.2553 - f1_score: 0.9400 - val_loss: 1.6569 - val_f1_score: 0.6518
Epoch 414/500
28/28 [=====] - 3s 97ms/step - loss: 0.2464 - f1_score: 0.9411 - val_loss: 1.5715 - val_f1_score: 0.6585
Epoch 415/500
28/28 [=====] - 3s 97ms/step - loss: 0.2612 - f1_score: 0.9357 - val_loss: 1.8630 - val_f1_score: 0.6166
Epoch 416/500
28/28 [=====] - 3s 97ms/step - loss: 0.2664 - f1_score: 0.9308 - val_loss: 1.6444 - val_f1_score: 0.6372
Epoch 417/500
28/28 [=====] - 3s 98ms/step - loss: 0.2363 - f1_score: 0.9485 - val_loss: 1.7284 - val_f1_score: 0.6361
Epoch 418/500
28/28 [=====] - 3s 97ms/step - loss: 0.2618 - f1_score: 0.9347 - val_loss: 1.6293 - val_f1_score: 0.6417
Epoch 419/500
28/28 [=====] - 3s 97ms/step - loss: 0.2488 - f1_score: 0.9384 - val_loss: 1.6765 - val_f1_score: 0.6337
Epoch 420/500
28/28 [=====] - 3s 96ms/step - loss: 0.2462 - f1_score: 0.9381 - val_loss: 1.6604 - val_f1_score: 0.6532
Epoch 421/500
28/28 [=====] - 3s 97ms/step - loss: 0.2359 - f1_score: 0.9436 - val_loss: 1.5963 - val_f1_score: 0.6611
Epoch 422/500
28/28 [=====] - 3s 99ms/step - loss: 0.2272 - f1_score: 0.9435 - val_loss: 1.5941 - val_f1_score: 0.6691
Epoch 423/500
28/28 [=====] - 3s 97ms/step - loss: 0.2477 - f1_score: 0.9393 - val_loss: 1.6062 - val_f1_score: 0.6751
Epoch 424/500
28/28 [=====] - 3s 97ms/step - loss: 0.2618 - f1_score: 0.9390 - val_loss: 1.5456 - val_f1_score: 0.6570
Epoch 425/500
28/28 [=====] - 3s 98ms/step - loss: 0.2512 - f1_score: 0.9433 - val_loss: 1.5698 - val_f1_score: 0.6482
Epoch 426/500
```

```
28/28 [=====] - 3s 97ms/step - loss: 0.2536 - f1_score: 0.9416 - val_loss: 1.6557 - val_f1_score: 0.6251
Epoch 427/500
28/28 [=====] - 3s 97ms/step - loss: 0.2410 - f1_score: 0.9436 - val_loss: 1.6274 - val_f1_score: 0.6120
Epoch 428/500
28/28 [=====] - 3s 100ms/step - loss: 0.2323 - f1_score: 0.9463 - val_loss: 1.6579 - val_f1_score: 0.6417
Epoch 429/500
28/28 [=====] - 3s 98ms/step - loss: 0.2616 - f1_score: 0.9361 - val_loss: 1.6100 - val_f1_score: 0.6529
Epoch 430/500
28/28 [=====] - 3s 97ms/step - loss: 0.2337 - f1_score: 0.9426 - val_loss: 1.6030 - val_f1_score: 0.6425
Epoch 431/500
28/28 [=====] - 3s 98ms/step - loss: 0.2380 - f1_score: 0.9438 - val_loss: 1.5001 - val_f1_score: 0.6653
Epoch 432/500
28/28 [=====] - 3s 97ms/step - loss: 0.2232 - f1_score: 0.9522 - val_loss: 1.6585 - val_f1_score: 0.6480
Epoch 433/500
28/28 [=====] - 3s 98ms/step - loss: 0.2488 - f1_score: 0.9434 - val_loss: 1.5723 - val_f1_score: 0.6476
Epoch 434/500
28/28 [=====] - 3s 97ms/step - loss: 0.2205 - f1_score: 0.9519 - val_loss: 1.6334 - val_f1_score: 0.6298
Epoch 435/500
28/28 [=====] - 3s 97ms/step - loss: 0.2503 - f1_score: 0.9421 - val_loss: 1.6957 - val_f1_score: 0.6297
Epoch 436/500
28/28 [=====] - 3s 97ms/step - loss: 0.2358 - f1_score: 0.9460 - val_loss: 1.5997 - val_f1_score: 0.6530
Epoch 437/500
28/28 [=====] - 3s 97ms/step - loss: 0.2235 - f1_score: 0.9474 - val_loss: 1.6520 - val_f1_score: 0.6566
Epoch 438/500
28/28 [=====] - 3s 97ms/step - loss: 0.2332 - f1_score: 0.9464 - val_loss: 1.6462 - val_f1_score: 0.6376
Epoch 439/500
28/28 [=====] - 3s 99ms/step - loss: 0.2119 - f1_score: 0.9507 - val_loss: 1.7297 - val_f1_score: 0.6311
Epoch 440/500
28/28 [=====] - ETA: 0s - loss: 0.2296 - f1_score: 0.9462
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 435ms/step - loss: 0.2296 - f1_score: 0.9462 - val_loss: 1.5810 - val_f1_score: 0.6778
Epoch 441/500
28/28 [=====] - 3s 94ms/step - loss: 0.2378 - f1_score: 0.9400 - val_loss: 1.6049 - val_f1_score: 0.6767
Epoch 442/500
28/28 [=====] - 3s 95ms/step - loss: 0.2123 - f1_score: 0.9455 - val_loss: 1.6477 - val_f1_score: 0.6285
Epoch 443/500
28/28 [=====] - 3s 96ms/step - loss: 0.2238 - f1_score: 0.9467 - val_loss: 1.6141 - val_f1_score: 0.6717
Epoch 444/500
28/28 [=====] - 3s 96ms/step - loss: 0.2212 - f1_score: 0.9471 - val_loss: 1.6499 - val_f1_score: 0.6488
Epoch 445/500
28/28 [=====] - 3s 99ms/step - loss: 0.2379 - f1_score: 0.9395 - val_loss: 1.6896 - val_f1_score: 0.6532
Epoch 446/500
28/28 [=====] - 3s 99ms/step - loss: 0.2235 - f1_score: 0.9449 - val_loss: 1.5827 - val_f1_score: 0.6738
Epoch 447/500
28/28 [=====] - 3s 99ms/step - loss: 0.2282 - f1_score: 0.9486 - val_loss: 1.7039 - val_f1_score: 0.6224
Epoch 448/500
28/28 [=====] - 3s 97ms/step - loss: 0.2613 - f1_score: 0.9342 - val_loss: 1.7057 - val_f1_score: 0.6730
Epoch 449/500
28/28 [=====] - 3s 97ms/step - loss: 0.2267 - f1_score: 0.9503 - val_loss: 1.6458 - val_f1_score: 0.6550
Epoch 450/500
28/28 [=====] - 3s 97ms/step - loss: 0.2332 - f1_score: 0.9427 - val_loss: 1.5773 - val_f1_score: 0.6500
Epoch 451/500
28/28 [=====] - ETA: 0s - loss: 0.2275 - f1_score: 0.9463
```

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 1DCNN + 1 GRU Mish/assets
```

```
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
```

```
28/28 [=====] - 12s 446ms/step - loss: 0.2275 -  
f1_score: 0.9463 - val_loss: 1.5605 - val_f1_score: 0.6851  
Epoch 452/500  
28/28 [=====] - 3s 93ms/step - loss: 0.2129 - f1_score:  
0.9517 - val_loss: 1.5556 - val_f1_score: 0.6281  
Epoch 453/500  
28/28 [=====] - 3s 95ms/step - loss: 0.2319 - f1_score:  
0.9437 - val_loss: 1.5504 - val_f1_score: 0.6635  
Epoch 454/500  
28/28 [=====] - 3s 96ms/step - loss: 0.2498 - f1_score:  
0.9376 - val_loss: 1.4961 - val_f1_score: 0.6632  
Epoch 455/500  
28/28 [=====] - 3s 95ms/step - loss: 0.2263 - f1_score:  
0.9458 - val_loss: 1.7011 - val_f1_score: 0.6360  
Epoch 456/500  
28/28 [=====] - 3s 95ms/step - loss: 0.2395 - f1_score:  
0.9361 - val_loss: 1.6789 - val_f1_score: 0.6495  
Epoch 457/500  
28/28 [=====] - 3s 96ms/step - loss: 0.2210 - f1_score:  
0.9521 - val_loss: 1.5679 - val_f1_score: 0.6482  
Epoch 458/500  
28/28 [=====] - 3s 96ms/step - loss: 0.2198 - f1_score:  
0.9503 - val_loss: 1.6662 - val_f1_score: 0.6636  
Epoch 459/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2103 - f1_score:  
0.9483 - val_loss: 1.6092 - val_f1_score: 0.6727  
Epoch 460/500  
28/28 [=====] - 3s 98ms/step - loss: 0.2286 - f1_score:  
0.9452 - val_loss: 1.7023 - val_f1_score: 0.6493  
Epoch 461/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2049 - f1_score:  
0.9530 - val_loss: 1.6957 - val_f1_score: 0.6500  
Epoch 462/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2145 - f1_score:  
0.9492 - val_loss: 1.6534 - val_f1_score: 0.6380  
Epoch 463/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2177 - f1_score:  
0.9480 - val_loss: 1.6895 - val_f1_score: 0.6426  
Epoch 464/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2338 - f1_score:  
0.9476 - val_loss: 1.5121 - val_f1_score: 0.6774  
Epoch 465/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2170 - f1_score:  
0.9507 - val_loss: 1.6456 - val_f1_score: 0.6705  
Epoch 466/500  
28/28 [=====] - 3s 97ms/step - loss: 0.2016 - f1_score:  
0.9613 - val_loss: 1.6212 - val_f1_score: 0.6400  
Epoch 467/500
```

```
28/28 [=====] - 3s 98ms/step - loss: 0.2103 - f1_score: 0.9488 - val_loss: 1.6539 - val_f1_score: 0.6733
Epoch 468/500
28/28 [=====] - 3s 99ms/step - loss: 0.2162 - f1_score: 0.9480 - val_loss: 1.5703 - val_f1_score: 0.6439
Epoch 469/500
28/28 [=====] - 3s 97ms/step - loss: 0.2102 - f1_score: 0.9545 - val_loss: 1.5850 - val_f1_score: 0.6703
Epoch 470/500
28/28 [=====] - 3s 97ms/step - loss: 0.2007 - f1_score: 0.9530 - val_loss: 1.7089 - val_f1_score: 0.6522
Epoch 471/500
28/28 [=====] - 3s 99ms/step - loss: 0.2085 - f1_score: 0.9541 - val_loss: 1.7305 - val_f1_score: 0.6633
Epoch 472/500
28/28 [=====] - 3s 98ms/step - loss: 0.2118 - f1_score: 0.9438 - val_loss: 1.6041 - val_f1_score: 0.6773
Epoch 473/500
28/28 [=====] - 3s 98ms/step - loss: 0.1976 - f1_score: 0.9549 - val_loss: 1.6212 - val_f1_score: 0.6429
Epoch 474/500
28/28 [=====] - 3s 97ms/step - loss: 0.1885 - f1_score: 0.9603 - val_loss: 1.6892 - val_f1_score: 0.6332
Epoch 475/500
28/28 [=====] - 3s 97ms/step - loss: 0.2144 - f1_score: 0.9468 - val_loss: 1.6759 - val_f1_score: 0.6498
Epoch 476/500
28/28 [=====] - 3s 98ms/step - loss: 0.2044 - f1_score: 0.9548 - val_loss: 1.6771 - val_f1_score: 0.6646
Epoch 477/500
28/28 [=====] - 3s 98ms/step - loss: 0.2150 - f1_score: 0.9483 - val_loss: 1.6459 - val_f1_score: 0.6463
Epoch 478/500
28/28 [=====] - ETA: 0s - loss: 0.2206 - f1_score: 0.9454
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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 437ms/step - loss: 0.2206 - f1_score: 0.9454 - val_loss: 1.6791 - val_f1_score: 0.6855
Epoch 479/500
28/28 [=====] - 3s 93ms/step - loss: 0.2080 - f1_score: 0.9545 - val_loss: 1.6024 - val_f1_score: 0.6458
```

```
Epoch 480/500
28/28 [=====] - 3s 96ms/step - loss: 0.1955 - f1_score: 0.9536 - val_loss: 1.5797 - val_f1_score: 0.6527
Epoch 481/500
28/28 [=====] - 3s 96ms/step - loss: 0.1994 - f1_score: 0.9557 - val_loss: 1.6481 - val_f1_score: 0.6587
Epoch 482/500
28/28 [=====] - 3s 96ms/step - loss: 0.1972 - f1_score: 0.9529 - val_loss: 1.6382 - val_f1_score: 0.6495
Epoch 483/500
28/28 [=====] - 3s 96ms/step - loss: 0.2128 - f1_score: 0.9498 - val_loss: 1.6278 - val_f1_score: 0.6547
Epoch 484/500
28/28 [=====] - ETA: 0s - loss: 0.2163 - f1_score: 0.9462

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 1DCNN + 1 GRU Mish/assets
INFO:tensorflow:Assets written to: 1 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 28s 1s/step - loss: 0.2163 - f1_score: 0.9462 - val_loss: 1.6760 - val_f1_score: 0.6916
Epoch 485/500
28/28 [=====] - 3s 92ms/step - loss: 0.2141 - f1_score: 0.9523 - val_loss: 1.7033 - val_f1_score: 0.6344
Epoch 486/500
28/28 [=====] - 3s 93ms/step - loss: 0.1972 - f1_score: 0.9601 - val_loss: 1.7303 - val_f1_score: 0.6439
Epoch 487/500
28/28 [=====] - 3s 93ms/step - loss: 0.1976 - f1_score: 0.9539 - val_loss: 1.6759 - val_f1_score: 0.6782
Epoch 488/500
28/28 [=====] - 3s 93ms/step - loss: 0.1998 - f1_score: 0.9527 - val_loss: 1.7019 - val_f1_score: 0.6383
Epoch 489/500
28/28 [=====] - 3s 96ms/step - loss: 0.1900 - f1_score: 0.9577 - val_loss: 1.7445 - val_f1_score: 0.6472
Epoch 490/500
28/28 [=====] - 3s 94ms/step - loss: 0.2127 - f1_score: 0.9516 - val_loss: 1.7428 - val_f1_score: 0.6334
Epoch 491/500
28/28 [=====] - 3s 95ms/step - loss: 0.2341 - f1_score: 0.9441 - val_loss: 1.6337 - val_f1_score: 0.6711
Epoch 492/500
28/28 [=====] - 3s 95ms/step - loss: 0.2060 - f1_score:
```

```

0.9541 - val_loss: 1.6994 - val_f1_score: 0.6720
Epoch 493/500
28/28 [=====] - 3s 95ms/step - loss: 0.2114 - f1_score:
0.9498 - val_loss: 1.6111 - val_f1_score: 0.6594
Epoch 494/500
28/28 [=====] - 3s 96ms/step - loss: 0.1952 - f1_score:
0.9530 - val_loss: 1.5989 - val_f1_score: 0.6564
Epoch 495/500
28/28 [=====] - 3s 98ms/step - loss: 0.1954 - f1_score:
0.9549 - val_loss: 1.7052 - val_f1_score: 0.6728
Epoch 496/500
28/28 [=====] - 3s 98ms/step - loss: 0.1848 - f1_score:
0.9614 - val_loss: 1.6037 - val_f1_score: 0.6694
Epoch 497/500
28/28 [=====] - 3s 99ms/step - loss: 0.2006 - f1_score:
0.9501 - val_loss: 1.7724 - val_f1_score: 0.6425
Epoch 498/500
28/28 [=====] - 3s 98ms/step - loss: 0.1825 - f1_score:
0.9588 - val_loss: 1.7289 - val_f1_score: 0.6478
Epoch 499/500
28/28 [=====] - 3s 96ms/step - loss: 0.1961 - f1_score:
0.9532 - val_loss: 1.6683 - val_f1_score: 0.6547
Epoch 500/500
28/28 [=====] - 3s 96ms/step - loss: 0.2001 - f1_score:
0.9561 - val_loss: 1.6346 - val_f1_score: 0.6442

```

[131]: # convert the history.history dict to a pandas DataFrame:  
`hist_df = pd.DataFrame(History.history)`

```

# or save to csv:
hist_csv_file = '1 1DCNN + 1 GRU Mish/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)

```

[132]: `hist_df = pd.read_csv('1 1DCNN + 1 GRU Mish/history.csv', index_col=0)`  
`hist_df.tail()`

	loss	f1_score	val_loss	val_f1_score
495	0.184797	0.961433	1.603674	0.669427
496	0.200553	0.950136	1.772372	0.642456
497	0.182463	0.958838	1.728884	0.647819
498	0.196128	0.953176	1.668275	0.654729
499	0.200051	0.956079	1.634593	0.644167

[133]: # 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()`

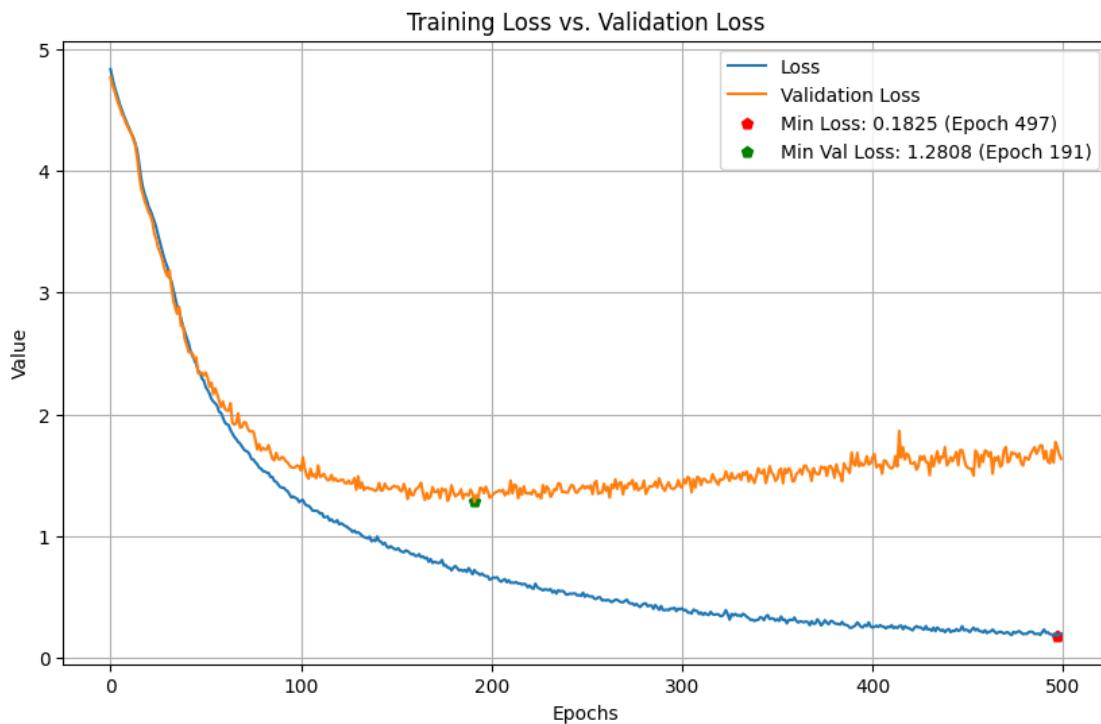
```

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()

```

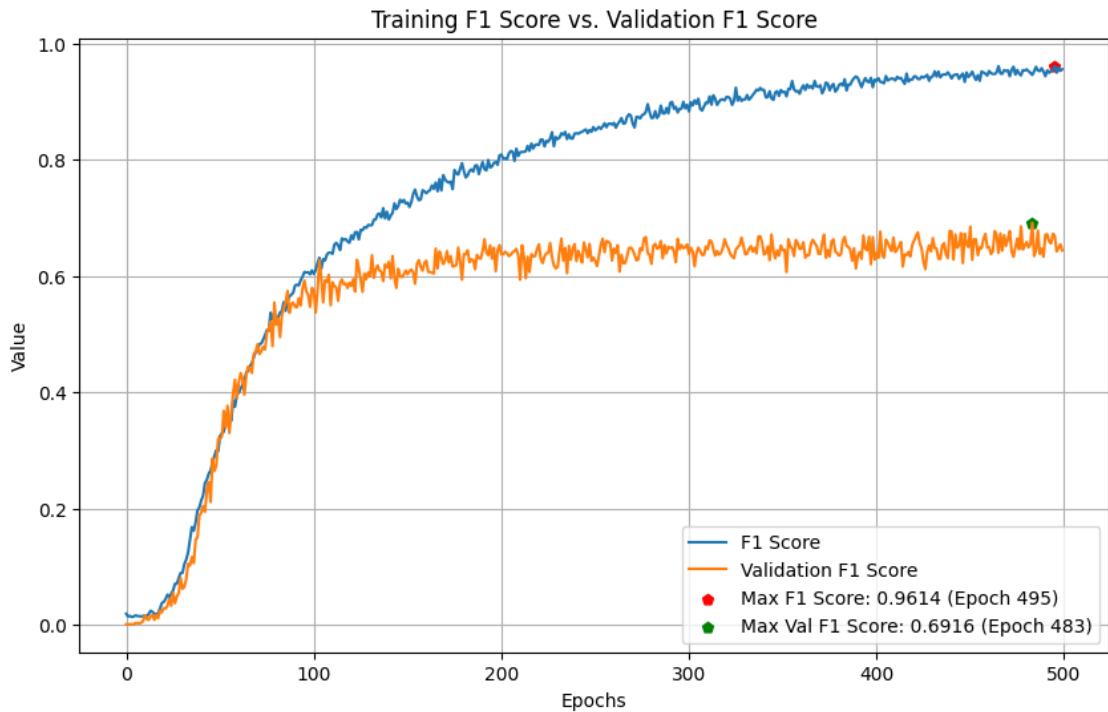


```
[134]: # Find the epoch with the highest F1 Score and Validation F1 Score
max_f1_epoch = hist_df['f1_score'].idxmax()
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()

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 14ms/step

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

AXE	0.800	1.000	0.889	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.667	1.000	0.800	10
BEE	0.833	0.500	0.625	10
BELT	1.000	1.000	1.000	4
BITE	0.875	0.875	0.875	8
BREAKFAST	0.667	1.000	0.800	6
CANCER	0.667	0.500	0.571	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.667	0.667	0.667	6
DARK	0.800	1.000	0.889	4
DEAF	0.375	0.500	0.429	6
DECIDE	1.000	0.667	0.800	6
DEMAND	0.857	0.750	0.800	8
DEVELOP	0.333	0.333	0.333	6

DINNER	1.000	0.875	0.933	8
DOG	0.000	0.000	0.000	6
DOWNSIZE	0.857	0.750	0.800	8
DRAG	0.667	0.500	0.571	4
EAT	1.000	0.500	0.667	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.357	0.625	0.455	8
FINE	0.500	0.500	0.500	4
FLOAT	0.400	0.500	0.444	4
FOREIGNER	0.800	0.667	0.727	6
GUESS	0.857	0.750	0.800	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	1.000	0.667	0.800	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	0.750	0.375	0.500	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.750	0.750	0.750	4
MEAT	0.500	1.000	0.667	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.889	1.000	0.941	8
NOON	0.875	0.875	0.875	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.308	0.667	0.421	6
RAZOR	1.000	0.500	0.667	4
RIVER	0.545	1.000	0.706	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.889	0.800	0.842	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.000	0.000	0.000	4
TWINS	0.667	0.750	0.706	8
WHATFOR	0.778	0.700	0.737	10
accuracy			0.694	324
macro avg	0.662	0.663	0.644	324
weighted avg	0.697	0.694	0.677	324

```
[195]: reconstructed_model = tf.keras.models.load_model("1 1DCNN + 1 GRU Mish")
```

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

Model: "sequential\_1"

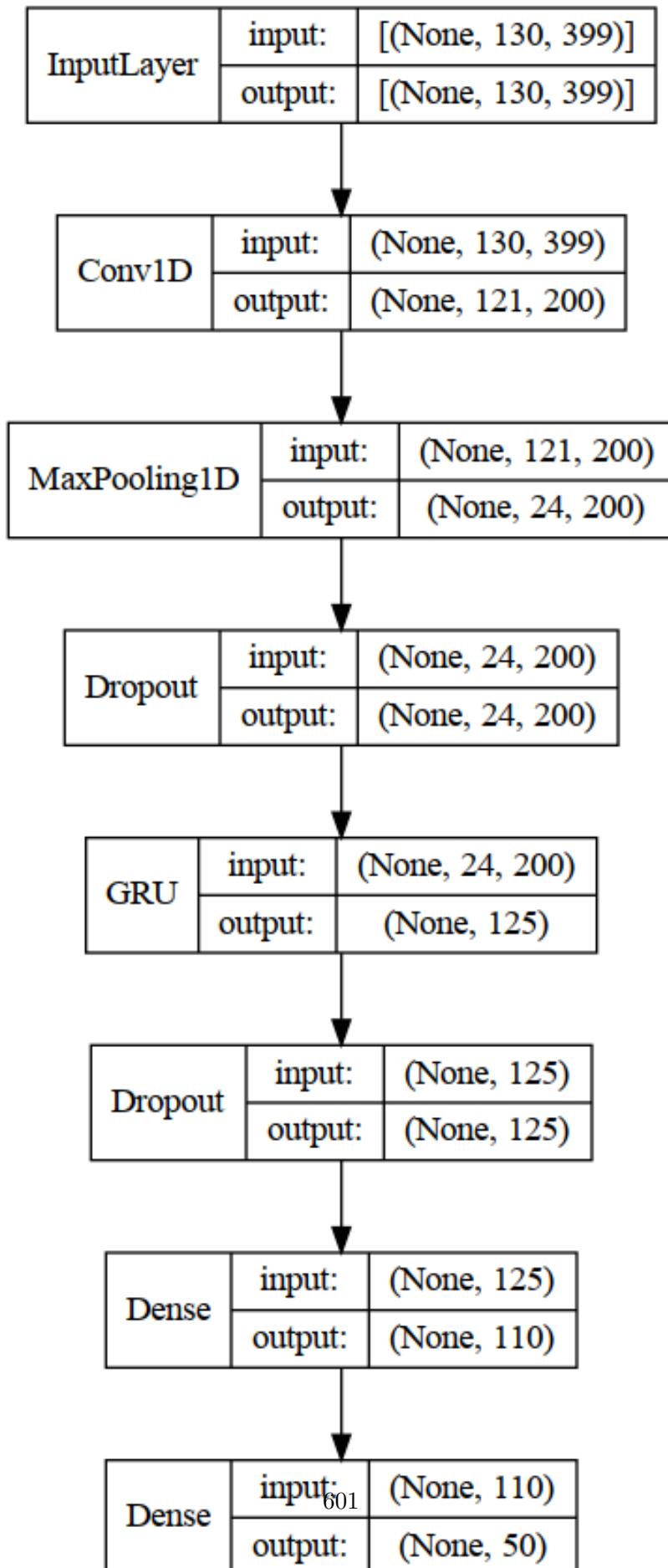
Layer (type)	Output Shape	Param #
--------------	--------------	---------

```
=====
conv1d_1 (Conv1D)           (None, 121, 200)      798200
max_pooling1d_1 (MaxPooling 1D) (None, 24, 200)    0
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
```

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

```
[197]:
```



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

11/11 [=====] - 1s 14ms/step - loss: 1.6760 - f1_score: 0.6916
```

```
[198]: [1.6759867668151855, 0.6916062831878662]
```

```
[199]: 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       0.727     1.000     0.842        8
      BACKPACK      0.667     1.000     0.800        6
      BASKETBALL     0.909     1.000     0.952       10
          BEE       0.800     0.400     0.533       10
          BELT      1.000     1.000     1.000        4
          BITE       0.778     0.875     0.824        8
      BREAKFAST      0.857     1.000     0.923        6
          CANCER     0.800     0.500     0.615        8
      CHRISTMAS     1.000     1.000     1.000        6
      CONFUSED      0.455     0.833     0.588        6
          DARK      1.000     1.000     1.000        4
          DEAF       0.429     0.500     0.462        6
      DECIDE      1.000     0.667     0.800        6
      DEMAND      0.833     0.625     0.714        8
      DEVELOP      0.500     0.333     0.400        6
      DINNER      0.889     1.000     0.941        8
          DOG       0.500     0.167     0.250        6
      DOWNSIZE      0.778     0.875     0.824        8
          DRAG      1.000     0.500     0.667        4
          EAT       1.000     0.667     0.800        6
          EDIT       0.857     1.000     0.923        6
      ELEVATOR      0.462     0.750     0.571        8
          FINE      1.000     0.500     0.667        4
          FLOAT     1.000     0.500     0.667        4
      FOREIGNER     1.000     0.667     0.800        6
          GUESS     0.778     0.875     0.824        8
      HALLOWEEN     0.800     1.000     0.889        8
      HOSPITAL      0.667     0.667     0.667        6
      HURDLE/TRIP    0.250     0.250     0.250        4
      JEWELRY      1.000     0.500     0.667        4
```

KNIGHT	0.500	0.250	0.333	4
LOCK	0.667	0.500	0.571	8
LUNCH	0.857	0.750	0.800	8
MAPLE	0.750	0.750	0.750	4
MEAT	0.600	1.000	0.750	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.700	0.875	0.778	8
NOON	0.750	0.750	0.750	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.400	0.667	0.500	6
RAZOR	0.500	0.500	0.500	4
RIVER	0.600	1.000	0.750	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.900	0.900	0.900	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.667	0.500	0.571	4
TWINS	0.700	0.875	0.778	8
WHATFOR	0.778	0.700	0.737	10
accuracy			0.725	324
macro avg	0.727	0.701	0.692	324
weighted avg	0.737	0.725	0.711	324

#### 4.7.1 1 1D-CNN + 1 GRU Trial 717

```
[122]: best_model = tuner.get_best_models(num_models=4)[3]

2023-09-17 12:40:01.255432: 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.
2023-09-17 12:40:01.330281: 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
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object: (root).optimizer._variables.7
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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.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
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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:Value in checkpoint could not be found in the restored
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```

```
object: (root).optimizer._variables.5
WARNING:tensorflow:Value in checkpoint could not be found in the restored
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```

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```

```
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See https://www.tensorflow.org/api\_docs/python/tf/train/Checkpoint#restorefor
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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
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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
```

```
[123]: best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-17 12:40:06.501632: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
84/84 [=====] - 2s 16ms/step - loss: 0.4298 - f1_score: 0.8801
```

```
[123]: [0.42978453636169434, 0.8801132440567017]
```

```
[124]: best_model.evaluate(Xval, Yval)
```

```
11/11 [=====] - 0s 17ms/step - loss: 1.3133 - f1_score: 0.6747
```

```
[124]: [1.3133209943771362, 0.674684464931488]
```

```
[125]: bestHP = tuner.get_best_hyperparameters(num_trials=3)[2]
```

```
[126]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 1D-CNN + 1 GRU Trial 717/',
    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
```

```
2023-09-17 12:40:25.055858: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x10b8efe0 initialized for platform CUDA (this does not guarantee
```

that XLA will be used). Devices:

```
2023-09-17 12:40:25.055892: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
2023-09-17 12:40:25.068139: I tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
2023-09-17 12:40:25.223115: 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: 5.1934 - f1\_score: 0.0136

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 16s 418ms/step - loss: 5.1934 -
f1_score: 0.0136 - val_loss: 5.0518 - val_f1_score: 9.6970e-04
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 4.9505 - f1_score: 0.0177
```

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 349ms/step - loss: 4.9505 -
f1_score: 0.0177 - val_loss: 4.8324 - val_f1_score: 0.0027
Epoch 3/500
28/28 [=====] - ETA: 0s - loss: 4.7677 - f1_score: 0.0158
```

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 9s 337ms/step - loss: 4.7677 -
f1_score: 0.0158 - val_loss: 4.6444 - val_f1_score: 0.0036
```

```
Epoch 4/500
28/28 [=====] - ETA: 0s - loss: 4.5975 - 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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 10s 382ms/step - loss: 4.5975 -
f1_score: 0.0153 - val_loss: 4.4959 - val_f1_score: 0.0118
Epoch 5/500
28/28 [=====] - 3s 108ms/step - loss: 4.4415 -
f1_score: 0.0269 - val_loss: 4.3333 - val_f1_score: 0.0074
Epoch 6/500
28/28 [=====] - ETA: 0s - loss: 4.2767 - f1_score: 0.0319

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 12s 441ms/step - loss: 4.2767 -
f1_score: 0.0319 - val_loss: 4.1731 - val_f1_score: 0.0142
Epoch 7/500
28/28 [=====] - ETA: 0s - loss: 4.0752 - f1_score: 0.0381

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 11s 395ms/step - loss: 4.0752 -
f1_score: 0.0381 - val_loss: 3.9538 - val_f1_score: 0.0217
Epoch 8/500
28/28 [=====] - ETA: 0s - loss: 3.8774 - f1_score: 0.0462

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 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 11s 402ms/step - loss: 3.8774 -

f1\_score: 0.0462 - val\_loss: 3.7508 - val\_f1\_score: 0.0473

Epoch 9/500

28/28 [=====] - ETA: 0s - loss: 3.7198 - f1\_score:

0.0627

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 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 10s 349ms/step - loss: 3.7198 -

f1\_score: 0.0627 - val\_loss: 3.5737 - val\_f1\_score: 0.0760

Epoch 10/500

28/28 [=====] - 3s 108ms/step - loss: 3.5331 -

f1\_score: 0.0795 - val\_loss: 3.3523 - val\_f1\_score: 0.0718

Epoch 11/500

28/28 [=====] - ETA: 0s - loss: 3.3478 - f1\_score:

0.0970

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 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 10s 376ms/step - loss: 3.3478 -

f1\_score: 0.0970 - val\_loss: 3.2125 - val\_f1\_score: 0.0995

Epoch 12/500

28/28 [=====] - ETA: 0s - loss: 3.1860 - f1\_score:

0.1355

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 717/assets

INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

```
28/28 [=====] - 11s 398ms/step - loss: 3.1860 -
f1_score: 0.1355 - val_loss: 3.0004 - val_f1_score: 0.1390
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 3.0400 - f1_score:
0.1549

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 12s 429ms/step - loss: 3.0400 -
f1_score: 0.1549 - val_loss: 2.8649 - val_f1_score: 0.1678
Epoch 14/500
28/28 [=====] - 3s 108ms/step - loss: 2.8839 -
f1_score: 0.1808 - val_loss: 2.9129 - val_f1_score: 0.1365
Epoch 15/500
28/28 [=====] - ETA: 0s - loss: 2.8065 - f1_score:
0.1963

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 369ms/step - loss: 2.8065 -
f1_score: 0.1963 - val_loss: 2.6208 - val_f1_score: 0.2361
Epoch 16/500
28/28 [=====] - 3s 108ms/step - loss: 2.6786 -
f1_score: 0.2181 - val_loss: 2.5355 - val_f1_score: 0.2303
Epoch 17/500
28/28 [=====] - ETA: 0s - loss: 2.5936 - f1_score:
0.2453

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 12s 425ms/step - loss: 2.5936 -
f1_score: 0.2453 - val_loss: 2.5061 - val_f1_score: 0.2686
Epoch 18/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.5394 - f1_score: 0.2560
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 355ms/step - loss: 2.5394 -
f1_score: 0.2560 - val_loss: 2.4443 - val_f1_score: 0.2706
Epoch 19/500
28/28 [=====] - ETA: 0s - loss: 2.4671 - f1_score: 0.2707
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 389ms/step - loss: 2.4671 -
f1_score: 0.2707 - val_loss: 2.3975 - val_f1_score: 0.2788
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 2.4070 - f1_score: 0.2890
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 398ms/step - loss: 2.4070 -
f1_score: 0.2890 - val_loss: 2.3618 - val_f1_score: 0.2954
Epoch 21/500
28/28 [=====] - ETA: 0s - loss: 2.3419 - f1_score: 0.3041
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 717/assets
```

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INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 10s 363ms/step - loss: 2.3419 -  
f1_score: 0.3041 - val_loss: 2.3048 - val_f1_score: 0.3053  
Epoch 22/500  
28/28 [=====] - ETA: 0s - loss: 2.2844 - f1_score:  
0.3193  
  
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 717/assets  
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 11s 387ms/step - loss: 2.2844 -  
f1_score: 0.3193 - val_loss: 2.2811 - val_f1_score: 0.3281  
Epoch 23/500  
28/28 [=====] - 3s 109ms/step - loss: 2.2349 -  
f1_score: 0.3378 - val_loss: 2.4029 - val_f1_score: 0.3056  
Epoch 24/500  
28/28 [=====] - ETA: 0s - loss: 2.1882 - f1_score:  
0.3469  
  
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 717/assets  
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 10s 384ms/step - loss: 2.1882 -  
f1_score: 0.3469 - val_loss: 2.1892 - val_f1_score: 0.3319  
Epoch 25/500  
28/28 [=====] - ETA: 0s - loss: 2.1546 - f1_score:  
0.3482  
  
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 717/assets  
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 10s 369ms/step - loss: 2.1546 -  
f1_score: 0.3482 - val_loss: 2.1652 - val_f1_score: 0.3409  
Epoch 26/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.0925 - f1_score: 0.3771
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 410ms/step - loss: 2.0925 - f1_score: 0.3771 - val_loss: 2.1735 - val_f1_score: 0.3458
Epoch 27/500
28/28 [=====] - 3s 108ms/step - loss: 2.0586 - f1_score: 0.3746 - val_loss: 2.1989 - val_f1_score: 0.3427
Epoch 28/500
28/28 [=====] - 3s 109ms/step - loss: 2.0349 - f1_score: 0.3854 - val_loss: 2.1914 - val_f1_score: 0.3380
Epoch 29/500
28/28 [=====] - ETA: 0s - loss: 1.9962 - f1_score: 0.4003
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 391ms/step - loss: 1.9962 - f1_score: 0.4003 - val_loss: 2.0245 - val_f1_score: 0.3771
Epoch 30/500
28/28 [=====] - 3s 108ms/step - loss: 1.9516 - f1_score: 0.4027 - val_loss: 2.1334 - val_f1_score: 0.3661
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 1.9347 - f1_score: 0.4184
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 365ms/step - loss: 1.9347 - f1_score: 0.4184 - val_loss: 2.0505 - val_f1_score: 0.3804
Epoch 32/500
```

```
28/28 [=====] - ETA: 0s - loss: 1.8891 - f1_score: 0.4427
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 378ms/step - loss: 1.8891 - f1_score: 0.4427 - val_loss: 2.0168 - val_f1_score: 0.3806
Epoch 33/500
28/28 [=====] - ETA: 0s - loss: 1.8530 - f1_score: 0.4459
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 9s 342ms/step - loss: 1.8530 - f1_score: 0.4459 - val_loss: 2.0671 - val_f1_score: 0.3817
Epoch 34/500
28/28 [=====] - ETA: 0s - loss: 1.8353 - f1_score: 0.4516
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 417ms/step - loss: 1.8353 - f1_score: 0.4516 - val_loss: 1.9743 - val_f1_score: 0.4243
Epoch 35/500
28/28 [=====] - 3s 108ms/step - loss: 1.7866 - f1_score: 0.4716 - val_loss: 1.9955 - val_f1_score: 0.4235
Epoch 36/500
28/28 [=====] - ETA: 0s - loss: 1.7556 - f1_score: 0.4642
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 404ms/step - loss: 1.7556 -
f1_score: 0.4642 - val_loss: 1.9512 - val_f1_score: 0.4444
Epoch 37/500
28/28 [=====] - 3s 108ms/step - loss: 1.7357 -
f1_score: 0.4728 - val_loss: 2.0752 - val_f1_score: 0.3954
Epoch 38/500
28/28 [=====] - ETA: 0s - loss: 1.7137 - f1_score:
0.4897

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 10s 368ms/step - loss: 1.7137 -
f1_score: 0.4897 - val_loss: 1.9028 - val_f1_score: 0.4667
Epoch 39/500
28/28 [=====] - 3s 108ms/step - loss: 1.6888 -
f1_score: 0.4917 - val_loss: 1.9634 - val_f1_score: 0.4076
Epoch 40/500
28/28 [=====] - 3s 108ms/step - loss: 1.6730 -
f1_score: 0.4978 - val_loss: 1.8549 - val_f1_score: 0.4341
Epoch 41/500
28/28 [=====] - 3s 109ms/step - loss: 1.6293 -
f1_score: 0.5044 - val_loss: 1.8431 - val_f1_score: 0.4562
Epoch 42/500
28/28 [=====] - 3s 109ms/step - loss: 1.6028 -
f1_score: 0.5024 - val_loss: 1.8194 - val_f1_score: 0.4587
Epoch 43/500
28/28 [=====] - ETA: 0s - loss: 1.5939 - f1_score:
0.5154

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
```

```
28/28 [=====] - 11s 393ms/step - loss: 1.5939 -  
f1_score: 0.5154 - val_loss: 1.8546 - val_f1_score: 0.4697  
Epoch 44/500  
28/28 [=====] - ETA: 0s - loss: 1.5390 - f1_score:  
0.5439  
  
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 717/assets  
  
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 11s 395ms/step - loss: 1.5390 -  
f1_score: 0.5439 - val_loss: 1.8468 - val_f1_score: 0.4953  
Epoch 45/500  
28/28 [=====] - 3s 109ms/step - loss: 1.5358 -  
f1_score: 0.5355 - val_loss: 1.8435 - val_f1_score: 0.4614  
Epoch 46/500  
28/28 [=====] - 3s 109ms/step - loss: 1.5045 -  
f1_score: 0.5467 - val_loss: 1.9326 - val_f1_score: 0.4542  
Epoch 47/500  
28/28 [=====] - ETA: 0s - loss: 1.4917 - f1_score:  
0.5376  
  
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 717/assets  
  
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets  
28/28 [=====] - 10s 377ms/step - loss: 1.4917 -  
f1_score: 0.5376 - val_loss: 1.7920 - val_f1_score: 0.4965  
Epoch 48/500  
28/28 [=====] - 3s 108ms/step - loss: 1.4711 -  
f1_score: 0.5543 - val_loss: 1.8674 - val_f1_score: 0.4760  
Epoch 49/500  
28/28 [=====] - 3s 109ms/step - loss: 1.4605 -  
f1_score: 0.5595 - val_loss: 1.7754 - val_f1_score: 0.4893  
Epoch 50/500  
28/28 [=====] - ETA: 0s - loss: 1.4377 - f1_score:  
0.5757  
  
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 415ms/step - loss: 1.4377 -
f1_score: 0.5757 - val_loss: 1.7543 - val_f1_score: 0.5275
Epoch 51/500
28/28 [=====] - 3s 109ms/step - loss: 1.4147 -
f1_score: 0.5814 - val_loss: 1.8130 - val_f1_score: 0.5126
Epoch 52/500
28/28 [=====] - 3s 110ms/step - loss: 1.3904 -
f1_score: 0.5891 - val_loss: 1.8554 - val_f1_score: 0.4824
Epoch 53/500
28/28 [=====] - 3s 109ms/step - loss: 1.3864 -
f1_score: 0.5802 - val_loss: 1.8024 - val_f1_score: 0.4957
Epoch 54/500
28/28 [=====] - 3s 110ms/step - loss: 1.3566 -
f1_score: 0.5841 - val_loss: 1.8547 - val_f1_score: 0.4705
Epoch 55/500
28/28 [=====] - ETA: 0s - loss: 1.3246 - f1_score:
0.5975

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 409ms/step - loss: 1.3246 -
f1_score: 0.5975 - val_loss: 1.6759 - val_f1_score: 0.5424
Epoch 56/500
28/28 [=====] - 3s 109ms/step - loss: 1.3430 -
f1_score: 0.5976 - val_loss: 1.8012 - val_f1_score: 0.4788
Epoch 57/500
28/28 [=====] - 3s 109ms/step - loss: 1.3027 -
f1_score: 0.5974 - val_loss: 1.7058 - val_f1_score: 0.4981
Epoch 58/500
28/28 [=====] - 3s 110ms/step - loss: 1.2810 -
f1_score: 0.6161 - val_loss: 1.6817 - val_f1_score: 0.5294
Epoch 59/500
28/28 [=====] - 3s 109ms/step - loss: 1.2656 -
f1_score: 0.6159 - val_loss: 1.7076 - val_f1_score: 0.5312
Epoch 60/500
28/28 [=====] - 3s 109ms/step - loss: 1.2432 -
f1_score: 0.6227 - val_loss: 1.7749 - val_f1_score: 0.5355
Epoch 61/500
28/28 [=====] - 3s 110ms/step - loss: 1.2324 -
f1_score: 0.6325 - val_loss: 1.7104 - val_f1_score: 0.5194
```

```
Epoch 62/500
28/28 [=====] - ETA: 0s - loss: 1.2375 - f1_score: 0.6235

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 12s 456ms/step - loss: 1.2375 - f1_score: 0.6235 - val_loss: 1.6372 - val_f1_score: 0.5485
Epoch 63/500
28/28 [=====] - ETA: 0s - loss: 1.1972 - f1_score: 0.6389

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 411ms/step - loss: 1.1972 - f1_score: 0.6389 - val_loss: 1.6025 - val_f1_score: 0.5525
Epoch 64/500
28/28 [=====] - 3s 109ms/step - loss: 1.2057 - f1_score: 0.6297 - val_loss: 1.7327 - val_f1_score: 0.4958
Epoch 65/500
28/28 [=====] - 3s 109ms/step - loss: 1.1790 - f1_score: 0.6472 - val_loss: 1.7075 - val_f1_score: 0.5188
Epoch 66/500
28/28 [=====] - 3s 109ms/step - loss: 1.1691 - f1_score: 0.6442 - val_loss: 1.6855 - val_f1_score: 0.5347
Epoch 67/500
28/28 [=====] - 3s 109ms/step - loss: 1.1347 - f1_score: 0.6546 - val_loss: 1.6544 - val_f1_score: 0.5339
Epoch 68/500
28/28 [=====] - 3s 109ms/step - loss: 1.1162 - f1_score: 0.6697 - val_loss: 1.6266 - val_f1_score: 0.5519
Epoch 69/500
28/28 [=====] - 3s 110ms/step - loss: 1.1028 - f1_score: 0.6699 - val_loss: 1.5856 - val_f1_score: 0.5427
Epoch 70/500
28/28 [=====] - 3s 110ms/step - loss: 1.1208 - f1_score: 0.6659 - val_loss: 1.6200 - val_f1_score: 0.5449
Epoch 71/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 1.1037 -
f1_score: 0.6677 - val_loss: 1.6232 - val_f1_score: 0.5352
Epoch 72/500
28/28 [=====] - 3s 111ms/step - loss: 1.0941 -
f1_score: 0.6673 - val_loss: 1.6192 - val_f1_score: 0.5496
Epoch 73/500
28/28 [=====] - ETA: 0s - loss: 1.0623 - f1_score:
0.6702

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 12s 425ms/step - loss: 1.0623 -
f1_score: 0.6702 - val_loss: 1.5735 - val_f1_score: 0.5566
Epoch 74/500
28/28 [=====] - 3s 109ms/step - loss: 1.0671 -
f1_score: 0.6689 - val_loss: 1.6172 - val_f1_score: 0.5418
Epoch 75/500
28/28 [=====] - 3s 111ms/step - loss: 1.0569 -
f1_score: 0.6782 - val_loss: 1.5610 - val_f1_score: 0.5542
Epoch 76/500
28/28 [=====] - 3s 114ms/step - loss: 1.0344 -
f1_score: 0.6890 - val_loss: 1.7140 - val_f1_score: 0.5247
Epoch 77/500
28/28 [=====] - ETA: 0s - loss: 1.0277 - f1_score:
0.6960

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 14s 515ms/step - loss: 1.0277 -
f1_score: 0.6960 - val_loss: 1.6490 - val_f1_score: 0.5598
Epoch 78/500
28/28 [=====] - 3s 116ms/step - loss: 1.0222 -
f1_score: 0.6957 - val_loss: 1.6227 - val_f1_score: 0.5443
Epoch 79/500
28/28 [=====] - ETA: 0s - loss: 1.0037 - f1_score:
0.6854

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 13s 468ms/step - loss: 1.0037 -
f1_score: 0.6854 - val_loss: 1.5938 - val_f1_score: 0.5717
Epoch 80/500
28/28 [=====] - 3s 109ms/step - loss: 0.9956 -
f1_score: 0.7123 - val_loss: 1.5362 - val_f1_score: 0.5666
Epoch 81/500
28/28 [=====] - 3s 119ms/step - loss: 0.9882 -
f1_score: 0.7057 - val_loss: 1.5689 - val_f1_score: 0.5497
Epoch 82/500
28/28 [=====] - 3s 112ms/step - loss: 0.9670 -
f1_score: 0.7150 - val_loss: 1.6654 - val_f1_score: 0.5514
Epoch 83/500
28/28 [=====] - 3s 109ms/step - loss: 0.9755 -
f1_score: 0.7111 - val_loss: 1.5985 - val_f1_score: 0.5337
Epoch 84/500
28/28 [=====] - 3s 109ms/step - loss: 0.9348 -
f1_score: 0.7214 - val_loss: 1.6639 - val_f1_score: 0.5656
Epoch 85/500
28/28 [=====] - 3s 110ms/step - loss: 0.9259 -
f1_score: 0.7209 - val_loss: 1.5483 - val_f1_score: 0.5574
Epoch 86/500
28/28 [=====] - ETA: 0s - loss: 0.9136 - f1_score:
0.7196
```

```
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 13s 480ms/step - loss: 0.9136 -
f1_score: 0.7196 - val_loss: 1.6493 - val_f1_score: 0.5721
Epoch 87/500
28/28 [=====] - ETA: 0s - loss: 0.9174 - f1_score:
0.7265
```

```
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 416ms/step - loss: 0.9174 -
f1_score: 0.7265 - val_loss: 1.6276 - val_f1_score: 0.5743
Epoch 88/500
28/28 [=====] - 3s 109ms/step - loss: 0.9097 -
f1_score: 0.7197 - val_loss: 1.5001 - val_f1_score: 0.5673
Epoch 89/500
28/28 [=====] - 3s 110ms/step - loss: 0.8746 -
f1_score: 0.7390 - val_loss: 1.5135 - val_f1_score: 0.5508
Epoch 90/500
28/28 [=====] - 3s 111ms/step - loss: 0.8931 -
f1_score: 0.7290 - val_loss: 1.6047 - val_f1_score: 0.5355
Epoch 91/500
28/28 [=====] - 3s 110ms/step - loss: 0.8742 -
f1_score: 0.7372 - val_loss: 1.5868 - val_f1_score: 0.5551
Epoch 92/500
28/28 [=====] - 3s 109ms/step - loss: 0.8857 -
f1_score: 0.7219 - val_loss: 1.6017 - val_f1_score: 0.5576
Epoch 93/500
28/28 [=====] - 3s 110ms/step - loss: 0.8408 -
f1_score: 0.7581 - val_loss: 1.5835 - val_f1_score: 0.5692
Epoch 94/500
28/28 [=====] - 3s 110ms/step - loss: 0.8291 -
f1_score: 0.7521 - val_loss: 1.5545 - val_f1_score: 0.5686
Epoch 95/500
28/28 [=====] - 3s 110ms/step - loss: 0.8211 -
f1_score: 0.7596 - val_loss: 1.5355 - val_f1_score: 0.5624
Epoch 96/500
28/28 [=====] - 3s 110ms/step - loss: 0.8346 -
f1_score: 0.7486 - val_loss: 1.6104 - val_f1_score: 0.5541
Epoch 97/500
28/28 [=====] - ETA: 0s - loss: 0.8320 - f1_score:
0.7523
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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 11s 421ms/step - loss: 0.8320 -
f1_score: 0.7523 - val_loss: 1.4902 - val_f1_score: 0.5995
Epoch 98/500
28/28 [=====] - 3s 109ms/step - loss: 0.8337 -
f1_score: 0.7398 - val_loss: 1.6365 - val_f1_score: 0.5528
```

Epoch 99/500  
28/28 [=====] - 3s 109ms/step - loss: 0.8177 -  
f1\_score: 0.7630 - val\_loss: 1.5609 - val\_f1\_score: 0.5565  
Epoch 100/500  
28/28 [=====] - 3s 110ms/step - loss: 0.8214 -  
f1\_score: 0.7503 - val\_loss: 1.6436 - val\_f1\_score: 0.5657  
Epoch 101/500  
28/28 [=====] - 3s 110ms/step - loss: 0.8012 -  
f1\_score: 0.7565 - val\_loss: 1.5906 - val\_f1\_score: 0.5846  
Epoch 102/500  
28/28 [=====] - 3s 110ms/step - loss: 0.8001 -  
f1\_score: 0.7634 - val\_loss: 1.6402 - val\_f1\_score: 0.5421  
Epoch 103/500  
28/28 [=====] - 3s 110ms/step - loss: 0.7740 -  
f1\_score: 0.7726 - val\_loss: 1.5419 - val\_f1\_score: 0.5709  
Epoch 104/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7498 -  
f1\_score: 0.7752 - val\_loss: 1.5095 - val\_f1\_score: 0.5779  
Epoch 105/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7661 -  
f1\_score: 0.7731 - val\_loss: 1.5496 - val\_f1\_score: 0.5733  
Epoch 106/500  
28/28 [=====] - 3s 110ms/step - loss: 0.7485 -  
f1\_score: 0.7777 - val\_loss: 1.5865 - val\_f1\_score: 0.5714  
Epoch 107/500  
28/28 [=====] - 3s 117ms/step - loss: 0.7449 -  
f1\_score: 0.7822 - val\_loss: 1.5788 - val\_f1\_score: 0.5889  
Epoch 108/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7270 -  
f1\_score: 0.7903 - val\_loss: 1.7254 - val\_f1\_score: 0.5512  
Epoch 109/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7202 -  
f1\_score: 0.7872 - val\_loss: 1.6410 - val\_f1\_score: 0.5790  
Epoch 110/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7251 -  
f1\_score: 0.7845 - val\_loss: 1.6735 - val\_f1\_score: 0.5528  
Epoch 111/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7081 -  
f1\_score: 0.8020 - val\_loss: 1.5998 - val\_f1\_score: 0.5590  
Epoch 112/500  
28/28 [=====] - 3s 112ms/step - loss: 0.7082 -  
f1\_score: 0.7916 - val\_loss: 1.5971 - val\_f1\_score: 0.5902  
Epoch 113/500  
28/28 [=====] - 3s 111ms/step - loss: 0.7040 -  
f1\_score: 0.7979 - val\_loss: 1.5602 - val\_f1\_score: 0.5912  
Epoch 114/500  
28/28 [=====] - 3s 110ms/step - loss: 0.6717 -  
f1\_score: 0.7996 - val\_loss: 1.6345 - val\_f1\_score: 0.5648

```
Epoch 115/500
28/28 [=====] - 3s 111ms/step - loss: 0.6609 -
f1_score: 0.8100 - val_loss: 1.5661 - val_f1_score: 0.5663
Epoch 116/500
28/28 [=====] - 3s 111ms/step - loss: 0.6573 -
f1_score: 0.8014 - val_loss: 1.5726 - val_f1_score: 0.5974
Epoch 117/500
28/28 [=====] - 3s 113ms/step - loss: 0.6585 -
f1_score: 0.8033 - val_loss: 1.5568 - val_f1_score: 0.5846
Epoch 118/500
28/28 [=====] - 3s 112ms/step - loss: 0.6372 -
f1_score: 0.8163 - val_loss: 1.6198 - val_f1_score: 0.5718
Epoch 119/500
28/28 [=====] - 3s 112ms/step - loss: 0.6366 -
f1_score: 0.8110 - val_loss: 1.6869 - val_f1_score: 0.5670
Epoch 120/500
28/28 [=====] - 3s 111ms/step - loss: 0.6392 -
f1_score: 0.8144 - val_loss: 1.6181 - val_f1_score: 0.5723
Epoch 121/500
28/28 [=====] - 3s 111ms/step - loss: 0.6473 -
f1_score: 0.8156 - val_loss: 1.7830 - val_f1_score: 0.5316
Epoch 122/500
28/28 [=====] - 3s 111ms/step - loss: 0.6543 -
f1_score: 0.8012 - val_loss: 1.5748 - val_f1_score: 0.5823
Epoch 123/500
28/28 [=====] - 3s 111ms/step - loss: 0.6483 -
f1_score: 0.8059 - val_loss: 1.6529 - val_f1_score: 0.5503
Epoch 124/500
28/28 [=====] - ETA: 0s - loss: 0.6197 - f1_score:
0.8161

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets

28/28 [=====] - 12s 448ms/step - loss: 0.6197 -
f1_score: 0.8161 - val_loss: 1.5815 - val_f1_score: 0.6251
Epoch 125/500
28/28 [=====] - 3s 109ms/step - loss: 0.6290 -
f1_score: 0.8236 - val_loss: 1.5312 - val_f1_score: 0.5864
Epoch 126/500
28/28 [=====] - 3s 110ms/step - loss: 0.6356 -
f1_score: 0.8131 - val_loss: 1.7088 - val_f1_score: 0.6056
Epoch 127/500
28/28 [=====] - 3s 111ms/step - loss: 0.6103 -
```

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f1_score: 0.8200 - val_loss: 1.6418 - val_f1_score: 0.5803
Epoch 128/500
28/28 [=====] - 3s 110ms/step - loss: 0.6091 -
f1_score: 0.8255 - val_loss: 1.7436 - val_f1_score: 0.5629
Epoch 129/500
28/28 [=====] - 3s 111ms/step - loss: 0.5851 -
f1_score: 0.8324 - val_loss: 1.5468 - val_f1_score: 0.5991
Epoch 130/500
28/28 [=====] - 3s 111ms/step - loss: 0.6272 -
f1_score: 0.8115 - val_loss: 1.7603 - val_f1_score: 0.5641
Epoch 131/500
28/28 [=====] - 3s 111ms/step - loss: 0.5910 -
f1_score: 0.8280 - val_loss: 1.7042 - val_f1_score: 0.5715
Epoch 132/500
28/28 [=====] - 3s 111ms/step - loss: 0.5725 -
f1_score: 0.8330 - val_loss: 1.5918 - val_f1_score: 0.5748
Epoch 133/500
28/28 [=====] - 3s 111ms/step - loss: 0.5716 -
f1_score: 0.8292 - val_loss: 1.5940 - val_f1_score: 0.5750
Epoch 134/500
28/28 [=====] - 3s 111ms/step - loss: 0.5639 -
f1_score: 0.8312 - val_loss: 1.5619 - val_f1_score: 0.5975
Epoch 135/500
28/28 [=====] - 3s 111ms/step - loss: 0.5744 -
f1_score: 0.8259 - val_loss: 1.6283 - val_f1_score: 0.5812
Epoch 136/500
28/28 [=====] - 3s 111ms/step - loss: 0.5373 -
f1_score: 0.8513 - val_loss: 1.5770 - val_f1_score: 0.5960
Epoch 137/500
28/28 [=====] - 3s 111ms/step - loss: 0.5802 -
f1_score: 0.8332 - val_loss: 1.7163 - val_f1_score: 0.5744
Epoch 138/500
28/28 [=====] - 3s 112ms/step - loss: 0.5822 -
f1_score: 0.8311 - val_loss: 1.6011 - val_f1_score: 0.5868
Epoch 139/500
28/28 [=====] - 3s 111ms/step - loss: 0.5586 -
f1_score: 0.8407 - val_loss: 1.6665 - val_f1_score: 0.5814
Epoch 140/500
28/28 [=====] - 3s 112ms/step - loss: 0.5461 -
f1_score: 0.8404 - val_loss: 1.5434 - val_f1_score: 0.5965
Epoch 141/500
28/28 [=====] - 3s 111ms/step - loss: 0.5456 -
f1_score: 0.8436 - val_loss: 1.7445 - val_f1_score: 0.5771
Epoch 142/500
28/28 [=====] - 3s 114ms/step - loss: 0.5478 -
f1_score: 0.8411 - val_loss: 1.6630 - val_f1_score: 0.5767
Epoch 143/500
28/28 [=====] - 3s 114ms/step - loss: 0.5193 -
```

```
f1_score: 0.8548 - val_loss: 1.6833 - val_f1_score: 0.5754
Epoch 144/500
28/28 [=====] - 3s 114ms/step - loss: 0.5199 -
f1_score: 0.8515 - val_loss: 1.6829 - val_f1_score: 0.5720
Epoch 145/500
28/28 [=====] - 3s 111ms/step - loss: 0.5086 -
f1_score: 0.8552 - val_loss: 1.6508 - val_f1_score: 0.5944
Epoch 146/500
28/28 [=====] - 3s 112ms/step - loss: 0.5241 -
f1_score: 0.8577 - val_loss: 1.7186 - val_f1_score: 0.5880
Epoch 147/500
28/28 [=====] - 3s 112ms/step - loss: 0.5231 -
f1_score: 0.8511 - val_loss: 1.6111 - val_f1_score: 0.5863
Epoch 148/500
28/28 [=====] - 3s 111ms/step - loss: 0.5262 -
f1_score: 0.8519 - val_loss: 1.6239 - val_f1_score: 0.5932
Epoch 149/500
28/28 [=====] - 3s 112ms/step - loss: 0.5064 -
f1_score: 0.8615 - val_loss: 1.6469 - val_f1_score: 0.5747
Epoch 150/500
28/28 [=====] - 3s 115ms/step - loss: 0.5021 -
f1_score: 0.8522 - val_loss: 1.6965 - val_f1_score: 0.5936
Epoch 151/500
28/28 [=====] - 3s 111ms/step - loss: 0.4790 -
f1_score: 0.8597 - val_loss: 1.5819 - val_f1_score: 0.5731
Epoch 152/500
28/28 [=====] - 3s 112ms/step - loss: 0.5021 -
f1_score: 0.8532 - val_loss: 1.7831 - val_f1_score: 0.5807
Epoch 153/500
28/28 [=====] - 3s 112ms/step - loss: 0.4871 -
f1_score: 0.8589 - val_loss: 1.7521 - val_f1_score: 0.6007
Epoch 154/500
28/28 [=====] - 3s 112ms/step - loss: 0.4767 -
f1_score: 0.8724 - val_loss: 1.8070 - val_f1_score: 0.5679
Epoch 155/500
28/28 [=====] - 3s 111ms/step - loss: 0.4580 -
f1_score: 0.8737 - val_loss: 1.6888 - val_f1_score: 0.5851
Epoch 156/500
28/28 [=====] - 3s 111ms/step - loss: 0.4696 -
f1_score: 0.8660 - val_loss: 1.6567 - val_f1_score: 0.5935
Epoch 157/500
28/28 [=====] - 3s 112ms/step - loss: 0.4818 -
f1_score: 0.8652 - val_loss: 1.7024 - val_f1_score: 0.5822
Epoch 158/500
28/28 [=====] - 3s 112ms/step - loss: 0.4610 -
f1_score: 0.8769 - val_loss: 1.7207 - val_f1_score: 0.5530
Epoch 159/500
28/28 [=====] - 3s 112ms/step - loss: 0.4385 -
```

```
f1_score: 0.8828 - val_loss: 1.6313 - val_f1_score: 0.5696
Epoch 160/500
28/28 [=====] - 3s 112ms/step - loss: 0.4621 -
f1_score: 0.8733 - val_loss: 1.7814 - val_f1_score: 0.5728
Epoch 161/500
28/28 [=====] - 3s 111ms/step - loss: 0.4601 -
f1_score: 0.8703 - val_loss: 1.7703 - val_f1_score: 0.5715
Epoch 162/500
28/28 [=====] - 3s 113ms/step - loss: 0.4425 -
f1_score: 0.8755 - val_loss: 1.6511 - val_f1_score: 0.6066
Epoch 163/500
28/28 [=====] - 3s 112ms/step - loss: 0.4409 -
f1_score: 0.8830 - val_loss: 1.8191 - val_f1_score: 0.5651
Epoch 164/500
28/28 [=====] - 3s 111ms/step - loss: 0.4434 -
f1_score: 0.8824 - val_loss: 1.8302 - val_f1_score: 0.5764
Epoch 165/500
28/28 [=====] - 3s 112ms/step - loss: 0.4522 -
f1_score: 0.8741 - val_loss: 1.6289 - val_f1_score: 0.5856
Epoch 166/500
28/28 [=====] - 3s 112ms/step - loss: 0.4195 -
f1_score: 0.8925 - val_loss: 1.7333 - val_f1_score: 0.5730
Epoch 167/500
28/28 [=====] - 3s 111ms/step - loss: 0.4440 -
f1_score: 0.8765 - val_loss: 1.8253 - val_f1_score: 0.5832
Epoch 168/500
28/28 [=====] - 3s 112ms/step - loss: 0.4264 -
f1_score: 0.8901 - val_loss: 1.6769 - val_f1_score: 0.5746
Epoch 169/500
28/28 [=====] - 3s 111ms/step - loss: 0.4397 -
f1_score: 0.8785 - val_loss: 1.7308 - val_f1_score: 0.6025
Epoch 170/500
28/28 [=====] - 3s 111ms/step - loss: 0.4226 -
f1_score: 0.8911 - val_loss: 1.7530 - val_f1_score: 0.5543
Epoch 171/500
28/28 [=====] - 3s 113ms/step - loss: 0.4259 -
f1_score: 0.8904 - val_loss: 1.8098 - val_f1_score: 0.5550
Epoch 172/500
28/28 [=====] - 3s 111ms/step - loss: 0.4197 -
f1_score: 0.8896 - val_loss: 1.9034 - val_f1_score: 0.5823
Epoch 173/500
28/28 [=====] - 3s 112ms/step - loss: 0.4308 -
f1_score: 0.8750 - val_loss: 1.8662 - val_f1_score: 0.5814
Epoch 174/500
28/28 [=====] - 3s 111ms/step - loss: 0.4334 -
f1_score: 0.8865 - val_loss: 1.7670 - val_f1_score: 0.5743
Epoch 175/500
28/28 [=====] - 3s 112ms/step - loss: 0.4292 -
```

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f1_score: 0.8766 - val_loss: 1.8411 - val_f1_score: 0.5964
Epoch 176/500
28/28 [=====] - 3s 111ms/step - loss: 0.4203 -
f1_score: 0.8830 - val_loss: 1.8395 - val_f1_score: 0.5993
Epoch 177/500
28/28 [=====] - 3s 111ms/step - loss: 0.4174 -
f1_score: 0.8850 - val_loss: 1.8948 - val_f1_score: 0.5659
Epoch 178/500
28/28 [=====] - 3s 111ms/step - loss: 0.4062 -
f1_score: 0.8935 - val_loss: 1.7052 - val_f1_score: 0.5802
Epoch 179/500
28/28 [=====] - 3s 111ms/step - loss: 0.4260 -
f1_score: 0.8855 - val_loss: 1.8679 - val_f1_score: 0.5597
Epoch 180/500
28/28 [=====] - 3s 112ms/step - loss: 0.3879 -
f1_score: 0.8984 - val_loss: 1.8060 - val_f1_score: 0.5819
Epoch 181/500
28/28 [=====] - 3s 112ms/step - loss: 0.4002 -
f1_score: 0.8944 - val_loss: 1.8578 - val_f1_score: 0.5816
Epoch 182/500
28/28 [=====] - 3s 111ms/step - loss: 0.3984 -
f1_score: 0.8922 - val_loss: 1.9531 - val_f1_score: 0.5709
Epoch 183/500
28/28 [=====] - 3s 112ms/step - loss: 0.3776 -
f1_score: 0.9022 - val_loss: 1.8158 - val_f1_score: 0.5840
Epoch 184/500
28/28 [=====] - 3s 111ms/step - loss: 0.4019 -
f1_score: 0.8876 - val_loss: 1.7707 - val_f1_score: 0.5768
Epoch 185/500
28/28 [=====] - 3s 112ms/step - loss: 0.3622 -
f1_score: 0.9090 - val_loss: 1.7417 - val_f1_score: 0.5747
Epoch 186/500
28/28 [=====] - 3s 114ms/step - loss: 0.3786 -
f1_score: 0.9006 - val_loss: 1.8258 - val_f1_score: 0.5869
Epoch 187/500
28/28 [=====] - 3s 113ms/step - loss: 0.3610 -
f1_score: 0.9058 - val_loss: 1.9209 - val_f1_score: 0.5771
Epoch 188/500
28/28 [=====] - 3s 112ms/step - loss: 0.3774 -
f1_score: 0.8975 - val_loss: 1.7560 - val_f1_score: 0.5967
Epoch 189/500
28/28 [=====] - 3s 112ms/step - loss: 0.3969 -
f1_score: 0.8945 - val_loss: 2.1574 - val_f1_score: 0.5723
Epoch 190/500
28/28 [=====] - 3s 111ms/step - loss: 0.4004 -
f1_score: 0.8926 - val_loss: 1.7468 - val_f1_score: 0.5952
Epoch 191/500
28/28 [=====] - 3s 112ms/step - loss: 0.3641 -
```

```
f1_score: 0.9102 - val_loss: 1.7895 - val_f1_score: 0.5943
Epoch 192/500
28/28 [=====] - 3s 112ms/step - loss: 0.3761 -
f1_score: 0.9015 - val_loss: 1.7479 - val_f1_score: 0.5890
Epoch 193/500
28/28 [=====] - 3s 112ms/step - loss: 0.3759 -
f1_score: 0.9065 - val_loss: 1.7742 - val_f1_score: 0.6064
Epoch 194/500
28/28 [=====] - 3s 112ms/step - loss: 0.3421 -
f1_score: 0.9198 - val_loss: 1.8167 - val_f1_score: 0.5569
Epoch 195/500
28/28 [=====] - 3s 112ms/step - loss: 0.3582 -
f1_score: 0.9064 - val_loss: 1.8578 - val_f1_score: 0.5822
Epoch 196/500
28/28 [=====] - 3s 112ms/step - loss: 0.3683 -
f1_score: 0.9096 - val_loss: 1.9922 - val_f1_score: 0.5725
Epoch 197/500
28/28 [=====] - 3s 112ms/step - loss: 0.3388 -
f1_score: 0.9169 - val_loss: 1.7249 - val_f1_score: 0.5938
Epoch 198/500
28/28 [=====] - 3s 112ms/step - loss: 0.3506 -
f1_score: 0.9118 - val_loss: 1.7641 - val_f1_score: 0.6020
Epoch 199/500
28/28 [=====] - 3s 115ms/step - loss: 0.3571 -
f1_score: 0.9106 - val_loss: 1.8673 - val_f1_score: 0.5973
Epoch 200/500
28/28 [=====] - 3s 115ms/step - loss: 0.3500 -
f1_score: 0.9050 - val_loss: 1.8372 - val_f1_score: 0.5641
Epoch 201/500
28/28 [=====] - 3s 117ms/step - loss: 0.3249 -
f1_score: 0.9222 - val_loss: 1.8749 - val_f1_score: 0.5906
Epoch 202/500
28/28 [=====] - 3s 113ms/step - loss: 0.3345 -
f1_score: 0.9207 - val_loss: 1.8670 - val_f1_score: 0.5812
Epoch 203/500
28/28 [=====] - 3s 112ms/step - loss: 0.3285 -
f1_score: 0.9228 - val_loss: 1.8075 - val_f1_score: 0.5920
Epoch 204/500
28/28 [=====] - 3s 112ms/step - loss: 0.3462 -
f1_score: 0.9164 - val_loss: 2.0519 - val_f1_score: 0.5699
Epoch 205/500
28/28 [=====] - 3s 111ms/step - loss: 0.3427 -
f1_score: 0.9133 - val_loss: 1.8989 - val_f1_score: 0.6037
Epoch 206/500
28/28 [=====] - 3s 112ms/step - loss: 0.3457 -
f1_score: 0.9070 - val_loss: 1.9129 - val_f1_score: 0.5689
Epoch 207/500
28/28 [=====] - 3s 112ms/step - loss: 0.3773 -
```

```
f1_score: 0.9043 - val_loss: 2.0760 - val_f1_score: 0.5677
Epoch 208/500
28/28 [=====] - 3s 112ms/step - loss: 0.3314 -
f1_score: 0.9123 - val_loss: 1.8398 - val_f1_score: 0.5947
Epoch 209/500
28/28 [=====] - 3s 112ms/step - loss: 0.3418 -
f1_score: 0.9166 - val_loss: 1.9915 - val_f1_score: 0.5406
Epoch 210/500
28/28 [=====] - 3s 112ms/step - loss: 0.3435 -
f1_score: 0.9094 - val_loss: 1.8820 - val_f1_score: 0.5678
Epoch 211/500
28/28 [=====] - 3s 112ms/step - loss: 0.3271 -
f1_score: 0.9150 - val_loss: 2.0242 - val_f1_score: 0.5837
Epoch 212/500
28/28 [=====] - 3s 113ms/step - loss: 0.3282 -
f1_score: 0.9191 - val_loss: 1.9387 - val_f1_score: 0.5726
Epoch 213/500
28/28 [=====] - 3s 112ms/step - loss: 0.3288 -
f1_score: 0.9156 - val_loss: 1.8696 - val_f1_score: 0.5893
Epoch 214/500
28/28 [=====] - 3s 114ms/step - loss: 0.3203 -
f1_score: 0.9200 - val_loss: 1.9974 - val_f1_score: 0.5694
Epoch 215/500
28/28 [=====] - 3s 112ms/step - loss: 0.3168 -
f1_score: 0.9229 - val_loss: 1.9492 - val_f1_score: 0.5896
Epoch 216/500
28/28 [=====] - 3s 112ms/step - loss: 0.3259 -
f1_score: 0.9194 - val_loss: 1.9630 - val_f1_score: 0.5770
Epoch 217/500
28/28 [=====] - 3s 112ms/step - loss: 0.2932 -
f1_score: 0.9319 - val_loss: 2.0013 - val_f1_score: 0.5709
Epoch 218/500
28/28 [=====] - 3s 112ms/step - loss: 0.3077 -
f1_score: 0.9230 - val_loss: 1.9991 - val_f1_score: 0.5827
Epoch 219/500
28/28 [=====] - 3s 112ms/step - loss: 0.2891 -
f1_score: 0.9321 - val_loss: 1.9978 - val_f1_score: 0.5659
Epoch 220/500
28/28 [=====] - 3s 112ms/step - loss: 0.2925 -
f1_score: 0.9284 - val_loss: 1.9491 - val_f1_score: 0.5705
Epoch 221/500
28/28 [=====] - 3s 112ms/step - loss: 0.3030 -
f1_score: 0.9253 - val_loss: 1.9671 - val_f1_score: 0.5797
Epoch 222/500
28/28 [=====] - 3s 114ms/step - loss: 0.3157 -
f1_score: 0.9224 - val_loss: 1.8421 - val_f1_score: 0.6103
Epoch 223/500
28/28 [=====] - 3s 112ms/step - loss: 0.2975 -
```

```
f1_score: 0.9271 - val_loss: 1.9131 - val_f1_score: 0.5987
Epoch 224/500
28/28 [=====] - 3s 112ms/step - loss: 0.2879 -
f1_score: 0.9312 - val_loss: 2.0110 - val_f1_score: 0.5869
Epoch 225/500
28/28 [=====] - 3s 112ms/step - loss: 0.3006 -
f1_score: 0.9263 - val_loss: 1.9719 - val_f1_score: 0.5679
Epoch 226/500
28/28 [=====] - 3s 112ms/step - loss: 0.3060 -
f1_score: 0.9169 - val_loss: 2.1262 - val_f1_score: 0.5833
Epoch 227/500
28/28 [=====] - 3s 113ms/step - loss: 0.3110 -
f1_score: 0.9256 - val_loss: 1.9861 - val_f1_score: 0.5868
Epoch 228/500
28/28 [=====] - 3s 112ms/step - loss: 0.3068 -
f1_score: 0.9217 - val_loss: 2.0265 - val_f1_score: 0.5855
Epoch 229/500
28/28 [=====] - 3s 112ms/step - loss: 0.2920 -
f1_score: 0.9273 - val_loss: 1.8808 - val_f1_score: 0.5819
Epoch 230/500
28/28 [=====] - 3s 113ms/step - loss: 0.2949 -
f1_score: 0.9245 - val_loss: 2.0214 - val_f1_score: 0.5807
Epoch 231/500
28/28 [=====] - 3s 112ms/step - loss: 0.2935 -
f1_score: 0.9238 - val_loss: 1.9347 - val_f1_score: 0.5849
Epoch 232/500
28/28 [=====] - 3s 112ms/step - loss: 0.2804 -
f1_score: 0.9349 - val_loss: 2.0126 - val_f1_score: 0.5898
Epoch 233/500
28/28 [=====] - 3s 112ms/step - loss: 0.3155 -
f1_score: 0.9204 - val_loss: 1.9180 - val_f1_score: 0.6015
Epoch 234/500
28/28 [=====] - 3s 112ms/step - loss: 0.2936 -
f1_score: 0.9275 - val_loss: 2.1617 - val_f1_score: 0.5974
Epoch 235/500
28/28 [=====] - 3s 112ms/step - loss: 0.3026 -
f1_score: 0.9262 - val_loss: 2.0826 - val_f1_score: 0.5837
Epoch 236/500
28/28 [=====] - 3s 112ms/step - loss: 0.2835 -
f1_score: 0.9329 - val_loss: 2.0499 - val_f1_score: 0.5869
Epoch 237/500
28/28 [=====] - 3s 112ms/step - loss: 0.2928 -
f1_score: 0.9275 - val_loss: 2.0205 - val_f1_score: 0.5781
Epoch 238/500
28/28 [=====] - 3s 112ms/step - loss: 0.2819 -
f1_score: 0.9302 - val_loss: 1.9928 - val_f1_score: 0.5710
Epoch 239/500
28/28 [=====] - 3s 112ms/step - loss: 0.3191 -
```

```
f1_score: 0.9149 - val_loss: 1.9710 - val_f1_score: 0.5989
Epoch 240/500
28/28 [=====] - 3s 112ms/step - loss: 0.2929 -
f1_score: 0.9342 - val_loss: 2.0457 - val_f1_score: 0.5888
Epoch 241/500
28/28 [=====] - 3s 112ms/step - loss: 0.2615 -
f1_score: 0.9420 - val_loss: 2.0965 - val_f1_score: 0.5788
Epoch 242/500
28/28 [=====] - 3s 112ms/step - loss: 0.2724 -
f1_score: 0.9362 - val_loss: 2.0398 - val_f1_score: 0.6114
Epoch 243/500
28/28 [=====] - 3s 112ms/step - loss: 0.2884 -
f1_score: 0.9342 - val_loss: 1.9566 - val_f1_score: 0.5933
Epoch 244/500
28/28 [=====] - 3s 112ms/step - loss: 0.2859 -
f1_score: 0.9331 - val_loss: 2.0634 - val_f1_score: 0.5748
Epoch 245/500
28/28 [=====] - 3s 112ms/step - loss: 0.2939 -
f1_score: 0.9226 - val_loss: 1.9350 - val_f1_score: 0.5974
Epoch 246/500
28/28 [=====] - 3s 113ms/step - loss: 0.2984 -
f1_score: 0.9237 - val_loss: 1.8967 - val_f1_score: 0.5755
Epoch 247/500
28/28 [=====] - 3s 112ms/step - loss: 0.2587 -
f1_score: 0.9354 - val_loss: 2.0547 - val_f1_score: 0.5713
Epoch 248/500
28/28 [=====] - 3s 112ms/step - loss: 0.2319 -
f1_score: 0.9502 - val_loss: 2.0061 - val_f1_score: 0.5824
Epoch 249/500
28/28 [=====] - 3s 115ms/step - loss: 0.2601 -
f1_score: 0.9387 - val_loss: 2.1156 - val_f1_score: 0.5695
Epoch 250/500
28/28 [=====] - 3s 111ms/step - loss: 0.2674 -
f1_score: 0.9365 - val_loss: 2.1889 - val_f1_score: 0.5750
Epoch 251/500
28/28 [=====] - 3s 111ms/step - loss: 0.2523 -
f1_score: 0.9451 - val_loss: 2.0519 - val_f1_score: 0.5725
Epoch 252/500
28/28 [=====] - 3s 111ms/step - loss: 0.2513 -
f1_score: 0.9357 - val_loss: 2.0096 - val_f1_score: 0.5765
Epoch 253/500
28/28 [=====] - 3s 112ms/step - loss: 0.2752 -
f1_score: 0.9309 - val_loss: 1.9654 - val_f1_score: 0.5856
Epoch 254/500
28/28 [=====] - 3s 112ms/step - loss: 0.2500 -
f1_score: 0.9422 - val_loss: 1.9990 - val_f1_score: 0.6019
Epoch 255/500
28/28 [=====] - 3s 112ms/step - loss: 0.2632 -
```

```
f1_score: 0.9361 - val_loss: 2.1115 - val_f1_score: 0.6174
Epoch 256/500
28/28 [=====] - 3s 114ms/step - loss: 0.2498 -
f1_score: 0.9402 - val_loss: 2.0206 - val_f1_score: 0.5865
Epoch 257/500
28/28 [=====] - 3s 115ms/step - loss: 0.2496 -
f1_score: 0.9395 - val_loss: 1.9159 - val_f1_score: 0.6069
Epoch 258/500
28/28 [=====] - 4s 128ms/step - loss: 0.2816 -
f1_score: 0.9319 - val_loss: 2.0622 - val_f1_score: 0.5734
Epoch 259/500
28/28 [=====] - 3s 115ms/step - loss: 0.2543 -
f1_score: 0.9386 - val_loss: 1.9840 - val_f1_score: 0.5893
Epoch 260/500
28/28 [=====] - 3s 112ms/step - loss: 0.2365 -
f1_score: 0.9438 - val_loss: 2.0909 - val_f1_score: 0.5712
Epoch 261/500
28/28 [=====] - 3s 113ms/step - loss: 0.2520 -
f1_score: 0.9355 - val_loss: 2.0499 - val_f1_score: 0.5914
Epoch 262/500
28/28 [=====] - 3s 112ms/step - loss: 0.2855 -
f1_score: 0.9305 - val_loss: 2.1687 - val_f1_score: 0.6237
Epoch 263/500
28/28 [=====] - 3s 113ms/step - loss: 0.2467 -
f1_score: 0.9399 - val_loss: 2.0420 - val_f1_score: 0.5871
Epoch 264/500
28/28 [=====] - 3s 112ms/step - loss: 0.2582 -
f1_score: 0.9349 - val_loss: 2.0561 - val_f1_score: 0.6184
Epoch 265/500
28/28 [=====] - 3s 112ms/step - loss: 0.2666 -
f1_score: 0.9335 - val_loss: 2.1560 - val_f1_score: 0.5961
Epoch 266/500
28/28 [=====] - 3s 111ms/step - loss: 0.2611 -
f1_score: 0.9410 - val_loss: 2.2805 - val_f1_score: 0.5790
Epoch 267/500
28/28 [=====] - 3s 112ms/step - loss: 0.2500 -
f1_score: 0.9373 - val_loss: 2.0534 - val_f1_score: 0.5726
Epoch 268/500
28/28 [=====] - 3s 111ms/step - loss: 0.2479 -
f1_score: 0.9392 - val_loss: 2.0840 - val_f1_score: 0.5642
Epoch 269/500
28/28 [=====] - 3s 113ms/step - loss: 0.2497 -
f1_score: 0.9404 - val_loss: 2.0776 - val_f1_score: 0.5749
Epoch 270/500
28/28 [=====] - 3s 112ms/step - loss: 0.2337 -
f1_score: 0.9509 - val_loss: 2.1834 - val_f1_score: 0.5614
Epoch 271/500
28/28 [=====] - 3s 112ms/step - loss: 0.2461 -
```

```
f1_score: 0.9414 - val_loss: 2.1656 - val_f1_score: 0.5676
Epoch 272/500
28/28 [=====] - 3s 112ms/step - loss: 0.2419 -
f1_score: 0.9413 - val_loss: 2.1281 - val_f1_score: 0.5800
Epoch 273/500
28/28 [=====] - 3s 112ms/step - loss: 0.2430 -
f1_score: 0.9464 - val_loss: 2.0694 - val_f1_score: 0.5814
Epoch 274/500
28/28 [=====] - 3s 112ms/step - loss: 0.2316 -
f1_score: 0.9459 - val_loss: 2.2000 - val_f1_score: 0.5654
Epoch 275/500
28/28 [=====] - 3s 112ms/step - loss: 0.2467 -
f1_score: 0.9431 - val_loss: 1.9938 - val_f1_score: 0.5971
Epoch 276/500
28/28 [=====] - 3s 112ms/step - loss: 0.2482 -
f1_score: 0.9403 - val_loss: 2.2432 - val_f1_score: 0.5795
Epoch 277/500
28/28 [=====] - 3s 112ms/step - loss: 0.2349 -
f1_score: 0.9465 - val_loss: 2.1626 - val_f1_score: 0.5886
Epoch 278/500
28/28 [=====] - 3s 111ms/step - loss: 0.2508 -
f1_score: 0.9390 - val_loss: 2.1646 - val_f1_score: 0.5684
Epoch 279/500
28/28 [=====] - 3s 112ms/step - loss: 0.2371 -
f1_score: 0.9449 - val_loss: 2.1687 - val_f1_score: 0.5854
Epoch 280/500
28/28 [=====] - 3s 112ms/step - loss: 0.2439 -
f1_score: 0.9431 - val_loss: 2.2463 - val_f1_score: 0.5786
Epoch 281/500
28/28 [=====] - 3s 112ms/step - loss: 0.2259 -
f1_score: 0.9469 - val_loss: 2.1484 - val_f1_score: 0.5791
Epoch 282/500
28/28 [=====] - 3s 112ms/step - loss: 0.2312 -
f1_score: 0.9485 - val_loss: 2.0839 - val_f1_score: 0.5860
Epoch 283/500
28/28 [=====] - 3s 112ms/step - loss: 0.2299 -
f1_score: 0.9474 - val_loss: 2.1975 - val_f1_score: 0.6003
Epoch 284/500
28/28 [=====] - 3s 112ms/step - loss: 0.2332 -
f1_score: 0.9454 - val_loss: 2.3637 - val_f1_score: 0.5797
Epoch 285/500
28/28 [=====] - 3s 112ms/step - loss: 0.2517 -
f1_score: 0.9351 - val_loss: 2.3396 - val_f1_score: 0.5784
Epoch 286/500
28/28 [=====] - 3s 112ms/step - loss: 0.2225 -
f1_score: 0.9508 - val_loss: 2.2965 - val_f1_score: 0.5630
Epoch 287/500
28/28 [=====] - 3s 112ms/step - loss: 0.2270 -
```

```
f1_score: 0.9423 - val_loss: 2.2606 - val_f1_score: 0.5688
Epoch 288/500
28/28 [=====] - 3s 113ms/step - loss: 0.2230 -
f1_score: 0.9516 - val_loss: 2.2223 - val_f1_score: 0.5861
Epoch 289/500
28/28 [=====] - 3s 112ms/step - loss: 0.2329 -
f1_score: 0.9483 - val_loss: 2.2601 - val_f1_score: 0.5807
Epoch 290/500
28/28 [=====] - 3s 112ms/step - loss: 0.2200 -
f1_score: 0.9465 - val_loss: 2.1210 - val_f1_score: 0.6076
Epoch 291/500
28/28 [=====] - 3s 113ms/step - loss: 0.2297 -
f1_score: 0.9366 - val_loss: 2.0473 - val_f1_score: 0.5823
Epoch 292/500
28/28 [=====] - 3s 113ms/step - loss: 0.2099 -
f1_score: 0.9511 - val_loss: 2.3095 - val_f1_score: 0.5645
Epoch 293/500
28/28 [=====] - 3s 113ms/step - loss: 0.2489 -
f1_score: 0.9392 - val_loss: 2.2015 - val_f1_score: 0.5729
Epoch 294/500
28/28 [=====] - 3s 111ms/step - loss: 0.2227 -
f1_score: 0.9469 - val_loss: 2.0949 - val_f1_score: 0.5857
Epoch 295/500
28/28 [=====] - 3s 113ms/step - loss: 0.2181 -
f1_score: 0.9531 - val_loss: 2.2526 - val_f1_score: 0.5704
Epoch 296/500
28/28 [=====] - 3s 112ms/step - loss: 0.2269 -
f1_score: 0.9443 - val_loss: 2.1771 - val_f1_score: 0.5737
Epoch 297/500
28/28 [=====] - 3s 112ms/step - loss: 0.2276 -
f1_score: 0.9450 - val_loss: 2.3738 - val_f1_score: 0.5753
Epoch 298/500
28/28 [=====] - 3s 113ms/step - loss: 0.2421 -
f1_score: 0.9462 - val_loss: 2.2961 - val_f1_score: 0.5727
Epoch 299/500
28/28 [=====] - 3s 114ms/step - loss: 0.2060 -
f1_score: 0.9546 - val_loss: 2.1552 - val_f1_score: 0.6020
Epoch 300/500
28/28 [=====] - 3s 114ms/step - loss: 0.2229 -
f1_score: 0.9504 - val_loss: 2.1068 - val_f1_score: 0.5830
Epoch 301/500
28/28 [=====] - 3s 114ms/step - loss: 0.2509 -
f1_score: 0.9381 - val_loss: 2.2045 - val_f1_score: 0.5493
Epoch 302/500
28/28 [=====] - 3s 112ms/step - loss: 0.2092 -
f1_score: 0.9515 - val_loss: 2.2030 - val_f1_score: 0.6094
Epoch 303/500
28/28 [=====] - 3s 113ms/step - loss: 0.2150 -
```

```
f1_score: 0.9520 - val_loss: 2.0315 - val_f1_score: 0.5795
Epoch 304/500
28/28 [=====] - 3s 112ms/step - loss: 0.2063 -
f1_score: 0.9551 - val_loss: 2.0562 - val_f1_score: 0.6043
Epoch 305/500
28/28 [=====] - 3s 112ms/step - loss: 0.2270 -
f1_score: 0.9380 - val_loss: 2.1196 - val_f1_score: 0.5980
Epoch 306/500
28/28 [=====] - 3s 112ms/step - loss: 0.2324 -
f1_score: 0.9460 - val_loss: 2.3610 - val_f1_score: 0.5717
Epoch 307/500
28/28 [=====] - 3s 113ms/step - loss: 0.2380 -
f1_score: 0.9467 - val_loss: 2.2991 - val_f1_score: 0.5680
Epoch 308/500
28/28 [=====] - 3s 112ms/step - loss: 0.2135 -
f1_score: 0.9514 - val_loss: 2.0360 - val_f1_score: 0.6035
Epoch 309/500
28/28 [=====] - 3s 112ms/step - loss: 0.2094 -
f1_score: 0.9467 - val_loss: 2.1961 - val_f1_score: 0.5768
Epoch 310/500
28/28 [=====] - 3s 112ms/step - loss: 0.2081 -
f1_score: 0.9534 - val_loss: 2.1546 - val_f1_score: 0.5795
Epoch 311/500
28/28 [=====] - 3s 112ms/step - loss: 0.2116 -
f1_score: 0.9500 - val_loss: 2.2053 - val_f1_score: 0.5793
Epoch 312/500
28/28 [=====] - 3s 113ms/step - loss: 0.2064 -
f1_score: 0.9574 - val_loss: 2.1728 - val_f1_score: 0.5936
Epoch 313/500
28/28 [=====] - 3s 113ms/step - loss: 0.1914 -
f1_score: 0.9560 - val_loss: 2.5322 - val_f1_score: 0.5366
Epoch 314/500
28/28 [=====] - 3s 116ms/step - loss: 0.2340 -
f1_score: 0.9449 - val_loss: 2.1004 - val_f1_score: 0.6217
Epoch 315/500
28/28 [=====] - 3s 115ms/step - loss: 0.2055 -
f1_score: 0.9517 - val_loss: 2.1496 - val_f1_score: 0.5958
Epoch 316/500
28/28 [=====] - 3s 115ms/step - loss: 0.1952 -
f1_score: 0.9550 - val_loss: 2.1823 - val_f1_score: 0.5898
Epoch 317/500
28/28 [=====] - 3s 112ms/step - loss: 0.1920 -
f1_score: 0.9586 - val_loss: 2.1983 - val_f1_score: 0.5791
Epoch 318/500
28/28 [=====] - 3s 112ms/step - loss: 0.2035 -
f1_score: 0.9509 - val_loss: 2.2444 - val_f1_score: 0.6041
Epoch 319/500
28/28 [=====] - 3s 113ms/step - loss: 0.1854 -
```

```
f1_score: 0.9581 - val_loss: 2.2953 - val_f1_score: 0.6049
Epoch 320/500
28/28 [=====] - 3s 115ms/step - loss: 0.2117 -
f1_score: 0.9511 - val_loss: 2.2585 - val_f1_score: 0.5851
Epoch 321/500
28/28 [=====] - 3s 113ms/step - loss: 0.1788 -
f1_score: 0.9645 - val_loss: 2.3568 - val_f1_score: 0.5756
Epoch 322/500
28/28 [=====] - 3s 112ms/step - loss: 0.1997 -
f1_score: 0.9532 - val_loss: 2.1883 - val_f1_score: 0.5848
Epoch 323/500
28/28 [=====] - 3s 112ms/step - loss: 0.1863 -
f1_score: 0.9589 - val_loss: 2.2391 - val_f1_score: 0.5899
Epoch 324/500
28/28 [=====] - 3s 113ms/step - loss: 0.1887 -
f1_score: 0.9593 - val_loss: 2.1800 - val_f1_score: 0.5878
Epoch 325/500
28/28 [=====] - 3s 112ms/step - loss: 0.1902 -
f1_score: 0.9578 - val_loss: 2.1647 - val_f1_score: 0.5951
Epoch 326/500
28/28 [=====] - 3s 112ms/step - loss: 0.2098 -
f1_score: 0.9550 - val_loss: 2.3121 - val_f1_score: 0.5767
Epoch 327/500
28/28 [=====] - 3s 112ms/step - loss: 0.2000 -
f1_score: 0.9577 - val_loss: 2.3827 - val_f1_score: 0.5939
Epoch 328/500
28/28 [=====] - 3s 113ms/step - loss: 0.2009 -
f1_score: 0.9565 - val_loss: 2.1672 - val_f1_score: 0.5831
Epoch 329/500
28/28 [=====] - 3s 112ms/step - loss: 0.1761 -
f1_score: 0.9646 - val_loss: 2.2783 - val_f1_score: 0.5574
Epoch 330/500
28/28 [=====] - 3s 112ms/step - loss: 0.2007 -
f1_score: 0.9508 - val_loss: 2.2747 - val_f1_score: 0.5947
Epoch 331/500
28/28 [=====] - 3s 111ms/step - loss: 0.1969 -
f1_score: 0.9564 - val_loss: 2.2960 - val_f1_score: 0.5929
Epoch 332/500
28/28 [=====] - 3s 111ms/step - loss: 0.1923 -
f1_score: 0.9607 - val_loss: 2.3675 - val_f1_score: 0.5927
Epoch 333/500
28/28 [=====] - 3s 112ms/step - loss: 0.1811 -
f1_score: 0.9625 - val_loss: 2.2322 - val_f1_score: 0.6083
Epoch 334/500
28/28 [=====] - 3s 112ms/step - loss: 0.2033 -
f1_score: 0.9557 - val_loss: 2.3445 - val_f1_score: 0.5897
Epoch 335/500
28/28 [=====] - 3s 111ms/step - loss: 0.1954 -
```

```
f1_score: 0.9576 - val_loss: 2.0776 - val_f1_score: 0.5996
Epoch 336/500
28/28 [=====] - 3s 112ms/step - loss: 0.1963 -
f1_score: 0.9588 - val_loss: 2.2472 - val_f1_score: 0.5900
Epoch 337/500
28/28 [=====] - 3s 112ms/step - loss: 0.1959 -
f1_score: 0.9558 - val_loss: 2.4459 - val_f1_score: 0.5781
Epoch 338/500
28/28 [=====] - 3s 112ms/step - loss: 0.2022 -
f1_score: 0.9522 - val_loss: 2.3384 - val_f1_score: 0.5887
Epoch 339/500
28/28 [=====] - 3s 114ms/step - loss: 0.1907 -
f1_score: 0.9540 - val_loss: 2.3756 - val_f1_score: 0.5875
Epoch 340/500
28/28 [=====] - 3s 112ms/step - loss: 0.1856 -
f1_score: 0.9611 - val_loss: 2.3844 - val_f1_score: 0.5770
Epoch 341/500
28/28 [=====] - 3s 112ms/step - loss: 0.1991 -
f1_score: 0.9530 - val_loss: 2.3699 - val_f1_score: 0.5629
Epoch 342/500
28/28 [=====] - 3s 112ms/step - loss: 0.1788 -
f1_score: 0.9646 - val_loss: 2.2460 - val_f1_score: 0.5798
Epoch 343/500
28/28 [=====] - 3s 112ms/step - loss: 0.1912 -
f1_score: 0.9571 - val_loss: 2.5405 - val_f1_score: 0.5588
Epoch 344/500
28/28 [=====] - 3s 112ms/step - loss: 0.1889 -
f1_score: 0.9556 - val_loss: 2.3381 - val_f1_score: 0.5826
Epoch 345/500
28/28 [=====] - 3s 112ms/step - loss: 0.1763 -
f1_score: 0.9615 - val_loss: 2.4205 - val_f1_score: 0.5871
Epoch 346/500
28/28 [=====] - 3s 112ms/step - loss: 0.1904 -
f1_score: 0.9576 - val_loss: 2.5224 - val_f1_score: 0.5814
Epoch 347/500
28/28 [=====] - 3s 112ms/step - loss: 0.1965 -
f1_score: 0.9569 - val_loss: 2.2741 - val_f1_score: 0.6057
Epoch 348/500
28/28 [=====] - 3s 112ms/step - loss: 0.1853 -
f1_score: 0.9584 - val_loss: 2.3632 - val_f1_score: 0.5899
Epoch 349/500
28/28 [=====] - 3s 114ms/step - loss: 0.1954 -
f1_score: 0.9552 - val_loss: 2.4574 - val_f1_score: 0.5688
Epoch 350/500
28/28 [=====] - 3s 112ms/step - loss: 0.1970 -
f1_score: 0.9535 - val_loss: 2.3519 - val_f1_score: 0.5658
Epoch 351/500
28/28 [=====] - 3s 113ms/step - loss: 0.2082 -
```

```
f1_score: 0.9541 - val_loss: 2.4155 - val_f1_score: 0.5719
Epoch 352/500
28/28 [=====] - 3s 112ms/step - loss: 0.1747 -
f1_score: 0.9624 - val_loss: 2.5099 - val_f1_score: 0.5565
Epoch 353/500
28/28 [=====] - 3s 112ms/step - loss: 0.1864 -
f1_score: 0.9588 - val_loss: 2.2623 - val_f1_score: 0.5979
Epoch 354/500
28/28 [=====] - 3s 113ms/step - loss: 0.1812 -
f1_score: 0.9595 - val_loss: 2.4378 - val_f1_score: 0.5681
Epoch 355/500
28/28 [=====] - 3s 112ms/step - loss: 0.1816 -
f1_score: 0.9668 - val_loss: 2.4260 - val_f1_score: 0.5617
Epoch 356/500
28/28 [=====] - 3s 113ms/step - loss: 0.1973 -
f1_score: 0.9518 - val_loss: 2.3158 - val_f1_score: 0.5795
Epoch 357/500
28/28 [=====] - 3s 112ms/step - loss: 0.1760 -
f1_score: 0.9637 - val_loss: 2.3843 - val_f1_score: 0.5768
Epoch 358/500
28/28 [=====] - 3s 112ms/step - loss: 0.1621 -
f1_score: 0.9671 - val_loss: 2.4295 - val_f1_score: 0.5635
Epoch 359/500
28/28 [=====] - 3s 112ms/step - loss: 0.1972 -
f1_score: 0.9579 - val_loss: 2.5366 - val_f1_score: 0.5601
Epoch 360/500
28/28 [=====] - 3s 112ms/step - loss: 0.2258 -
f1_score: 0.9434 - val_loss: 2.3879 - val_f1_score: 0.5783
Epoch 361/500
28/28 [=====] - 3s 112ms/step - loss: 0.1878 -
f1_score: 0.9597 - val_loss: 2.4138 - val_f1_score: 0.5866
Epoch 362/500
28/28 [=====] - 3s 112ms/step - loss: 0.1901 -
f1_score: 0.9603 - val_loss: 2.4617 - val_f1_score: 0.5894
Epoch 363/500
28/28 [=====] - 3s 112ms/step - loss: 0.1690 -
f1_score: 0.9630 - val_loss: 2.3695 - val_f1_score: 0.6034
Epoch 364/500
28/28 [=====] - 3s 112ms/step - loss: 0.1628 -
f1_score: 0.9644 - val_loss: 2.1456 - val_f1_score: 0.5915
Epoch 365/500
28/28 [=====] - 3s 112ms/step - loss: 0.1749 -
f1_score: 0.9629 - val_loss: 2.2698 - val_f1_score: 0.5709
Epoch 366/500
28/28 [=====] - 3s 115ms/step - loss: 0.1792 -
f1_score: 0.9605 - val_loss: 2.2057 - val_f1_score: 0.5972
Epoch 367/500
28/28 [=====] - 3s 115ms/step - loss: 0.1556 -
```

```
f1_score: 0.9687 - val_loss: 2.2410 - val_f1_score: 0.5733
Epoch 368/500
28/28 [=====] - 3s 112ms/step - loss: 0.1769 -
f1_score: 0.9626 - val_loss: 2.2302 - val_f1_score: 0.5866
Epoch 369/500
28/28 [=====] - 3s 113ms/step - loss: 0.1759 -
f1_score: 0.9658 - val_loss: 2.4194 - val_f1_score: 0.5826
Epoch 370/500
28/28 [=====] - 3s 112ms/step - loss: 0.1934 -
f1_score: 0.9591 - val_loss: 2.3620 - val_f1_score: 0.5933
Epoch 371/500
28/28 [=====] - 3s 115ms/step - loss: 0.1734 -
f1_score: 0.9608 - val_loss: 2.2105 - val_f1_score: 0.5937
Epoch 372/500
28/28 [=====] - 3s 115ms/step - loss: 0.1751 -
f1_score: 0.9580 - val_loss: 2.4027 - val_f1_score: 0.5846
Epoch 373/500
28/28 [=====] - 3s 115ms/step - loss: 0.1968 -
f1_score: 0.9526 - val_loss: 2.3629 - val_f1_score: 0.5824
Epoch 374/500
28/28 [=====] - 3s 112ms/step - loss: 0.1914 -
f1_score: 0.9546 - val_loss: 2.3267 - val_f1_score: 0.5849
Epoch 375/500
28/28 [=====] - 3s 112ms/step - loss: 0.1711 -
f1_score: 0.9627 - val_loss: 2.2356 - val_f1_score: 0.5894
Epoch 376/500
28/28 [=====] - 3s 113ms/step - loss: 0.1570 -
f1_score: 0.9717 - val_loss: 2.6354 - val_f1_score: 0.5190
Epoch 377/500
28/28 [=====] - 3s 112ms/step - loss: 0.1763 -
f1_score: 0.9603 - val_loss: 2.4030 - val_f1_score: 0.6039
Epoch 378/500
28/28 [=====] - 3s 112ms/step - loss: 0.1824 -
f1_score: 0.9590 - val_loss: 2.2504 - val_f1_score: 0.6023
Epoch 379/500
28/28 [=====] - 3s 113ms/step - loss: 0.1846 -
f1_score: 0.9580 - val_loss: 2.4251 - val_f1_score: 0.5977
Epoch 380/500
28/28 [=====] - 3s 112ms/step - loss: 0.1693 -
f1_score: 0.9665 - val_loss: 2.5284 - val_f1_score: 0.5822
Epoch 381/500
28/28 [=====] - 3s 113ms/step - loss: 0.1857 -
f1_score: 0.9559 - val_loss: 2.3953 - val_f1_score: 0.5802
Epoch 382/500
28/28 [=====] - 3s 112ms/step - loss: 0.1653 -
f1_score: 0.9664 - val_loss: 2.3520 - val_f1_score: 0.5861
Epoch 383/500
28/28 [=====] - 3s 112ms/step - loss: 0.1840 -
```

```
f1_score: 0.9598 - val_loss: 2.3490 - val_f1_score: 0.5846
Epoch 384/500
28/28 [=====] - 3s 112ms/step - loss: 0.1737 -
f1_score: 0.9636 - val_loss: 2.3665 - val_f1_score: 0.5867
Epoch 385/500
28/28 [=====] - 3s 112ms/step - loss: 0.1689 -
f1_score: 0.9589 - val_loss: 2.6321 - val_f1_score: 0.5784
Epoch 386/500
28/28 [=====] - 3s 112ms/step - loss: 0.1658 -
f1_score: 0.9668 - val_loss: 2.5074 - val_f1_score: 0.5966
Epoch 387/500
28/28 [=====] - 3s 113ms/step - loss: 0.1728 -
f1_score: 0.9587 - val_loss: 2.6227 - val_f1_score: 0.5676
Epoch 388/500
28/28 [=====] - 3s 111ms/step - loss: 0.1823 -
f1_score: 0.9619 - val_loss: 2.4431 - val_f1_score: 0.5738
Epoch 389/500
28/28 [=====] - 3s 112ms/step - loss: 0.1923 -
f1_score: 0.9548 - val_loss: 2.6621 - val_f1_score: 0.5355
Epoch 390/500
28/28 [=====] - 3s 112ms/step - loss: 0.1936 -
f1_score: 0.9545 - val_loss: 2.3681 - val_f1_score: 0.5994
Epoch 391/500
28/28 [=====] - 3s 112ms/step - loss: 0.1639 -
f1_score: 0.9649 - val_loss: 2.3730 - val_f1_score: 0.5839
Epoch 392/500
28/28 [=====] - 3s 112ms/step - loss: 0.1747 -
f1_score: 0.9612 - val_loss: 2.4796 - val_f1_score: 0.5929
Epoch 393/500
28/28 [=====] - 3s 115ms/step - loss: 0.1486 -
f1_score: 0.9697 - val_loss: 2.2621 - val_f1_score: 0.5908
Epoch 394/500
28/28 [=====] - 3s 111ms/step - loss: 0.1527 -
f1_score: 0.9672 - val_loss: 2.2822 - val_f1_score: 0.5943
Epoch 395/500
28/28 [=====] - 3s 115ms/step - loss: 0.1656 -
f1_score: 0.9661 - val_loss: 2.5647 - val_f1_score: 0.5676
Epoch 396/500
28/28 [=====] - 3s 112ms/step - loss: 0.1625 -
f1_score: 0.9624 - val_loss: 2.4537 - val_f1_score: 0.5627
Epoch 397/500
28/28 [=====] - 3s 112ms/step - loss: 0.1608 -
f1_score: 0.9664 - val_loss: 2.4311 - val_f1_score: 0.5959
Epoch 398/500
28/28 [=====] - 3s 112ms/step - loss: 0.1672 -
f1_score: 0.9638 - val_loss: 2.5172 - val_f1_score: 0.5786
Epoch 399/500
28/28 [=====] - 3s 113ms/step - loss: 0.1893 -
```

```
f1_score: 0.9616 - val_loss: 2.2704 - val_f1_score: 0.6099
Epoch 400/500
28/28 [=====] - 3s 113ms/step - loss: 0.1662 -
f1_score: 0.9604 - val_loss: 2.3338 - val_f1_score: 0.5861
Epoch 401/500
28/28 [=====] - 3s 112ms/step - loss: 0.1579 -
f1_score: 0.9679 - val_loss: 2.3184 - val_f1_score: 0.5602
Epoch 402/500
28/28 [=====] - 3s 112ms/step - loss: 0.1560 -
f1_score: 0.9661 - val_loss: 2.4440 - val_f1_score: 0.5862
Epoch 403/500
28/28 [=====] - 3s 113ms/step - loss: 0.1618 -
f1_score: 0.9625 - val_loss: 2.3752 - val_f1_score: 0.5666
Epoch 404/500
28/28 [=====] - 3s 112ms/step - loss: 0.1828 -
f1_score: 0.9559 - val_loss: 2.3398 - val_f1_score: 0.5639
Epoch 405/500
28/28 [=====] - 3s 112ms/step - loss: 0.1587 -
f1_score: 0.9673 - val_loss: 2.3542 - val_f1_score: 0.5765
Epoch 406/500
28/28 [=====] - 3s 112ms/step - loss: 0.1660 -
f1_score: 0.9621 - val_loss: 2.2768 - val_f1_score: 0.5647
Epoch 407/500
28/28 [=====] - 3s 112ms/step - loss: 0.1561 -
f1_score: 0.9674 - val_loss: 2.3907 - val_f1_score: 0.5925
Epoch 408/500
28/28 [=====] - 3s 113ms/step - loss: 0.1638 -
f1_score: 0.9655 - val_loss: 2.7940 - val_f1_score: 0.5494
Epoch 409/500
28/28 [=====] - 3s 113ms/step - loss: 0.1771 -
f1_score: 0.9581 - val_loss: 2.4611 - val_f1_score: 0.5845
Epoch 410/500
28/28 [=====] - 3s 112ms/step - loss: 0.1656 -
f1_score: 0.9647 - val_loss: 2.3472 - val_f1_score: 0.5420
Epoch 411/500
28/28 [=====] - 3s 115ms/step - loss: 0.1575 -
f1_score: 0.9697 - val_loss: 2.5715 - val_f1_score: 0.5630
Epoch 412/500
28/28 [=====] - 3s 113ms/step - loss: 0.1622 -
f1_score: 0.9645 - val_loss: 2.2252 - val_f1_score: 0.5958
Epoch 413/500
28/28 [=====] - 3s 112ms/step - loss: 0.1517 -
f1_score: 0.9672 - val_loss: 2.3796 - val_f1_score: 0.5916
Epoch 414/500
28/28 [=====] - 3s 111ms/step - loss: 0.1728 -
f1_score: 0.9599 - val_loss: 2.4890 - val_f1_score: 0.5885
Epoch 415/500
28/28 [=====] - 3s 113ms/step - loss: 0.1649 -
```

```
f1_score: 0.9650 - val_loss: 2.4263 - val_f1_score: 0.5843
Epoch 416/500
28/28 [=====] - 3s 114ms/step - loss: 0.1441 -
f1_score: 0.9737 - val_loss: 2.5878 - val_f1_score: 0.5811
Epoch 417/500
28/28 [=====] - 3s 112ms/step - loss: 0.1486 -
f1_score: 0.9666 - val_loss: 2.4376 - val_f1_score: 0.5528
Epoch 418/500
28/28 [=====] - 3s 112ms/step - loss: 0.1500 -
f1_score: 0.9667 - val_loss: 2.3584 - val_f1_score: 0.5974
Epoch 419/500
28/28 [=====] - 3s 111ms/step - loss: 0.1491 -
f1_score: 0.9688 - val_loss: 2.4667 - val_f1_score: 0.5927
Epoch 420/500
28/28 [=====] - 3s 112ms/step - loss: 0.1500 -
f1_score: 0.9675 - val_loss: 2.4522 - val_f1_score: 0.5647
Epoch 421/500
28/28 [=====] - 3s 112ms/step - loss: 0.1623 -
f1_score: 0.9639 - val_loss: 2.5783 - val_f1_score: 0.5700
Epoch 422/500
28/28 [=====] - ETA: 0s - loss: 0.1492 - f1_score:
0.9700

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 717/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 717/assets
28/28 [=====] - 13s 476ms/step - loss: 0.1492 -
f1_score: 0.9700 - val_loss: 2.2838 - val_f1_score: 0.6289
Epoch 423/500
28/28 [=====] - 3s 110ms/step - loss: 0.1485 -
f1_score: 0.9667 - val_loss: 2.4558 - val_f1_score: 0.5814
Epoch 424/500
28/28 [=====] - 3s 110ms/step - loss: 0.1540 -
f1_score: 0.9661 - val_loss: 2.3902 - val_f1_score: 0.5726
Epoch 425/500
28/28 [=====] - 3s 114ms/step - loss: 0.1615 -
f1_score: 0.9678 - val_loss: 2.4114 - val_f1_score: 0.5965
Epoch 426/500
28/28 [=====] - 3s 113ms/step - loss: 0.1781 -
f1_score: 0.9619 - val_loss: 2.7473 - val_f1_score: 0.5716
Epoch 427/500
28/28 [=====] - 3s 113ms/step - loss: 0.1664 -
f1_score: 0.9630 - val_loss: 2.3671 - val_f1_score: 0.5597
Epoch 428/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 0.1754 -
f1_score: 0.9614 - val_loss: 2.4411 - val_f1_score: 0.5702
Epoch 429/500
28/28 [=====] - 3s 111ms/step - loss: 0.1591 -
f1_score: 0.9613 - val_loss: 2.4335 - val_f1_score: 0.5723
Epoch 430/500
28/28 [=====] - 3s 111ms/step - loss: 0.1784 -
f1_score: 0.9541 - val_loss: 2.4773 - val_f1_score: 0.5634
Epoch 431/500
28/28 [=====] - 3s 112ms/step - loss: 0.1391 -
f1_score: 0.9739 - val_loss: 2.4258 - val_f1_score: 0.5778
Epoch 432/500
28/28 [=====] - 3s 112ms/step - loss: 0.1384 -
f1_score: 0.9756 - val_loss: 2.3752 - val_f1_score: 0.5788
Epoch 433/500
28/28 [=====] - 3s 112ms/step - loss: 0.1447 -
f1_score: 0.9698 - val_loss: 2.4054 - val_f1_score: 0.5945
Epoch 434/500
28/28 [=====] - 3s 111ms/step - loss: 0.1520 -
f1_score: 0.9650 - val_loss: 2.4498 - val_f1_score: 0.5720
Epoch 435/500
28/28 [=====] - 3s 112ms/step - loss: 0.1699 -
f1_score: 0.9626 - val_loss: 2.4924 - val_f1_score: 0.5539
Epoch 436/500
28/28 [=====] - 3s 112ms/step - loss: 0.1566 -
f1_score: 0.9653 - val_loss: 2.4444 - val_f1_score: 0.5910
Epoch 437/500
28/28 [=====] - 3s 111ms/step - loss: 0.1462 -
f1_score: 0.9703 - val_loss: 2.3900 - val_f1_score: 0.6055
Epoch 438/500
28/28 [=====] - 3s 113ms/step - loss: 0.1366 -
f1_score: 0.9729 - val_loss: 2.3734 - val_f1_score: 0.5829
Epoch 439/500
28/28 [=====] - 3s 112ms/step - loss: 0.1474 -
f1_score: 0.9672 - val_loss: 2.5632 - val_f1_score: 0.5618
Epoch 440/500
28/28 [=====] - 3s 113ms/step - loss: 0.1583 -
f1_score: 0.9651 - val_loss: 2.4224 - val_f1_score: 0.5983
Epoch 441/500
28/28 [=====] - 3s 112ms/step - loss: 0.1551 -
f1_score: 0.9666 - val_loss: 2.5307 - val_f1_score: 0.5810
Epoch 442/500
28/28 [=====] - 3s 112ms/step - loss: 0.1468 -
f1_score: 0.9671 - val_loss: 2.5339 - val_f1_score: 0.5553
Epoch 443/500
28/28 [=====] - 3s 111ms/step - loss: 0.1560 -
f1_score: 0.9678 - val_loss: 2.6344 - val_f1_score: 0.5500
Epoch 444/500
```

```
28/28 [=====] - 3s 111ms/step - loss: 0.1574 -
f1_score: 0.9665 - val_loss: 2.4125 - val_f1_score: 0.5905
Epoch 445/500
28/28 [=====] - 3s 112ms/step - loss: 0.1467 -
f1_score: 0.9725 - val_loss: 2.4500 - val_f1_score: 0.5823
Epoch 446/500
28/28 [=====] - 3s 112ms/step - loss: 0.1450 -
f1_score: 0.9672 - val_loss: 2.3982 - val_f1_score: 0.6087
Epoch 447/500
28/28 [=====] - 3s 112ms/step - loss: 0.1503 -
f1_score: 0.9658 - val_loss: 2.5564 - val_f1_score: 0.5956
Epoch 448/500
28/28 [=====] - 3s 112ms/step - loss: 0.1534 -
f1_score: 0.9659 - val_loss: 2.5517 - val_f1_score: 0.5535
Epoch 449/500
28/28 [=====] - 3s 111ms/step - loss: 0.1578 -
f1_score: 0.9667 - val_loss: 2.6982 - val_f1_score: 0.5460
Epoch 450/500
28/28 [=====] - 3s 112ms/step - loss: 0.1243 -
f1_score: 0.9763 - val_loss: 2.4046 - val_f1_score: 0.5849
Epoch 451/500
28/28 [=====] - 3s 112ms/step - loss: 0.1570 -
f1_score: 0.9652 - val_loss: 2.3896 - val_f1_score: 0.5869
Epoch 452/500
28/28 [=====] - 3s 112ms/step - loss: 0.1572 -
f1_score: 0.9643 - val_loss: 2.3497 - val_f1_score: 0.6140
Epoch 453/500
28/28 [=====] - 3s 112ms/step - loss: 0.1713 -
f1_score: 0.9583 - val_loss: 2.3316 - val_f1_score: 0.5890
Epoch 454/500
28/28 [=====] - 3s 112ms/step - loss: 0.1553 -
f1_score: 0.9638 - val_loss: 2.4679 - val_f1_score: 0.5658
Epoch 455/500
28/28 [=====] - 3s 113ms/step - loss: 0.1370 -
f1_score: 0.9712 - val_loss: 2.4432 - val_f1_score: 0.5754
Epoch 456/500
28/28 [=====] - 3s 111ms/step - loss: 0.1469 -
f1_score: 0.9718 - val_loss: 2.4446 - val_f1_score: 0.5936
Epoch 457/500
28/28 [=====] - 3s 113ms/step - loss: 0.1552 -
f1_score: 0.9653 - val_loss: 2.3801 - val_f1_score: 0.5701
Epoch 458/500
28/28 [=====] - 3s 112ms/step - loss: 0.1534 -
f1_score: 0.9670 - val_loss: 2.2895 - val_f1_score: 0.5862
Epoch 459/500
28/28 [=====] - 3s 112ms/step - loss: 0.1437 -
f1_score: 0.9725 - val_loss: 2.3244 - val_f1_score: 0.5866
Epoch 460/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 0.1558 -
f1_score: 0.9665 - val_loss: 2.2912 - val_f1_score: 0.5891
Epoch 461/500
28/28 [=====] - 3s 112ms/step - loss: 0.1575 -
f1_score: 0.9681 - val_loss: 2.4097 - val_f1_score: 0.5875
Epoch 462/500
28/28 [=====] - 3s 112ms/step - loss: 0.1493 -
f1_score: 0.9691 - val_loss: 2.5378 - val_f1_score: 0.5591
Epoch 463/500
28/28 [=====] - 3s 112ms/step - loss: 0.1545 -
f1_score: 0.9653 - val_loss: 2.3673 - val_f1_score: 0.5900
Epoch 464/500
28/28 [=====] - 3s 113ms/step - loss: 0.1432 -
f1_score: 0.9715 - val_loss: 2.1795 - val_f1_score: 0.6057
Epoch 465/500
28/28 [=====] - 3s 112ms/step - loss: 0.1360 -
f1_score: 0.9723 - val_loss: 2.3609 - val_f1_score: 0.5979
Epoch 466/500
28/28 [=====] - 3s 111ms/step - loss: 0.1378 -
f1_score: 0.9704 - val_loss: 2.5614 - val_f1_score: 0.5553
Epoch 467/500
28/28 [=====] - 3s 112ms/step - loss: 0.1518 -
f1_score: 0.9685 - val_loss: 2.4333 - val_f1_score: 0.5710
Epoch 468/500
28/28 [=====] - 3s 112ms/step - loss: 0.1491 -
f1_score: 0.9682 - val_loss: 2.5218 - val_f1_score: 0.5638
Epoch 469/500
28/28 [=====] - 3s 113ms/step - loss: 0.1379 -
f1_score: 0.9689 - val_loss: 2.5782 - val_f1_score: 0.6028
Epoch 470/500
28/28 [=====] - 3s 112ms/step - loss: 0.1410 -
f1_score: 0.9683 - val_loss: 2.4166 - val_f1_score: 0.6211
Epoch 471/500
28/28 [=====] - 3s 112ms/step - loss: 0.1535 -
f1_score: 0.9669 - val_loss: 2.3678 - val_f1_score: 0.5917
Epoch 472/500
28/28 [=====] - 3s 115ms/step - loss: 0.1387 -
f1_score: 0.9721 - val_loss: 2.3678 - val_f1_score: 0.5975
Epoch 473/500
28/28 [=====] - 3s 113ms/step - loss: 0.1363 -
f1_score: 0.9688 - val_loss: 2.5075 - val_f1_score: 0.5738
Epoch 474/500
28/28 [=====] - 3s 112ms/step - loss: 0.1421 -
f1_score: 0.9722 - val_loss: 2.4733 - val_f1_score: 0.5631
Epoch 475/500
28/28 [=====] - 3s 112ms/step - loss: 0.1374 -
f1_score: 0.9731 - val_loss: 2.2967 - val_f1_score: 0.5840
Epoch 476/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 0.1386 -
f1_score: 0.9706 - val_loss: 2.4554 - val_f1_score: 0.5820
Epoch 477/500
28/28 [=====] - 3s 112ms/step - loss: 0.1618 -
f1_score: 0.9619 - val_loss: 2.6092 - val_f1_score: 0.5499
Epoch 478/500
28/28 [=====] - 3s 115ms/step - loss: 0.1705 -
f1_score: 0.9591 - val_loss: 2.3245 - val_f1_score: 0.5994
Epoch 479/500
28/28 [=====] - 3s 115ms/step - loss: 0.1333 -
f1_score: 0.9759 - val_loss: 2.3471 - val_f1_score: 0.6005
Epoch 480/500
28/28 [=====] - 3s 113ms/step - loss: 0.1397 -
f1_score: 0.9663 - val_loss: 2.5737 - val_f1_score: 0.5615
Epoch 481/500
28/28 [=====] - 3s 121ms/step - loss: 0.1269 -
f1_score: 0.9768 - val_loss: 2.4544 - val_f1_score: 0.5782
Epoch 482/500
28/28 [=====] - 3s 121ms/step - loss: 0.1380 -
f1_score: 0.9700 - val_loss: 2.2855 - val_f1_score: 0.5946
Epoch 483/500
28/28 [=====] - 3s 119ms/step - loss: 0.1236 -
f1_score: 0.9768 - val_loss: 2.4064 - val_f1_score: 0.5867
Epoch 484/500
28/28 [=====] - 3s 119ms/step - loss: 0.1458 -
f1_score: 0.9661 - val_loss: 2.5975 - val_f1_score: 0.5703
Epoch 485/500
28/28 [=====] - 3s 113ms/step - loss: 0.1405 -
f1_score: 0.9706 - val_loss: 2.4213 - val_f1_score: 0.5717
Epoch 486/500
28/28 [=====] - 3s 111ms/step - loss: 0.1321 -
f1_score: 0.9710 - val_loss: 2.4424 - val_f1_score: 0.5814
Epoch 487/500
28/28 [=====] - 3s 113ms/step - loss: 0.1279 -
f1_score: 0.9754 - val_loss: 2.3248 - val_f1_score: 0.5935
Epoch 488/500
28/28 [=====] - 3s 111ms/step - loss: 0.1422 -
f1_score: 0.9677 - val_loss: 2.4101 - val_f1_score: 0.5581
Epoch 489/500
28/28 [=====] - 3s 113ms/step - loss: 0.1449 -
f1_score: 0.9726 - val_loss: 2.5978 - val_f1_score: 0.5373
Epoch 490/500
28/28 [=====] - 3s 113ms/step - loss: 0.1439 -
f1_score: 0.9671 - val_loss: 2.5185 - val_f1_score: 0.5933
Epoch 491/500
28/28 [=====] - 3s 119ms/step - loss: 0.1412 -
f1_score: 0.9697 - val_loss: 2.5152 - val_f1_score: 0.5614
Epoch 492/500
```

```

28/28 [=====] - 3s 111ms/step - loss: 0.1433 -
f1_score: 0.9695 - val_loss: 2.4348 - val_f1_score: 0.5670
Epoch 493/500
28/28 [=====] - 3s 112ms/step - loss: 0.1466 -
f1_score: 0.9657 - val_loss: 2.7112 - val_f1_score: 0.5647
Epoch 494/500
28/28 [=====] - 3s 113ms/step - loss: 0.1568 -
f1_score: 0.9613 - val_loss: 2.4255 - val_f1_score: 0.5723
Epoch 495/500
28/28 [=====] - 3s 112ms/step - loss: 0.1411 -
f1_score: 0.9716 - val_loss: 2.4760 - val_f1_score: 0.5477
Epoch 496/500
28/28 [=====] - 3s 111ms/step - loss: 0.1434 -
f1_score: 0.9677 - val_loss: 2.7742 - val_f1_score: 0.5511
Epoch 497/500
28/28 [=====] - 3s 112ms/step - loss: 0.1336 -
f1_score: 0.9727 - val_loss: 2.4444 - val_f1_score: 0.5967
Epoch 498/500
28/28 [=====] - 3s 112ms/step - loss: 0.1328 -
f1_score: 0.9748 - val_loss: 2.3521 - val_f1_score: 0.5781
Epoch 499/500
28/28 [=====] - 3s 112ms/step - loss: 0.1328 -
f1_score: 0.9713 - val_loss: 2.3359 - val_f1_score: 0.5848
Epoch 500/500
28/28 [=====] - 3s 112ms/step - loss: 0.1181 -
f1_score: 0.9793 - val_loss: 2.5133 - val_f1_score: 0.5839

```

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

	precision	recall	f1-score	support
AXE	0.875	0.875	0.875	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.583	0.700	0.636	10
BEE	0.000	0.000	0.000	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.625	0.769	8
BREAKFAST	0.333	0.333	0.333	6
CANCER	0.889	1.000	0.941	8
CHRISTMAS	0.667	1.000	0.800	6
CONFUSED	0.556	0.833	0.667	6
DARK	1.000	1.000	1.000	4
DEAF	0.300	0.500	0.375	6

DECIDE	0.667	0.667	0.667	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	1.000	0.667	0.800	6
DINNER	0.250	0.125	0.167	8
DOG	1.000	0.333	0.500	6
DOWNSIZE	0.667	0.750	0.706	8
DRAG	0.000	0.000	0.000	4
EAT	0.600	0.500	0.545	6
EDIT	0.667	1.000	0.800	6
ELEVATOR	0.500	0.625	0.556	8
FINE	1.000	0.250	0.400	4
FLOAT	0.286	0.500	0.364	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.600	0.750	0.667	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	0.308	0.667	0.421	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	0.500	0.625	0.556	8
LUNCH	0.667	0.500	0.571	8
MAPLE	1.000	0.750	0.857	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	0.429	0.375	0.400	8
NOON	0.857	0.750	0.800	8
PARTY	0.714	0.625	0.667	8
PATIENT	1.000	0.167	0.286	6
RAZOR	0.200	0.250	0.222	4
RIVER	0.444	0.667	0.533	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.455	0.500	0.476	10
SINK	0.667	0.333	0.444	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.800	1.000	0.889	4
TWINS	0.357	0.625	0.455	8
WHATFOR	0.600	0.600	0.600	10
accuracy			0.602	324
macro avg	0.638	0.598	0.584	324
weighted avg	0.637	0.602	0.588	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 717/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)

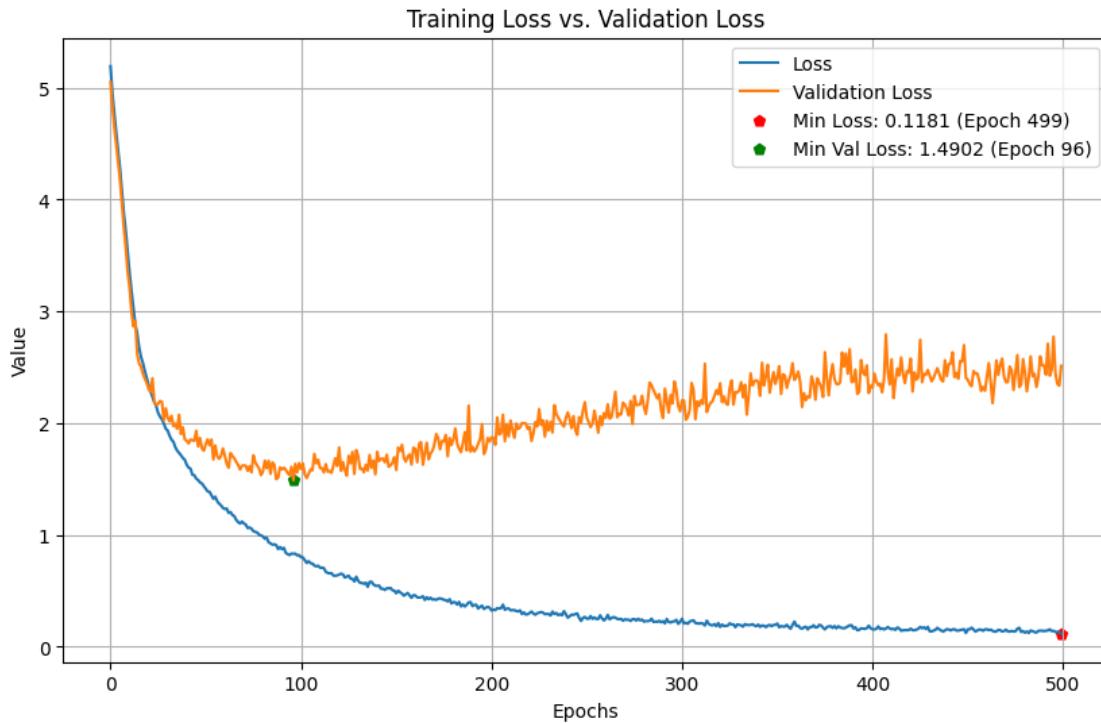
```

[130]: hist\_df = pd.read\_csv('1 1D-CNN + 1 GRU Trial 717/history.csv', index\_col=0)  
hist\_df.tail()

[130]:

	loss	f1_score	val_loss	val_f1_score
495	0.143407	0.967741	2.774204	0.551061
496	0.133611	0.972700	2.444389	0.596683
497	0.132800	0.974752	2.352121	0.578139
498	0.132822	0.971275	2.335888	0.584798
499	0.118077	0.979302	2.513285	0.583930

[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()

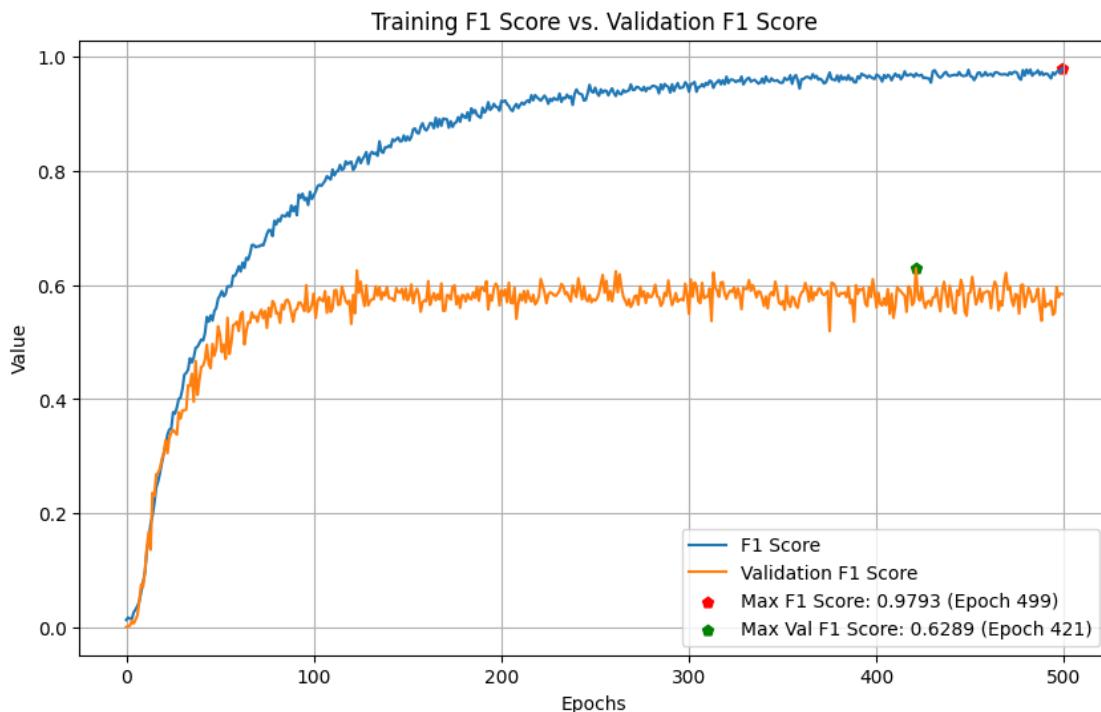
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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 717")
```

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

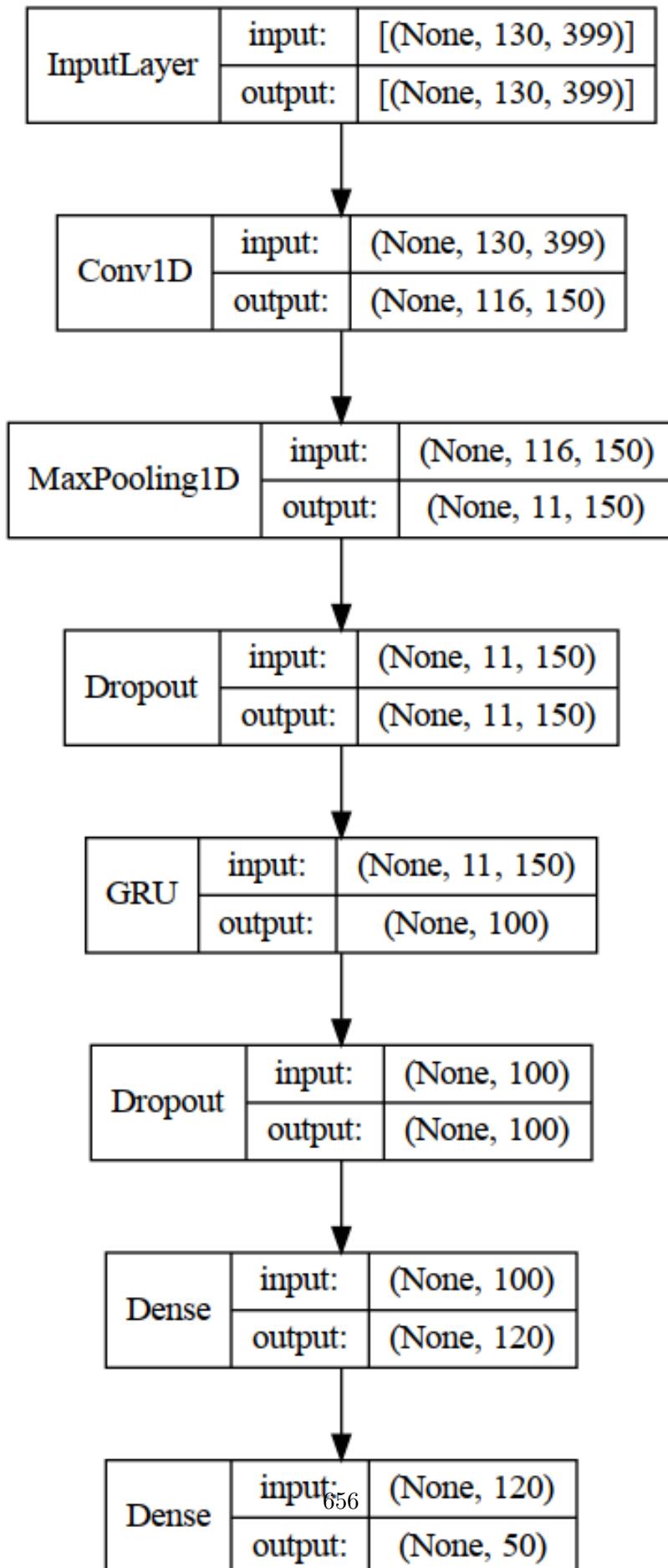
Model: "sequential\_1"

Layer (type)	Output Shape	Param #
<hr/>		
conv1d_1 (Conv1D)	(None, 116, 150)	897900
<hr/>		
max_pooling1d_1 (MaxPooling 1D)	(None, 11, 150)	0
<hr/>		
dropout_2 (Dropout)	(None, 11, 150)	0
<hr/>		
gru_1 (GRU)	(None, 100)	75600

```
dropout_3 (Dropout)           (None, 100)          0
dense_2 (Dense)              (None, 120)         12120
dense_3 (Dense)              (None, 50)          6050
=====
Total params: 991,670
Trainable params: 991,670
Non-trainable params: 0
```

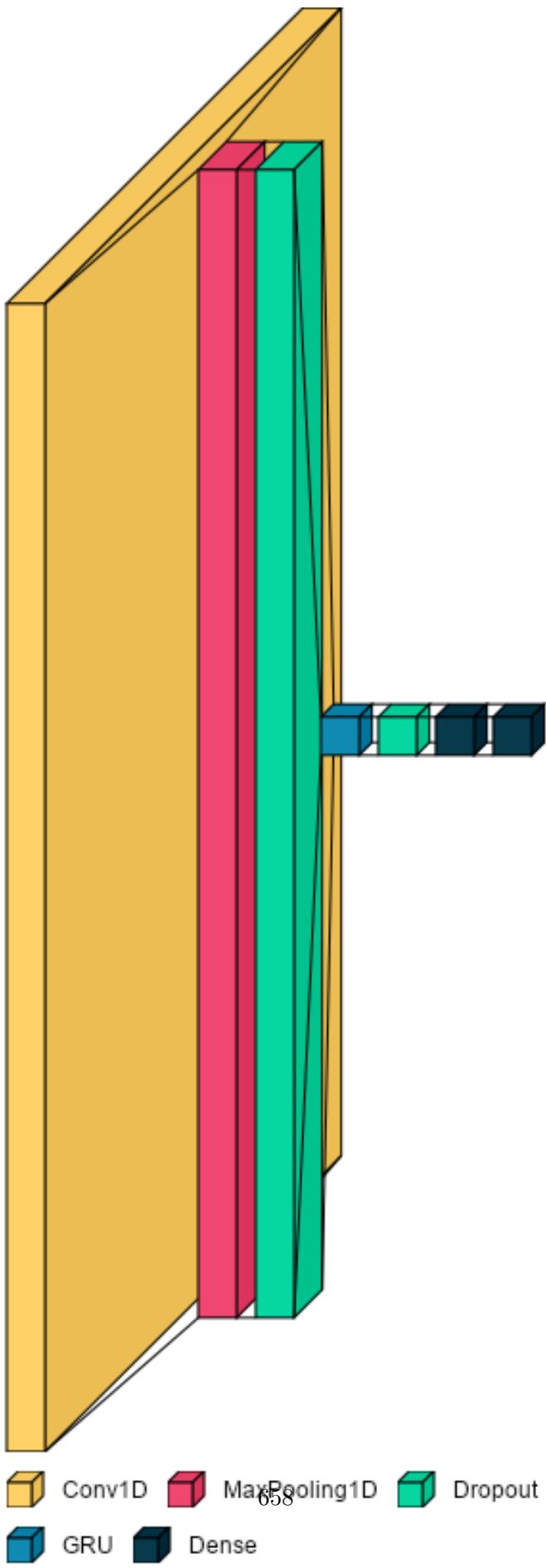
```
[135]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

```
[135]:
```



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

```
[136]:
```



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

11/11 [=====] - 1s 15ms/step - loss: 2.2838 - f1_score: 0.6289
```

[137]: [2.283757209777832, 0.628909707069397]

```
[138]: reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)

28/28 [=====] - 1s 32ms/step - loss: 0.0551 - f1_score: 1.0000
```

[138]: [0.05510687083005905, 1.0]

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

	precision	recall	f1-score	support
AXE	1.000	1.000	1.000	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.615	0.800	0.696	10
BEE	0.429	0.300	0.353	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.750	0.857	8
BREAKFAST	1.000	0.167	0.286	6
CANCER	0.875	0.875	0.875	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	0.500	0.667	0.571	6
DECIDE	0.800	0.667	0.727	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	1.000	0.500	0.667	6
DINNER	0.000	0.000	0.000	8
DOG	0.333	0.333	0.333	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	0.000	0.000	0.000	4
EAT	0.750	0.500	0.600	6
EDIT	0.857	1.000	0.923	6
ELEVATOR	0.538	0.875	0.667	8
FINE	1.000	0.500	0.667	4

FLOAT	0.286	0.500	0.364	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.667	0.750	0.706	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.444	0.667	0.533	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	0.429	0.750	0.545	8
LUNCH	1.000	0.500	0.667	8
MAPLE	1.000	0.500	0.667	4
MEAT	0.750	1.000	0.857	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	0.857	0.750	0.800	8
MOVIE	0.857	0.750	0.800	8
NOON	1.000	1.000	1.000	8
PARTY	0.545	0.750	0.632	8
PATIENT	0.500	0.167	0.250	6
RAZOR	0.333	0.500	0.400	4
RIVER	0.444	0.667	0.533	6
ROCKINGCHAIR	0.750	0.750	0.750	8
SHAVE	0.500	0.400	0.444	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.667	1.000	0.800	4
TWINS	0.353	0.750	0.480	8
WHATFOR	0.545	0.600	0.571	10
accuracy			0.654	324
macro avg	0.677	0.641	0.629	324
weighted avg	0.684	0.654	0.641	324

#### 4.7.2 1 1D-CNN + 1 GRU Trial 722

```
[122]: best_model = tuner.get_best_models(num_models=6)[5]

2023-09-17 13:19:49.922931: 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.
2023-09-17 13:19:49.997604: 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](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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WARNING:tensorflow:Value in checkpoint could not be found in the restored object: (root).optimizer.\_variables.0

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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.6

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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.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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```

```
[123]: best_model.evaluate(Xtrain, Ytrain)
```

```
2023-09-17 13:16:56.852631: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
```

```
84/84 [=====] - 2s 16ms/step - loss: 0.4927 - f1_score: 0.8692
```

```
[123]: [0.49272581934928894, 0.8691571950912476]
```

```
[124]: best_model.evaluate(Xval, Yval)
```

```
11/11 [=====] - 0s 18ms/step - loss: 1.2218 - f1_score: 0.6788
```

```
[124]: [1.221798300743103, 0.678809642791748]
```

```
[123]: bestHP = tuner.get_best_hyperparameters(num_trials=4)[3]
```

```
[124]: 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)
```

```
[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
```

```
2023-09-17 13:20:06.268035: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
```

```
2023-09-17 13:20:06.917417: I tensorflow/compiler/xla/service/service.cc:173]
XLA service 0x7f48cc6fe870 initialized for platform CUDA (this does not
guarantee that XLA will be used). Devices:
```

```
2023-09-17 13:20:06.917444: I tensorflow/compiler/xla/service/service.cc:181]
StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1
```

```
2023-09-17 13:20:06.927989: I
```

```
tensorflow/compiler/mlir/tensorflow/utils/dump_mlir_util.cc:268] disabling MLIR
crash reproducer, set env var `MLIR_CRASH_REPRODUCER_DIRECTORY` to enable.
```

```
2023-09-17 13:20:07.081098: 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: 4.3032 - f1_score: 0.0161
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 [=====] - 21s 597ms/step - loss: 4.3032 - f1_score: 0.0161 - val_loss: 4.1787 - val_f1_score: 7.5949e-04
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 4.2828 - f1_score: 0.0162
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 349ms/step - loss: 4.2828 - f1_score: 0.0162 - val_loss: 4.1592 - val_f1_score: 0.0017
Epoch 3/500
28/28 [=====] - ETA: 0s - loss: 4.2588 - f1_score: 0.0202
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 [=====] - 9s 336ms/step - loss: 4.2588 - f1_score: 0.0202 - val_loss: 4.1681 - val_f1_score: 0.0021
Epoch 4/500
28/28 [=====] - 2s 84ms/step - loss: 4.2351 - f1_score: 0.0171 - val_loss: 4.1271 - val_f1_score: 0.0012
Epoch 5/500
28/28 [=====] - 2s 84ms/step - loss: 4.2262 - f1_score: 0.0187 - val_loss: 4.1158 - val_f1_score: 7.2727e-04
Epoch 6/500
28/28 [=====] - ETA: 0s - loss: 4.2065 - f1_score: 0.0168
```

```
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 365ms/step - loss: 4.2065 -
f1_score: 0.0168 - val_loss: 4.1162 - val_f1_score: 0.0049
Epoch 7/500
28/28 [=====] - 2s 84ms/step - loss: 4.1949 - f1_score:
0.0172 - val_loss: 4.1342 - val_f1_score: 4.9080e-04
Epoch 8/500
28/28 [=====] - 2s 84ms/step - loss: 4.1986 - f1_score:
0.0213 - val_loss: 4.0959 - val_f1_score: 0.0014
Epoch 9/500
28/28 [=====] - 2s 84ms/step - loss: 4.1549 - f1_score:
0.0211 - val_loss: 4.0758 - val_f1_score: 0.0036
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 4.1467 - f1_score:
0.0182

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 [=====] - 9s 339ms/step - loss: 4.1467 -
f1_score: 0.0182 - val_loss: 4.0492 - val_f1_score: 0.0050
Epoch 11/500
28/28 [=====] - 2s 84ms/step - loss: 4.1236 - f1_score:
0.0216 - val_loss: 4.0893 - val_f1_score: 0.0043
Epoch 12/500
28/28 [=====] - ETA: 0s - loss: 4.1075 - f1_score:
0.0244

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: 4.1075 -
f1_score: 0.0244 - val_loss: 4.0652 - val_f1_score: 0.0068
```

```
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 4.0947 - f1_score: 0.0241

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 [=====] - 9s 333ms/step - loss: 4.0947 -
f1_score: 0.0241 - val_loss: 4.0002 - val_f1_score: 0.0118
Epoch 14/500
28/28 [=====] - ETA: 0s - loss: 4.0564 - f1_score: 0.0316

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 [=====] - 9s 315ms/step - loss: 4.0564 -
f1_score: 0.0316 - val_loss: 3.9723 - val_f1_score: 0.0203
Epoch 15/500
28/28 [=====] - 2s 84ms/step - loss: 4.0223 - f1_score: 0.0320 -
val_loss: 3.9410 - val_f1_score: 0.0093
Epoch 16/500
28/28 [=====] - ETA: 0s - loss: 3.9773 - f1_score: 0.0354

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 [=====] - 9s 338ms/step - loss: 3.9773 -
f1_score: 0.0354 - val_loss: 3.8515 - val_f1_score: 0.0227
Epoch 17/500
28/28 [=====] - ETA: 0s - loss: 3.9419 - f1_score: 0.0339

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 [=====] - 9s 338ms/step - loss: 3.9419 -
f1_score: 0.0339 - val_loss: 3.7765 - val_f1_score: 0.0265
Epoch 18/500
28/28 [=====] - 2s 86ms/step - loss: 3.8608 - f1_score:
0.0397 - val_loss: 3.7019 - val_f1_score: 0.0244
Epoch 19/500
28/28 [=====] - 2s 85ms/step - loss: 3.8006 - f1_score:
0.0406 - val_loss: 3.6150 - val_f1_score: 0.0221
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 3.7429 - f1_score:
0.0436

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 385ms/step - loss: 3.7429 -
f1_score: 0.0436 - val_loss: 3.5343 - val_f1_score: 0.0412
Epoch 21/500
28/28 [=====] - ETA: 0s - loss: 3.6861 - f1_score:
0.0522

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 350ms/step - loss: 3.6861 -
f1_score: 0.0522 - val_loss: 3.4988 - val_f1_score: 0.0477
Epoch 22/500
28/28 [=====] - 2s 85ms/step - loss: 3.6347 - f1_score:
0.0536 - val_loss: 3.4158 - val_f1_score: 0.0472
Epoch 23/500
28/28 [=====] - 2s 85ms/step - loss: 3.5914 - f1_score:
0.0507 - val_loss: 3.3899 - val_f1_score: 0.0432
Epoch 24/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.5472 - f1_score: 0.0603
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: 3.5472 - f1_score: 0.0603 - val_loss: 3.2994 - val_f1_score: 0.0593
Epoch 25/500
28/28 [=====] - ETA: 0s - loss: 3.4858 - f1_score: 0.0678
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 [=====] - 9s 343ms/step - loss: 3.4858 - f1_score: 0.0678 - val_loss: 3.2402 - val_f1_score: 0.0752
Epoch 26/500
28/28 [=====] - 2s 85ms/step - loss: 3.4303 - f1_score: 0.0723 - val_loss: 3.2216 - val_f1_score: 0.0738
Epoch 27/500
28/28 [=====] - ETA: 0s - loss: 3.3738 - f1_score: 0.0767
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 [=====] - 9s 344ms/step - loss: 3.3738 - f1_score: 0.0767 - val_loss: 3.1855 - val_f1_score: 0.0890
Epoch 28/500
28/28 [=====] - 2s 85ms/step - loss: 3.3442 - f1_score: 0.0828 - val_loss: 3.1948 - val_f1_score: 0.0754
Epoch 29/500
28/28 [=====] - 2s 86ms/step - loss: 3.3046 - f1_score: 0.0928 - val_loss: 3.0976 - val_f1_score: 0.0776
Epoch 30/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.2569 - f1_score: 0.0986
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 410ms/step - loss: 3.2569 -
f1_score: 0.0986 - val_loss: 3.0424 - val_f1_score: 0.1101
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 3.2264 - f1_score: 0.1094
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 367ms/step - loss: 3.2264 -
f1_score: 0.1094 - val_loss: 3.0181 - val_f1_score: 0.1246
Epoch 32/500
28/28 [=====] - ETA: 0s - loss: 3.1801 - f1_score: 0.1171
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 350ms/step - loss: 3.1801 -
f1_score: 0.1171 - val_loss: 3.0061 - val_f1_score: 0.1369
Epoch 33/500
28/28 [=====] - 2s 85ms/step - loss: 3.1123 - f1_score: 0.1248 -
val_loss: 2.9222 - val_f1_score: 0.1276
Epoch 34/500
28/28 [=====] - ETA: 0s - loss: 3.0526 - f1_score: 0.1473
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 [=====] - 9s 345ms/step - loss: 3.0526 - f1_score: 0.1473 - val_loss: 2.8352 - val_f1_score: 0.1586
Epoch 35/500
28/28 [=====] - 2s 84ms/step - loss: 2.9900 - f1_score: 0.1581 - val_loss: 2.8598 - val_f1_score: 0.1500
Epoch 36/500
28/28 [=====] - ETA: 0s - loss: 2.9594 - f1_score: 0.1590

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 [=====] - 9s 346ms/step - loss: 2.9594 - f1_score: 0.1590 - val_loss: 2.7248 - val_f1_score: 0.1638
Epoch 37/500
28/28 [=====] - 2s 85ms/step - loss: 2.9086 - f1_score: 0.1631 - val_loss: 2.8363 - val_f1_score: 0.1180
Epoch 38/500
28/28 [=====] - 2s 85ms/step - loss: 2.8487 - f1_score: 0.1782 - val_loss: 2.7419 - val_f1_score: 0.1463
Epoch 39/500
28/28 [=====] - 2s 86ms/step - loss: 2.8452 - f1_score: 0.1653 - val_loss: 2.7772 - val_f1_score: 0.1241
Epoch 40/500
28/28 [=====] - ETA: 0s - loss: 2.8039 - f1_score: 0.1879

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: 2.8039 - f1_score: 0.1879 - val_loss: 2.5718 - val_f1_score: 0.2082
Epoch 41/500
28/28 [=====] - 2s 85ms/step - loss: 2.7515 - f1_score:
```

```
0.1895 - val_loss: 2.5555 - val_f1_score: 0.1885
Epoch 42/500
28/28 [=====] - 2s 85ms/step - loss: 2.7079 - f1_score: 0.2036 - val_loss: 2.5544 - val_f1_score: 0.1970
Epoch 43/500
28/28 [=====] - 2s 85ms/step - loss: 2.7166 - f1_score: 0.2090 - val_loss: 2.5979 - val_f1_score: 0.1707
Epoch 44/500
28/28 [=====] - ETA: 0s - loss: 2.6573 - f1_score: 0.2279

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: 2.6573 - f1_score: 0.2279 - val_loss: 2.5800 - val_f1_score: 0.2097
Epoch 45/500
28/28 [=====] - ETA: 0s - loss: 2.6502 - f1_score: 0.2099

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: 2.6502 - f1_score: 0.2099 - val_loss: 2.5318 - val_f1_score: 0.2365
Epoch 46/500
28/28 [=====] - 2s 86ms/step - loss: 2.6219 - f1_score: 0.2324 - val_loss: 2.5258 - val_f1_score: 0.2091
Epoch 47/500
28/28 [=====] - 2s 86ms/step - loss: 2.5681 - f1_score: 0.2378 - val_loss: 2.4328 - val_f1_score: 0.2215
Epoch 48/500
28/28 [=====] - ETA: 0s - loss: 2.5477 - f1_score: 0.2401

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 406ms/step - loss: 2.5477 -  
f1_score: 0.2401 - val_loss: 2.4681 - val_f1_score: 0.2586  
Epoch 49/500  
28/28 [=====] - 2s 86ms/step - loss: 2.5344 - f1_score:  
0.2516 - val_loss: 2.4488 - val_f1_score: 0.2370  
Epoch 50/500  
28/28 [=====] - 2s 87ms/step - loss: 2.5414 - f1_score:  
0.2361 - val_loss: 2.3907 - val_f1_score: 0.2537  
Epoch 51/500  
28/28 [=====] - 2s 90ms/step - loss: 2.4977 - f1_score:  
0.2520 - val_loss: 2.4868 - val_f1_score: 0.2438  
Epoch 52/500  
28/28 [=====] - 2s 87ms/step - loss: 2.4678 - f1_score:  
0.2640 - val_loss: 2.3885 - val_f1_score: 0.2323  
Epoch 53/500  
28/28 [=====] - ETA: 0s - loss: 2.4603 - f1_score:  
0.2545  
  
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 441ms/step - loss: 2.4603 -  
f1_score: 0.2545 - val_loss: 2.3666 - val_f1_score: 0.2756  
Epoch 54/500  
28/28 [=====] - ETA: 0s - loss: 2.4165 - f1_score:  
0.2821  
  
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 369ms/step - loss: 2.4165 -  
f1_score: 0.2821 - val_loss: 2.4177 - val_f1_score: 0.2915  
Epoch 55/500  
28/28 [=====] - 2s 85ms/step - loss: 2.4019 - f1_score:  
0.2805 - val_loss: 2.3297 - val_f1_score: 0.2517  
Epoch 56/500  
28/28 [=====] - 2s 86ms/step - loss: 2.3666 - f1_score:  
0.2796 - val_loss: 2.3386 - val_f1_score: 0.2753
```

```
Epoch 57/500
28/28 [=====] - ETA: 0s - loss: 2.3449 - f1_score: 0.2949
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: 2.3449 -
f1_score: 0.2949 - val_loss: 2.3350 - val_f1_score: 0.3070
Epoch 58/500
28/28 [=====] - 2s 87ms/step - loss: 2.3270 - f1_score: 0.2971 -
val_loss: 2.2229 - val_f1_score: 0.2995
Epoch 59/500
28/28 [=====] - 2s 87ms/step - loss: 2.3134 - f1_score: 0.3007 -
val_loss: 2.2697 - val_f1_score: 0.3042
Epoch 60/500
28/28 [=====] - 2s 87ms/step - loss: 2.2742 - f1_score: 0.3180 -
val_loss: 2.2608 - val_f1_score: 0.2932
Epoch 61/500
28/28 [=====] - 2s 86ms/step - loss: 2.2697 - f1_score: 0.3173 -
val_loss: 2.1802 - val_f1_score: 0.3034
Epoch 62/500
28/28 [=====] - 2s 88ms/step - loss: 2.2793 - f1_score: 0.3107 -
val_loss: 2.1719 - val_f1_score: 0.2998
Epoch 63/500
28/28 [=====] - ETA: 0s - loss: 2.2256 - f1_score: 0.3257
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 406ms/step - loss: 2.2256 -
f1_score: 0.3257 - val_loss: 2.1656 - val_f1_score: 0.3104
Epoch 64/500
28/28 [=====] - 2s 86ms/step - loss: 2.2405 - f1_score: 0.3324 -
val_loss: 2.2788 - val_f1_score: 0.3033
Epoch 65/500
28/28 [=====] - ETA: 0s - loss: 2.1989 - f1_score: 0.3352
```

```
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 445ms/step - loss: 2.1989 -
f1_score: 0.3352 - val_loss: 2.1276 - val_f1_score: 0.3531
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 2.1770 - f1_score:
0.3389

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 [=====] - 9s 345ms/step - loss: 2.1770 -
f1_score: 0.3389 - val_loss: 2.1010 - val_f1_score: 0.3576
Epoch 67/500
28/28 [=====] - 2s 87ms/step - loss: 2.1618 - f1_score:
0.3337 - val_loss: 2.1842 - val_f1_score: 0.3028
Epoch 68/500
28/28 [=====] - 2s 86ms/step - loss: 2.1286 - f1_score:
0.3569 - val_loss: 2.2970 - val_f1_score: 0.3187
Epoch 69/500
28/28 [=====] - 2s 86ms/step - loss: 2.1136 - f1_score:
0.3512 - val_loss: 2.0867 - val_f1_score: 0.3473
Epoch 70/500
28/28 [=====] - ETA: 0s - loss: 2.1095 - f1_score:
0.3680

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 376ms/step - loss: 2.1095 -
f1_score: 0.3680 - val_loss: 2.0862 - val_f1_score: 0.3649
Epoch 71/500
28/28 [=====] - 2s 86ms/step - loss: 2.0775 - f1_score:
0.3627 - val_loss: 2.1455 - val_f1_score: 0.3360
```

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Epoch 72/500
28/28 [=====] - ETA: 0s - loss: 2.0757 - f1_score: 0.3662
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 422ms/step - loss: 2.0757 -
f1_score: 0.3662 - val_loss: 2.0265 - val_f1_score: 0.4077
Epoch 73/500
28/28 [=====] - 2s 85ms/step - loss: 2.0555 - f1_score: 0.3805 -
val_loss: 2.0592 - val_f1_score: 0.3932
Epoch 74/500
28/28 [=====] - 2s 88ms/step - loss: 2.0107 - f1_score: 0.3871 -
val_loss: 2.0563 - val_f1_score: 0.3937
Epoch 75/500
28/28 [=====] - 2s 87ms/step - loss: 2.0169 - f1_score: 0.3960 -
val_loss: 2.0852 - val_f1_score: 0.3720
Epoch 76/500
28/28 [=====] - ETA: 0s - loss: 1.9867 - f1_score: 0.3811
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 439ms/step - loss: 1.9867 -
f1_score: 0.3811 - val_loss: 1.9315 - val_f1_score: 0.4209
Epoch 77/500
28/28 [=====] - 2s 86ms/step - loss: 1.9958 - f1_score: 0.3811 -
val_loss: 2.0875 - val_f1_score: 0.3550
Epoch 78/500
28/28 [=====] - ETA: 0s - loss: 1.9737 - f1_score: 0.4090
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 [=====] - 10s 360ms/step - loss: 1.9737 -  
f1_score: 0.4090 - val_loss: 1.8987 - val_f1_score: 0.4302  
Epoch 79/500  
28/28 [=====] - 2s 85ms/step - loss: 1.9519 - f1_score:  
0.3987 - val_loss: 1.9143 - val_f1_score: 0.4014  
Epoch 80/500  
28/28 [=====] - ETA: 0s - loss: 1.9339 - f1_score:  
0.4055  
  
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 446ms/step - loss: 1.9339 -  
f1_score: 0.4055 - val_loss: 1.8782 - val_f1_score: 0.4605  
Epoch 81/500  
28/28 [=====] - 2s 85ms/step - loss: 1.9045 - f1_score:  
0.4209 - val_loss: 1.9159 - val_f1_score: 0.4342  
Epoch 82/500  
28/28 [=====] - ETA: 0s - loss: 1.8842 - f1_score:  
0.4127  
  
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 383ms/step - loss: 1.8842 -  
f1_score: 0.4127 - val_loss: 1.8515 - val_f1_score: 0.4607  
Epoch 83/500  
28/28 [=====] - 2s 87ms/step - loss: 1.9023 - f1_score:  
0.4310 - val_loss: 1.8215 - val_f1_score: 0.4431  
Epoch 84/500  
28/28 [=====] - ETA: 0s - loss: 1.8764 - f1_score:  
0.4261  
  
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 [=====] - 12s 457ms/step - loss: 1.8764 -  
f1_score: 0.4261 - val_loss: 1.8101 - val_f1_score: 0.4776  
Epoch 85/500  
28/28 [=====] - 2s 85ms/step - loss: 1.8708 - f1_score:  
0.4358 - val_loss: 1.8595 - val_f1_score: 0.4475  
Epoch 86/500  
28/28 [=====] - 2s 85ms/step - loss: 1.8431 - f1_score:  
0.4281 - val_loss: 1.8147 - val_f1_score: 0.4628  
Epoch 87/500  
28/28 [=====] - ETA: 0s - loss: 1.8305 - f1_score:  
0.4468  
  
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 381ms/step - loss: 1.8305 -  
f1_score: 0.4468 - val_loss: 1.7687 - val_f1_score: 0.4832  
Epoch 88/500  
28/28 [=====] - 2s 86ms/step - loss: 1.8062 - f1_score:  
0.4459 - val_loss: 1.7794 - val_f1_score: 0.4797  
Epoch 89/500  
28/28 [=====] - 2s 85ms/step - loss: 1.8099 - f1_score:  
0.4511 - val_loss: 1.8010 - val_f1_score: 0.4704  
Epoch 90/500  
28/28 [=====] - 2s 86ms/step - loss: 1.7987 - f1_score:  
0.4534 - val_loss: 1.8010 - val_f1_score: 0.4450  
Epoch 91/500  
28/28 [=====] - 2s 85ms/step - loss: 1.7974 - f1_score:  
0.4507 - val_loss: 1.7615 - val_f1_score: 0.4815  
Epoch 92/500  
28/28 [=====] - 2s 86ms/step - loss: 1.7810 - f1_score:  
0.4523 - val_loss: 1.7521 - val_f1_score: 0.4804  
Epoch 93/500  
28/28 [=====] - ETA: 0s - loss: 1.7350 - f1_score:  
0.4743  
  
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 [=====] - 10s 381ms/step - loss: 1.7350 -  
f1_score: 0.4743 - val_loss: 1.7653 - val_f1_score: 0.4889  
Epoch 94/500  
28/28 [=====] - 2s 85ms/step - loss: 1.7329 - f1_score:  
0.4653 - val_loss: 1.7767 - val_f1_score: 0.4814  
Epoch 95/500  
28/28 [=====] - ETA: 0s - loss: 1.7194 - f1_score:  
0.4661  
  
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: 1.7194 -  
f1_score: 0.4661 - val_loss: 1.7195 - val_f1_score: 0.5178  
Epoch 96/500  
28/28 [=====] - 2s 85ms/step - loss: 1.7028 - f1_score:  
0.4728 - val_loss: 1.6416 - val_f1_score: 0.5051  
Epoch 97/500  
28/28 [=====] - 2s 86ms/step - loss: 1.6927 - f1_score:  
0.4767 - val_loss: 1.7135 - val_f1_score: 0.4744  
Epoch 98/500  
28/28 [=====] - 2s 86ms/step - loss: 1.7111 - f1_score:  
0.4886 - val_loss: 1.6809 - val_f1_score: 0.5025  
Epoch 99/500  
28/28 [=====] - 2s 86ms/step - loss: 1.6921 - f1_score:  
0.4766 - val_loss: 1.7747 - val_f1_score: 0.4603  
Epoch 100/500  
28/28 [=====] - ETA: 0s - loss: 1.6418 - f1_score:  
0.4925  
  
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 445ms/step - loss: 1.6418 -  
f1_score: 0.4925 - val_loss: 1.6042 - val_f1_score: 0.5453  
Epoch 101/500  
28/28 [=====] - 2s 85ms/step - loss: 1.6418 - f1_score:  
0.4970 - val_loss: 1.6371 - val_f1_score: 0.5141  
Epoch 102/500  
28/28 [=====] - 2s 85ms/step - loss: 1.6345 - f1_score:
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0.5042 - val_loss: 1.7105 - val_f1_score: 0.4852
Epoch 103/500
28/28 [=====] - 2s 86ms/step - loss: 1.6262 - f1_score: 0.5054 - val_loss: 1.7584 - val_f1_score: 0.4884
Epoch 104/500
28/28 [=====] - 2s 87ms/step - loss: 1.6029 - f1_score: 0.5049 - val_loss: 1.6455 - val_f1_score: 0.5117
Epoch 105/500
28/28 [=====] - 2s 87ms/step - loss: 1.6026 - f1_score: 0.5101 - val_loss: 1.6028 - val_f1_score: 0.5398
Epoch 106/500
28/28 [=====] - 2s 88ms/step - loss: 1.5906 - f1_score: 0.5166 - val_loss: 1.6272 - val_f1_score: 0.5230
Epoch 107/500
28/28 [=====] - 2s 88ms/step - loss: 1.5701 - f1_score: 0.5273 - val_loss: 1.5690 - val_f1_score: 0.5245
Epoch 108/500
28/28 [=====] - ETA: 0s - loss: 1.5488 - f1_score: 0.5313
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: 1.5488 - f1_score: 0.5313 - val_loss: 1.5796 - val_f1_score: 0.5578
Epoch 109/500
28/28 [=====] - ETA: 0s - loss: 1.5515 - f1_score: 0.5231
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: 1.5515 - f1_score: 0.5231 - val_loss: 1.5622 - val_f1_score: 0.5607
Epoch 110/500
28/28 [=====] - 2s 85ms/step - loss: 1.5482 - f1_score: 0.5220 - val_loss: 1.7176 - val_f1_score: 0.5028
Epoch 111/500
28/28 [=====] - 2s 86ms/step - loss: 1.5332 - f1_score: 0.5276 - val_loss: 1.5462 - val_f1_score: 0.5498
```

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Epoch 112/500
28/28 [=====] - 2s 86ms/step - loss: 1.5069 - f1_score: 0.5402 - val_loss: 1.6129 - val_f1_score: 0.5184
Epoch 113/500
28/28 [=====] - 2s 86ms/step - loss: 1.4921 - f1_score: 0.5363 - val_loss: 1.5637 - val_f1_score: 0.5566
Epoch 114/500
28/28 [=====] - 2s 86ms/step - loss: 1.4843 - f1_score: 0.5563 - val_loss: 1.4964 - val_f1_score: 0.5603
Epoch 115/500
28/28 [=====] - ETA: 0s - loss: 1.4839 - f1_score: 0.5403

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 [=====] - 22s 821ms/step - loss: 1.4839 - f1_score: 0.5403 - val_loss: 1.5014 - val_f1_score: 0.5635
Epoch 116/500
28/28 [=====] - 2s 85ms/step - loss: 1.4866 - f1_score: 0.5423 - val_loss: 1.5651 - val_f1_score: 0.5570
Epoch 117/500
28/28 [=====] - ETA: 0s - loss: 1.4655 - f1_score: 0.5525

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 386ms/step - loss: 1.4655 - f1_score: 0.5525 - val_loss: 1.4706 - val_f1_score: 0.5826
Epoch 118/500
28/28 [=====] - 2s 85ms/step - loss: 1.4602 - f1_score: 0.5658 - val_loss: 1.6123 - val_f1_score: 0.5300
Epoch 119/500
28/28 [=====] - 2s 86ms/step - loss: 1.4609 - f1_score: 0.5533 - val_loss: 1.4838 - val_f1_score: 0.5452
Epoch 120/500
28/28 [=====] - 2s 85ms/step - loss: 1.4397 - f1_score: 0.5621 - val_loss: 1.5137 - val_f1_score: 0.5786
Epoch 121/500
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28/28 [=====] - 2s 86ms/step - loss: 1.4032 - f1_score: 0.5729 - val_loss: 1.4788 - val_f1_score: 0.5563
Epoch 122/500
28/28 [=====] - 2s 87ms/step - loss: 1.4166 - f1_score: 0.5667 - val_loss: 1.4970 - val_f1_score: 0.5435
Epoch 123/500
28/28 [=====] - 2s 86ms/step - loss: 1.4016 - f1_score: 0.5676 - val_loss: 1.5008 - val_f1_score: 0.5595
Epoch 124/500
28/28 [=====] - 2s 88ms/step - loss: 1.4003 - f1_score: 0.5639 - val_loss: 1.4618 - val_f1_score: 0.5615
Epoch 125/500
28/28 [=====] - 2s 87ms/step - loss: 1.3937 - f1_score: 0.5504 - val_loss: 1.4305 - val_f1_score: 0.5772
Epoch 126/500
28/28 [=====] - ETA: 0s - loss: 1.4012 - f1_score: 0.5661

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 418ms/step - loss: 1.4012 - f1_score: 0.5661 - val_loss: 1.4218 - val_f1_score: 0.5914
Epoch 127/500
28/28 [=====] - ETA: 0s - loss: 1.3724 - f1_score: 0.5796

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 [=====] - 9s 345ms/step - loss: 1.3724 - f1_score: 0.5796 - val_loss: 1.3833 - val_f1_score: 0.5948
Epoch 128/500
28/28 [=====] - 2s 86ms/step - loss: 1.3621 - f1_score: 0.5755 - val_loss: 1.5351 - val_f1_score: 0.5557
Epoch 129/500
28/28 [=====] - 2s 85ms/step - loss: 1.3506 - f1_score: 0.5803 - val_loss: 1.4752 - val_f1_score: 0.5836
Epoch 130/500
28/28 [=====] - 2s 86ms/step - loss: 1.3660 - f1_score:
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0.5680 - val_loss: 1.4269 - val_f1_score: 0.5865
Epoch 131/500
28/28 [=====] - 2s 86ms/step - loss: 1.3396 - f1_score: 0.5842 - val_loss: 1.5199 - val_f1_score: 0.5631
Epoch 132/500
28/28 [=====] - ETA: 0s - loss: 1.3397 - f1_score: 0.5800

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: 1.3397 - f1_score: 0.5800 - val_loss: 1.4334 - val_f1_score: 0.6059
Epoch 133/500
28/28 [=====] - 2s 85ms/step - loss: 1.3237 - f1_score: 0.5901 - val_loss: 1.5005 - val_f1_score: 0.5902
Epoch 134/500
28/28 [=====] - ETA: 0s - loss: 1.3192 - f1_score: 0.5900

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: 1.3192 - f1_score: 0.5900 - val_loss: 1.3824 - val_f1_score: 0.6096
Epoch 135/500
28/28 [=====] - 2s 85ms/step - loss: 1.3316 - f1_score: 0.5930 - val_loss: 1.4658 - val_f1_score: 0.5757
Epoch 136/500
28/28 [=====] - 2s 86ms/step - loss: 1.3365 - f1_score: 0.5876 - val_loss: 1.4239 - val_f1_score: 0.5970
Epoch 137/500
28/28 [=====] - ETA: 0s - loss: 1.2747 - f1_score: 0.6086

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 403ms/step - loss: 1.2747 -  
f1_score: 0.6086 - val_loss: 1.4200 - val_f1_score: 0.6136  
Epoch 138/500  
28/28 [=====] - 2s 86ms/step - loss: 1.2791 - f1_score:  
0.5994 - val_loss: 1.3414 - val_f1_score: 0.6014  
Epoch 139/500  
28/28 [=====] - ETA: 0s - loss: 1.2528 - f1_score:  
0.6192  
  
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: 1.2528 -  
f1_score: 0.6192 - val_loss: 1.3251 - val_f1_score: 0.6207  
Epoch 140/500  
28/28 [=====] - 2s 85ms/step - loss: 1.2700 - f1_score:  
0.6129 - val_loss: 1.3686 - val_f1_score: 0.6168  
Epoch 141/500  
28/28 [=====] - 2s 86ms/step - loss: 1.2730 - f1_score:  
0.6075 - val_loss: 1.3862 - val_f1_score: 0.6044  
Epoch 142/500  
28/28 [=====] - ETA: 0s - loss: 1.2388 - f1_score:  
0.6160  
  
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: 1.2388 -  
f1_score: 0.6160 - val_loss: 1.4103 - val_f1_score: 0.6243  
Epoch 143/500  
28/28 [=====] - 2s 85ms/step - loss: 1.2516 - f1_score:  
0.6149 - val_loss: 1.4122 - val_f1_score: 0.6116  
Epoch 144/500  
28/28 [=====] - 2s 86ms/step - loss: 1.2011 - f1_score:  
0.6319 - val_loss: 1.3695 - val_f1_score: 0.6169  
Epoch 145/500  
28/28 [=====] - ETA: 0s - loss: 1.2266 - f1_score:  
0.6192
```

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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 [=====] - 9s 335ms/step - loss: 1.2266 -
f1_score: 0.6192 - val_loss: 1.2617 - val_f1_score: 0.6312
Epoch 146/500
28/28 [=====] - 2s 86ms/step - loss: 1.2434 - f1_score:
0.6155 - val_loss: 1.4086 - val_f1_score: 0.5978
Epoch 147/500
28/28 [=====] - ETA: 0s - loss: 1.2716 - f1_score:
0.6040

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 453ms/step - loss: 1.2716 -
f1_score: 0.6040 - val_loss: 1.3602 - val_f1_score: 0.6446
Epoch 148/500
28/28 [=====] - 2s 85ms/step - loss: 1.2122 - f1_score:
0.6298 - val_loss: 1.3785 - val_f1_score: 0.6068
Epoch 149/500
28/28 [=====] - 2s 85ms/step - loss: 1.2511 - f1_score:
0.6144 - val_loss: 1.4187 - val_f1_score: 0.5964
Epoch 150/500
28/28 [=====] - 2s 86ms/step - loss: 1.1926 - f1_score:
0.6302 - val_loss: 1.4582 - val_f1_score: 0.5822
Epoch 151/500
28/28 [=====] - 2s 86ms/step - loss: 1.1948 - f1_score:
0.6332 - val_loss: 1.2982 - val_f1_score: 0.6297
Epoch 152/500
28/28 [=====] - 2s 86ms/step - loss: 1.2107 - f1_score:
0.6116 - val_loss: 1.2681 - val_f1_score: 0.6060
Epoch 153/500
28/28 [=====] - ETA: 0s - loss: 1.1922 - f1_score:
0.6207

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.
```

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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 [=====] - 10s 360ms/step - loss: 1.1922 - f1_score: 0.6207 - val_loss: 1.2905 - val_f1_score: 0.6580
Epoch 154/500
28/28 [=====] - 2s 85ms/step - loss: 1.1747 - f1_score: 0.6382 - val_loss: 1.4569 - val_f1_score: 0.5912
Epoch 155/500
28/28 [=====] - 2s 85ms/step - loss: 1.1535 - f1_score: 0.6471 - val_loss: 1.3493 - val_f1_score: 0.6204
Epoch 156/500
28/28 [=====] - 2s 86ms/step - loss: 1.1632 - f1_score: 0.6321 - val_loss: 1.3540 - val_f1_score: 0.6312
Epoch 157/500
28/28 [=====] - 2s 87ms/step - loss: 1.1499 - f1_score: 0.6372 - val_loss: 1.3418 - val_f1_score: 0.6318
Epoch 158/500
28/28 [=====] - 2s 87ms/step - loss: 1.1682 - f1_score: 0.6364 - val_loss: 1.3269 - val_f1_score: 0.6234
Epoch 159/500
28/28 [=====] - 2s 88ms/step - loss: 1.1714 - f1_score: 0.6284 - val_loss: 1.3836 - val_f1_score: 0.6223
Epoch 160/500
28/28 [=====] - 2s 88ms/step - loss: 1.1511 - f1_score: 0.6412 - val_loss: 1.2835 - val_f1_score: 0.6432
Epoch 161/500
28/28 [=====] - 2s 88ms/step - loss: 1.1351 - f1_score: 0.6523 - val_loss: 1.2813 - val_f1_score: 0.6427
Epoch 162/500
28/28 [=====] - 2s 88ms/step - loss: 1.1402 - f1_score: 0.6421 - val_loss: 1.2785 - val_f1_score: 0.6341
Epoch 163/500
28/28 [=====] - 2s 88ms/step - loss: 1.1301 - f1_score: 0.6520 - val_loss: 1.3069 - val_f1_score: 0.6329
Epoch 164/500
28/28 [=====] - 3s 90ms/step - loss: 1.0832 - f1_score: 0.6620 - val_loss: 1.2951 - val_f1_score: 0.6464
Epoch 165/500
28/28 [=====] - 2s 88ms/step - loss: 1.1112 - f1_score: 0.6451 - val_loss: 1.2945 - val_f1_score: 0.6435
Epoch 166/500
28/28 [=====] - 2s 89ms/step - loss: 1.0963 - f1_score: 0.6688 - val_loss: 1.3475 - val_f1_score: 0.6436
Epoch 167/500
28/28 [=====] - 2s 89ms/step - loss: 1.0982 - f1_score: 0.6592 - val_loss: 1.2386 - val_f1_score: 0.6430
Epoch 168/500
```

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28/28 [=====] - 2s 88ms/step - loss: 1.0967 - f1_score: 0.6595 - val_loss: 1.2605 - val_f1_score: 0.6403
Epoch 169/500
28/28 [=====] - 2s 89ms/step - loss: 1.0906 - f1_score: 0.6573 - val_loss: 1.3768 - val_f1_score: 0.6154
Epoch 170/500
28/28 [=====] - 2s 89ms/step - loss: 1.0990 - f1_score: 0.6625 - val_loss: 1.2934 - val_f1_score: 0.6366
Epoch 171/500
28/28 [=====] - ETA: 0s - loss: 1.0927 - f1_score: 0.6610

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 422ms/step - loss: 1.0927 - f1_score: 0.6610 - val_loss: 1.2335 - val_f1_score: 0.6654
Epoch 172/500
28/28 [=====] - 2s 86ms/step - loss: 1.0828 - f1_score: 0.6652 - val_loss: 1.3131 - val_f1_score: 0.6122
Epoch 173/500
28/28 [=====] - 2s 86ms/step - loss: 1.0405 - f1_score: 0.6677 - val_loss: 1.2712 - val_f1_score: 0.6338
Epoch 174/500
28/28 [=====] - 2s 87ms/step - loss: 1.0851 - f1_score: 0.6552 - val_loss: 1.2690 - val_f1_score: 0.6367
Epoch 175/500
28/28 [=====] - 2s 88ms/step - loss: 1.0765 - f1_score: 0.6556 - val_loss: 1.2445 - val_f1_score: 0.6514
Epoch 176/500
28/28 [=====] - 2s 88ms/step - loss: 1.0735 - f1_score: 0.6635 - val_loss: 1.3733 - val_f1_score: 0.6285
Epoch 177/500
28/28 [=====] - 2s 88ms/step - loss: 1.0575 - f1_score: 0.6741 - val_loss: 1.2856 - val_f1_score: 0.6417
Epoch 178/500
28/28 [=====] - 2s 88ms/step - loss: 1.0494 - f1_score: 0.6686 - val_loss: 1.2035 - val_f1_score: 0.6558
Epoch 179/500
28/28 [=====] - 2s 89ms/step - loss: 1.0341 - f1_score: 0.6762 - val_loss: 1.2303 - val_f1_score: 0.6436
Epoch 180/500
28/28 [=====] - 2s 89ms/step - loss: 1.0004 - f1_score: 0.6900 - val_loss: 1.2123 - val_f1_score: 0.6637
```

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Epoch 181/500
28/28 [=====] - ETA: 0s - loss: 1.0263 - f1_score: 0.6715
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 455ms/step - loss: 1.0263 -
f1_score: 0.6715 - val_loss: 1.1978 - val_f1_score: 0.6784
Epoch 182/500
28/28 [=====] - 2s 88ms/step - loss: 1.0245 - f1_score: 0.6721 -
val_loss: 1.2064 - val_f1_score: 0.6437
Epoch 183/500
28/28 [=====] - 2s 86ms/step - loss: 1.0296 - f1_score: 0.6757 -
val_loss: 1.1921 - val_f1_score: 0.6763
Epoch 184/500
28/28 [=====] - 2s 87ms/step - loss: 1.0412 - f1_score: 0.6755 -
val_loss: 1.2081 - val_f1_score: 0.6507
Epoch 185/500
28/28 [=====] - 2s 87ms/step - loss: 0.9771 - f1_score: 0.6927 -
val_loss: 1.2787 - val_f1_score: 0.6750
Epoch 186/500
28/28 [=====] - 2s 87ms/step - loss: 1.0422 - f1_score: 0.6719 -
val_loss: 1.1965 - val_f1_score: 0.6587
Epoch 187/500
28/28 [=====] - 2s 87ms/step - loss: 1.0087 - f1_score: 0.6860 -
val_loss: 1.1274 - val_f1_score: 0.6754
Epoch 188/500
28/28 [=====] - 2s 88ms/step - loss: 0.9836 - f1_score: 0.6864 -
val_loss: 1.2969 - val_f1_score: 0.6593
Epoch 189/500
28/28 [=====] - 2s 88ms/step - loss: 0.9755 - f1_score: 0.6911 -
val_loss: 1.1955 - val_f1_score: 0.6752
Epoch 190/500
28/28 [=====] - 2s 88ms/step - loss: 0.9833 - f1_score: 0.6949 -
val_loss: 1.1833 - val_f1_score: 0.6599
Epoch 191/500
28/28 [=====] - 2s 88ms/step - loss: 0.9951 - f1_score: 0.6869 -
val_loss: 1.1818 - val_f1_score: 0.6697
Epoch 192/500
28/28 [=====] - 2s 88ms/step - loss: 0.9528 - f1_score: 0.7028 -
val_loss: 1.1066 - val_f1_score: 0.6758
Epoch 193/500
28/28 [=====] - 2s 88ms/step - loss: 0.9979 - f1_score:
```

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0.6757 - val_loss: 1.1680 - val_f1_score: 0.6743
Epoch 194/500
28/28 [=====] - 2s 89ms/step - loss: 0.9902 - f1_score: 0.6851 - val_loss: 1.1807 - val_f1_score: 0.6635
Epoch 195/500
28/28 [=====] - 2s 89ms/step - loss: 0.9848 - f1_score: 0.6844 - val_loss: 1.2183 - val_f1_score: 0.6635
Epoch 196/500
28/28 [=====] - 2s 89ms/step - loss: 0.9760 - f1_score: 0.6978 - val_loss: 1.1479 - val_f1_score: 0.6723
Epoch 197/500
28/28 [=====] - 2s 88ms/step - loss: 0.9478 - f1_score: 0.7092 - val_loss: 1.2423 - val_f1_score: 0.6441
Epoch 198/500
28/28 [=====] - 2s 89ms/step - loss: 0.9717 - f1_score: 0.6910 - val_loss: 1.2054 - val_f1_score: 0.6551
Epoch 199/500
28/28 [=====] - 2s 89ms/step - loss: 0.9526 - f1_score: 0.7136 - val_loss: 1.2850 - val_f1_score: 0.6393
Epoch 200/500
28/28 [=====] - 2s 88ms/step - loss: 0.9443 - f1_score: 0.7120 - val_loss: 1.2235 - val_f1_score: 0.6675
Epoch 201/500
28/28 [=====] - 2s 89ms/step - loss: 0.9356 - f1_score: 0.7006 - val_loss: 1.1650 - val_f1_score: 0.6566
Epoch 202/500
28/28 [=====] - 2s 90ms/step - loss: 0.9317 - f1_score: 0.7093 - val_loss: 1.2402 - val_f1_score: 0.6430
Epoch 203/500
28/28 [=====] - 2s 88ms/step - loss: 0.9119 - f1_score: 0.7184 - val_loss: 1.2191 - val_f1_score: 0.6558
Epoch 204/500
28/28 [=====] - ETA: 0s - loss: 0.8984 - f1_score: 0.7203

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: 0.8984 - f1_score: 0.7203 - val_loss: 1.1685 - val_f1_score: 0.6850
Epoch 205/500
28/28 [=====] - 2s 86ms/step - loss: 0.9041 - f1_score: 0.7179 - val_loss: 1.1772 - val_f1_score: 0.6648
Epoch 206/500
```

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28/28 [=====] - 2s 87ms/step - loss: 0.8920 - f1_score: 0.7190 - val_loss: 1.1988 - val_f1_score: 0.6658
Epoch 207/500
28/28 [=====] - 2s 88ms/step - loss: 0.9237 - f1_score: 0.7231 - val_loss: 1.2448 - val_f1_score: 0.6483
Epoch 208/500
28/28 [=====] - 2s 88ms/step - loss: 0.8842 - f1_score: 0.7193 - val_loss: 1.2206 - val_f1_score: 0.6631
Epoch 209/500
28/28 [=====] - 2s 89ms/step - loss: 0.8992 - f1_score: 0.7229 - val_loss: 1.2869 - val_f1_score: 0.6425
Epoch 210/500
28/28 [=====] - 3s 91ms/step - loss: 0.9103 - f1_score: 0.7225 - val_loss: 1.2077 - val_f1_score: 0.6715
Epoch 211/500
28/28 [=====] - 3s 90ms/step - loss: 0.8805 - f1_score: 0.7252 - val_loss: 1.2045 - val_f1_score: 0.6540
Epoch 212/500
28/28 [=====] - 3s 89ms/step - loss: 0.9086 - f1_score: 0.7149 - val_loss: 1.2945 - val_f1_score: 0.6599
Epoch 213/500
28/28 [=====] - 2s 89ms/step - loss: 0.8713 - f1_score: 0.7158 - val_loss: 1.2522 - val_f1_score: 0.6554
Epoch 214/500
28/28 [=====] - 2s 89ms/step - loss: 0.8748 - f1_score: 0.7283 - val_loss: 1.2296 - val_f1_score: 0.6407
Epoch 215/500
28/28 [=====] - 2s 89ms/step - loss: 0.8342 - f1_score: 0.7329 - val_loss: 1.1955 - val_f1_score: 0.6550
Epoch 216/500
28/28 [=====] - 2s 88ms/step - loss: 0.8616 - f1_score: 0.7213 - val_loss: 1.2111 - val_f1_score: 0.6537
Epoch 217/500
28/28 [=====] - 2s 89ms/step - loss: 0.8850 - f1_score: 0.7194 - val_loss: 1.2034 - val_f1_score: 0.6629
Epoch 218/500
28/28 [=====] - 2s 89ms/step - loss: 0.9113 - f1_score: 0.7044 - val_loss: 1.2428 - val_f1_score: 0.6539
Epoch 219/500
28/28 [=====] - 2s 89ms/step - loss: 0.8409 - f1_score: 0.7421 - val_loss: 1.2626 - val_f1_score: 0.6587
Epoch 220/500
28/28 [=====] - ETA: 0s - loss: 0.8425 - f1_score: 0.7366
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.

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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 447ms/step - loss: 0.8425 - f1_score: 0.7366 - val_loss: 1.1436 - val_f1_score: 0.6955
Epoch 221/500
28/28 [=====] - 2s 87ms/step - loss: 0.8293 - f1_score: 0.7451 - val_loss: 1.2256 - val_f1_score: 0.6888
Epoch 222/500
28/28 [=====] - 2s 87ms/step - loss: 0.8415 - f1_score: 0.7292 - val_loss: 1.1663 - val_f1_score: 0.6914
Epoch 223/500
28/28 [=====] - 2s 88ms/step - loss: 0.8293 - f1_score: 0.7387 - val_loss: 1.2061 - val_f1_score: 0.6704
Epoch 224/500
28/28 [=====] - 2s 89ms/step - loss: 0.8555 - f1_score: 0.7336 - val_loss: 1.2618 - val_f1_score: 0.6533
Epoch 225/500
28/28 [=====] - 2s 89ms/step - loss: 0.8366 - f1_score: 0.7427 - val_loss: 1.1963 - val_f1_score: 0.6689
Epoch 226/500
28/28 [=====] - 2s 89ms/step - loss: 0.8360 - f1_score: 0.7247 - val_loss: 1.1799 - val_f1_score: 0.6744
Epoch 227/500
28/28 [=====] - 2s 89ms/step - loss: 0.8439 - f1_score: 0.7387 - val_loss: 1.2721 - val_f1_score: 0.6532
Epoch 228/500
28/28 [=====] - 2s 89ms/step - loss: 0.8542 - f1_score: 0.7320 - val_loss: 1.2060 - val_f1_score: 0.6695
Epoch 229/500
28/28 [=====] - 3s 90ms/step - loss: 0.7947 - f1_score: 0.7417 - val_loss: 1.1463 - val_f1_score: 0.6848
Epoch 230/500
28/28 [=====] - 2s 89ms/step - loss: 0.8265 - f1_score: 0.7455 - val_loss: 1.2456 - val_f1_score: 0.6395
Epoch 231/500
28/28 [=====] - 2s 89ms/step - loss: 0.8184 - f1_score: 0.7411 - val_loss: 1.2279 - val_f1_score: 0.6564
Epoch 232/500
28/28 [=====] - 3s 90ms/step - loss: 0.8098 - f1_score: 0.7462 - val_loss: 1.1447 - val_f1_score: 0.6770
Epoch 233/500
28/28 [=====] - 2s 89ms/step - loss: 0.8177 - f1_score: 0.7459 - val_loss: 1.1324 - val_f1_score: 0.6758
Epoch 234/500
28/28 [=====] - 2s 90ms/step - loss: 0.8079 - f1_score:
```

```
0.7501 - val_loss: 1.2946 - val_f1_score: 0.6468
Epoch 235/500
28/28 [=====] - ETA: 0s - loss: 0.7780 - f1_score: 0.7574

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 437ms/step - loss: 0.7780 - f1_score: 0.7574 - val_loss: 1.1151 - val_f1_score: 0.7150
Epoch 236/500
28/28 [=====] - 2s 86ms/step - loss: 0.8005 - f1_score: 0.7506 - val_loss: 1.1970 - val_f1_score: 0.6716
Epoch 237/500
28/28 [=====] - 2s 87ms/step - loss: 0.8076 - f1_score: 0.7476 - val_loss: 1.2771 - val_f1_score: 0.6572
Epoch 238/500
28/28 [=====] - 2s 88ms/step - loss: 0.7928 - f1_score: 0.7473 - val_loss: 1.1430 - val_f1_score: 0.6823
Epoch 239/500
28/28 [=====] - 3s 90ms/step - loss: 0.7716 - f1_score: 0.7599 - val_loss: 1.2858 - val_f1_score: 0.6352
Epoch 240/500
28/28 [=====] - 3s 91ms/step - loss: 0.8019 - f1_score: 0.7456 - val_loss: 1.1923 - val_f1_score: 0.6700
Epoch 241/500
28/28 [=====] - 3s 91ms/step - loss: 0.7804 - f1_score: 0.7577 - val_loss: 1.2353 - val_f1_score: 0.6861
Epoch 242/500
28/28 [=====] - 3s 91ms/step - loss: 0.7914 - f1_score: 0.7574 - val_loss: 1.1361 - val_f1_score: 0.6847
Epoch 243/500
28/28 [=====] - 2s 89ms/step - loss: 0.7673 - f1_score: 0.7595 - val_loss: 1.3185 - val_f1_score: 0.6442
Epoch 244/500
28/28 [=====] - 2s 89ms/step - loss: 0.7992 - f1_score: 0.7483 - val_loss: 1.2105 - val_f1_score: 0.6731
Epoch 245/500
28/28 [=====] - 2s 89ms/step - loss: 0.7622 - f1_score: 0.7652 - val_loss: 1.1848 - val_f1_score: 0.6695
Epoch 246/500
28/28 [=====] - 2s 90ms/step - loss: 0.7617 - f1_score: 0.7588 - val_loss: 1.1628 - val_f1_score: 0.6774
Epoch 247/500
```

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28/28 [=====] - 2s 90ms/step - loss: 0.7497 - f1_score: 0.7697 - val_loss: 1.2213 - val_f1_score: 0.6843
Epoch 248/500
28/28 [=====] - 2s 89ms/step - loss: 0.7659 - f1_score: 0.7649 - val_loss: 1.1249 - val_f1_score: 0.7028
Epoch 249/500
28/28 [=====] - 2s 89ms/step - loss: 0.7661 - f1_score: 0.7548 - val_loss: 1.2069 - val_f1_score: 0.6541
Epoch 250/500
28/28 [=====] - 3s 91ms/step - loss: 0.7219 - f1_score: 0.7734 - val_loss: 1.1146 - val_f1_score: 0.6923
Epoch 251/500
28/28 [=====] - 3s 91ms/step - loss: 0.7328 - f1_score: 0.7656 - val_loss: 1.1132 - val_f1_score: 0.7017
Epoch 252/500
28/28 [=====] - 2s 89ms/step - loss: 0.7180 - f1_score: 0.7773 - val_loss: 1.1468 - val_f1_score: 0.7014
Epoch 253/500
28/28 [=====] - 2s 89ms/step - loss: 0.7790 - f1_score: 0.7523 - val_loss: 1.1120 - val_f1_score: 0.6895
Epoch 254/500
28/28 [=====] - 2s 90ms/step - loss: 0.7292 - f1_score: 0.7668 - val_loss: 1.3957 - val_f1_score: 0.6283
Epoch 255/500
28/28 [=====] - 3s 90ms/step - loss: 0.7286 - f1_score: 0.7705 - val_loss: 1.2790 - val_f1_score: 0.6389
Epoch 256/500
28/28 [=====] - 2s 89ms/step - loss: 0.7394 - f1_score: 0.7636 - val_loss: 1.2071 - val_f1_score: 0.6603
Epoch 257/500
28/28 [=====] - 3s 90ms/step - loss: 0.7378 - f1_score: 0.7641 - val_loss: 1.1178 - val_f1_score: 0.7045
Epoch 258/500
28/28 [=====] - 3s 90ms/step - loss: 0.7233 - f1_score: 0.7680 - val_loss: 1.1948 - val_f1_score: 0.6612
Epoch 259/500
28/28 [=====] - 2s 90ms/step - loss: 0.7197 - f1_score: 0.7679 - val_loss: 1.1145 - val_f1_score: 0.6894
Epoch 260/500
28/28 [=====] - 3s 90ms/step - loss: 0.7048 - f1_score: 0.7725 - val_loss: 1.1619 - val_f1_score: 0.6906
Epoch 261/500
28/28 [=====] - 2s 89ms/step - loss: 0.7270 - f1_score: 0.7662 - val_loss: 1.0765 - val_f1_score: 0.7099
Epoch 262/500
28/28 [=====] - 2s 89ms/step - loss: 0.7136 - f1_score: 0.7723 - val_loss: 1.1260 - val_f1_score: 0.7013
Epoch 263/500
```

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28/28 [=====] - 3s 90ms/step - loss: 0.7194 - f1_score: 0.7744 - val_loss: 1.1630 - val_f1_score: 0.6725
Epoch 264/500
28/28 [=====] - 2s 90ms/step - loss: 0.7132 - f1_score: 0.7714 - val_loss: 1.1011 - val_f1_score: 0.6933
Epoch 265/500
28/28 [=====] - 2s 89ms/step - loss: 0.6839 - f1_score: 0.7854 - val_loss: 1.1275 - val_f1_score: 0.7051
Epoch 266/500
28/28 [=====] - 3s 91ms/step - loss: 0.6914 - f1_score: 0.7814 - val_loss: 1.1953 - val_f1_score: 0.6877
Epoch 267/500
28/28 [=====] - 3s 90ms/step - loss: 0.7009 - f1_score: 0.7784 - val_loss: 1.1702 - val_f1_score: 0.6894
Epoch 268/500
28/28 [=====] - 3s 91ms/step - loss: 0.7224 - f1_score: 0.7759 - val_loss: 1.1314 - val_f1_score: 0.7019
Epoch 269/500
28/28 [=====] - 2s 89ms/step - loss: 0.7142 - f1_score: 0.7774 - val_loss: 1.2569 - val_f1_score: 0.6609
Epoch 270/500
28/28 [=====] - 3s 90ms/step - loss: 0.6800 - f1_score: 0.7874 - val_loss: 1.1568 - val_f1_score: 0.6808
Epoch 271/500
28/28 [=====] - 3s 91ms/step - loss: 0.6968 - f1_score: 0.7774 - val_loss: 1.2906 - val_f1_score: 0.6528
Epoch 272/500
28/28 [=====] - 3s 97ms/step - loss: 0.7034 - f1_score: 0.7827 - val_loss: 1.2246 - val_f1_score: 0.6604
Epoch 273/500
28/28 [=====] - 3s 90ms/step - loss: 0.6826 - f1_score: 0.7857 - val_loss: 1.1754 - val_f1_score: 0.6694
Epoch 274/500
28/28 [=====] - 3s 90ms/step - loss: 0.6869 - f1_score: 0.7862 - val_loss: 1.0971 - val_f1_score: 0.6962
Epoch 275/500
28/28 [=====] - 3s 91ms/step - loss: 0.6985 - f1_score: 0.7865 - val_loss: 1.1618 - val_f1_score: 0.6839
Epoch 276/500
28/28 [=====] - 3s 90ms/step - loss: 0.6942 - f1_score: 0.7831 - val_loss: 1.3545 - val_f1_score: 0.6439
Epoch 277/500
28/28 [=====] - 3s 90ms/step - loss: 0.6694 - f1_score: 0.7923 - val_loss: 1.1533 - val_f1_score: 0.6790
Epoch 278/500
28/28 [=====] - 3s 91ms/step - loss: 0.6811 - f1_score: 0.7827 - val_loss: 1.1698 - val_f1_score: 0.6981
Epoch 279/500
```

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28/28 [=====] - 3s 90ms/step - loss: 0.6766 - f1_score: 0.7894 - val_loss: 1.1842 - val_f1_score: 0.6681
Epoch 280/500
28/28 [=====] - ETA: 0s - loss: 0.6621 - f1_score: 0.7929

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 460ms/step - loss: 0.6621 - f1_score: 0.7929 - val_loss: 1.0893 - val_f1_score: 0.7185
Epoch 281/500
28/28 [=====] - 2s 86ms/step - loss: 0.6623 - f1_score: 0.7865 - val_loss: 1.1265 - val_f1_score: 0.6857
Epoch 282/500
28/28 [=====] - 2s 87ms/step - loss: 0.6793 - f1_score: 0.7846 - val_loss: 1.2733 - val_f1_score: 0.6580
Epoch 283/500
28/28 [=====] - 2s 88ms/step - loss: 0.6740 - f1_score: 0.7846 - val_loss: 1.1479 - val_f1_score: 0.6624
Epoch 284/500
28/28 [=====] - 2s 88ms/step - loss: 0.6611 - f1_score: 0.7910 - val_loss: 1.0695 - val_f1_score: 0.6962
Epoch 285/500
28/28 [=====] - 2s 88ms/step - loss: 0.6492 - f1_score: 0.7906 - val_loss: 1.1804 - val_f1_score: 0.6763
Epoch 286/500
28/28 [=====] - 2s 89ms/step - loss: 0.6500 - f1_score: 0.8011 - val_loss: 1.2368 - val_f1_score: 0.6762
Epoch 287/500
28/28 [=====] - 3s 90ms/step - loss: 0.6789 - f1_score: 0.7798 - val_loss: 1.3624 - val_f1_score: 0.6429
Epoch 288/500
28/28 [=====] - 2s 89ms/step - loss: 0.6840 - f1_score: 0.7875 - val_loss: 1.2835 - val_f1_score: 0.6656
Epoch 289/500
28/28 [=====] - 3s 94ms/step - loss: 0.6467 - f1_score: 0.7936 - val_loss: 1.1741 - val_f1_score: 0.6934
Epoch 290/500
28/28 [=====] - 2s 89ms/step - loss: 0.6307 - f1_score: 0.7951 - val_loss: 1.1265 - val_f1_score: 0.6943
Epoch 291/500
28/28 [=====] - 2s 89ms/step - loss: 0.6455 - f1_score: 0.8004 - val_loss: 1.1820 - val_f1_score: 0.6831
```

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Epoch 292/500
28/28 [=====] - 3s 90ms/step - loss: 0.6446 - f1_score: 0.7961 - val_loss: 1.2114 - val_f1_score: 0.6736
Epoch 293/500
28/28 [=====] - 3s 90ms/step - loss: 0.6455 - f1_score: 0.7957 - val_loss: 1.1452 - val_f1_score: 0.6962
Epoch 294/500
28/28 [=====] - 3s 90ms/step - loss: 0.6036 - f1_score: 0.8041 - val_loss: 1.1564 - val_f1_score: 0.6677
Epoch 295/500
28/28 [=====] - 3s 92ms/step - loss: 0.6744 - f1_score: 0.7818 - val_loss: 1.2039 - val_f1_score: 0.6781
Epoch 296/500
28/28 [=====] - 2s 89ms/step - loss: 0.6027 - f1_score: 0.8121 - val_loss: 1.2596 - val_f1_score: 0.6612
Epoch 297/500
28/28 [=====] - 3s 90ms/step - loss: 0.6221 - f1_score: 0.8069 - val_loss: 1.3034 - val_f1_score: 0.6461
Epoch 298/500
28/28 [=====] - 3s 91ms/step - loss: 0.6272 - f1_score: 0.8037 - val_loss: 1.2064 - val_f1_score: 0.6774
Epoch 299/500
28/28 [=====] - 3s 90ms/step - loss: 0.6617 - f1_score: 0.7896 - val_loss: 1.1522 - val_f1_score: 0.6872
Epoch 300/500
28/28 [=====] - 3s 91ms/step - loss: 0.6286 - f1_score: 0.8054 - val_loss: 1.1134 - val_f1_score: 0.7098
Epoch 301/500
28/28 [=====] - 2s 90ms/step - loss: 0.6508 - f1_score: 0.7932 - val_loss: 1.2199 - val_f1_score: 0.6836
Epoch 302/500
28/28 [=====] - 3s 90ms/step - loss: 0.6166 - f1_score: 0.8065 - val_loss: 1.3671 - val_f1_score: 0.6455
Epoch 303/500
28/28 [=====] - 3s 90ms/step - loss: 0.6065 - f1_score: 0.8110 - val_loss: 1.2753 - val_f1_score: 0.6465
Epoch 304/500
28/28 [=====] - 3s 90ms/step - loss: 0.6077 - f1_score: 0.8041 - val_loss: 1.2361 - val_f1_score: 0.6630
Epoch 305/500
28/28 [=====] - 3s 90ms/step - loss: 0.6411 - f1_score: 0.7915 - val_loss: 1.3176 - val_f1_score: 0.6464
Epoch 306/500
28/28 [=====] - 3s 91ms/step - loss: 0.5893 - f1_score: 0.8189 - val_loss: 1.2711 - val_f1_score: 0.6588
Epoch 307/500
28/28 [=====] - 3s 97ms/step - loss: 0.6286 - f1_score: 0.8050 - val_loss: 1.2566 - val_f1_score: 0.6589
```

Epoch 308/500  
28/28 [=====] - 3s 94ms/step - loss: 0.5915 - f1\_score: 0.8110 - val\_loss: 1.1529 - val\_f1\_score: 0.7068  
Epoch 309/500  
28/28 [=====] - 3s 94ms/step - loss: 0.5955 - f1\_score: 0.8097 - val\_loss: 1.1640 - val\_f1\_score: 0.6898  
Epoch 310/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5974 - f1\_score: 0.8224 - val\_loss: 1.1728 - val\_f1\_score: 0.6827  
Epoch 311/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5848 - f1\_score: 0.8180 - val\_loss: 1.1550 - val\_f1\_score: 0.7104  
Epoch 312/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6060 - f1\_score: 0.8080 - val\_loss: 1.2643 - val\_f1\_score: 0.6646  
Epoch 313/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5728 - f1\_score: 0.8168 - val\_loss: 1.3245 - val\_f1\_score: 0.6560  
Epoch 314/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5940 - f1\_score: 0.8226 - val\_loss: 1.1325 - val\_f1\_score: 0.7063  
Epoch 315/500  
28/28 [=====] - 3s 91ms/step - loss: 0.6024 - f1\_score: 0.8108 - val\_loss: 1.1642 - val\_f1\_score: 0.6869  
Epoch 316/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5904 - f1\_score: 0.8235 - val\_loss: 1.2097 - val\_f1\_score: 0.6629  
Epoch 317/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5891 - f1\_score: 0.8209 - val\_loss: 1.1626 - val\_f1\_score: 0.6828  
Epoch 318/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6205 - f1\_score: 0.7993 - val\_loss: 1.2815 - val\_f1\_score: 0.6541  
Epoch 319/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5658 - f1\_score: 0.8294 - val\_loss: 1.3300 - val\_f1\_score: 0.6463  
Epoch 320/500  
28/28 [=====] - 3s 94ms/step - loss: 0.5847 - f1\_score: 0.8009 - val\_loss: 1.2921 - val\_f1\_score: 0.6510  
Epoch 321/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5742 - f1\_score: 0.8249 - val\_loss: 1.1880 - val\_f1\_score: 0.6575  
Epoch 322/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5724 - f1\_score: 0.8158 - val\_loss: 1.2420 - val\_f1\_score: 0.6653  
Epoch 323/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5541 - f1\_score: 0.8243 - val\_loss: 1.2150 - val\_f1\_score: 0.6748

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Epoch 324/500
28/28 [=====] - 3s 90ms/step - loss: 0.5858 - f1_score: 0.8174 - val_loss: 1.1737 - val_f1_score: 0.6746
Epoch 325/500
28/28 [=====] - 3s 90ms/step - loss: 0.5448 - f1_score: 0.8322 - val_loss: 1.1944 - val_f1_score: 0.6924
Epoch 326/500
28/28 [=====] - 3s 92ms/step - loss: 0.5692 - f1_score: 0.8228 - val_loss: 1.3541 - val_f1_score: 0.6350
Epoch 327/500
28/28 [=====] - 3s 90ms/step - loss: 0.5813 - f1_score: 0.8271 - val_loss: 1.3603 - val_f1_score: 0.6602
Epoch 328/500
28/28 [=====] - 3s 91ms/step - loss: 0.5856 - f1_score: 0.8281 - val_loss: 1.2315 - val_f1_score: 0.6501
Epoch 329/500
28/28 [=====] - 3s 92ms/step - loss: 0.5579 - f1_score: 0.8198 - val_loss: 1.3519 - val_f1_score: 0.6458
Epoch 330/500
28/28 [=====] - 3s 90ms/step - loss: 0.5515 - f1_score: 0.8204 - val_loss: 1.2058 - val_f1_score: 0.6950
Epoch 331/500
28/28 [=====] - 3s 90ms/step - loss: 0.5518 - f1_score: 0.8205 - val_loss: 1.2473 - val_f1_score: 0.6741
Epoch 332/500
28/28 [=====] - 3s 90ms/step - loss: 0.5499 - f1_score: 0.8368 - val_loss: 1.1884 - val_f1_score: 0.6822
Epoch 333/500
28/28 [=====] - 3s 91ms/step - loss: 0.5540 - f1_score: 0.8303 - val_loss: 1.2743 - val_f1_score: 0.6740
Epoch 334/500
28/28 [=====] - 3s 90ms/step - loss: 0.5602 - f1_score: 0.8286 - val_loss: 1.2529 - val_f1_score: 0.6846
Epoch 335/500
28/28 [=====] - 3s 91ms/step - loss: 0.5471 - f1_score: 0.8352 - val_loss: 1.1623 - val_f1_score: 0.6837
Epoch 336/500
28/28 [=====] - 3s 92ms/step - loss: 0.5550 - f1_score: 0.8292 - val_loss: 1.2782 - val_f1_score: 0.6589
Epoch 337/500
28/28 [=====] - 3s 91ms/step - loss: 0.5602 - f1_score: 0.8286 - val_loss: 1.2201 - val_f1_score: 0.6921
Epoch 338/500
28/28 [=====] - 3s 90ms/step - loss: 0.5696 - f1_score: 0.8182 - val_loss: 1.2247 - val_f1_score: 0.6624
Epoch 339/500
28/28 [=====] - 3s 94ms/step - loss: 0.5422 - f1_score: 0.8345 - val_loss: 1.2032 - val_f1_score: 0.6912
```

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Epoch 340/500
28/28 [=====] - ETA: 0s - loss: 0.5518 - f1_score: 0.8301
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 430ms/step - loss: 0.5518 - f1_score: 0.8301 - val_loss: 1.1144 - val_f1_score: 0.7189
Epoch 341/500
28/28 [=====] - 2s 86ms/step - loss: 0.5421 - f1_score: 0.8260 - val_loss: 1.3186 - val_f1_score: 0.6646
Epoch 342/500
28/28 [=====] - 2s 88ms/step - loss: 0.5269 - f1_score: 0.8423 - val_loss: 1.3098 - val_f1_score: 0.6585
Epoch 343/500
28/28 [=====] - 2s 89ms/step - loss: 0.5249 - f1_score: 0.8422 - val_loss: 1.2039 - val_f1_score: 0.6656
Epoch 344/500
28/28 [=====] - 2s 89ms/step - loss: 0.5437 - f1_score: 0.8300 - val_loss: 1.3202 - val_f1_score: 0.6552
Epoch 345/500
28/28 [=====] - 2s 89ms/step - loss: 0.5691 - f1_score: 0.8168 - val_loss: 1.2939 - val_f1_score: 0.6585
Epoch 346/500
28/28 [=====] - 2s 89ms/step - loss: 0.5250 - f1_score: 0.8431 - val_loss: 1.1926 - val_f1_score: 0.6847
Epoch 347/500
28/28 [=====] - 3s 90ms/step - loss: 0.5445 - f1_score: 0.8312 - val_loss: 1.2021 - val_f1_score: 0.6764
Epoch 348/500
28/28 [=====] - 2s 89ms/step - loss: 0.5457 - f1_score: 0.8333 - val_loss: 1.2068 - val_f1_score: 0.6791
Epoch 349/500
28/28 [=====] - 2s 89ms/step - loss: 0.5300 - f1_score: 0.8334 - val_loss: 1.2799 - val_f1_score: 0.6996
Epoch 350/500
28/28 [=====] - 2s 89ms/step - loss: 0.5351 - f1_score: 0.8367 - val_loss: 1.1772 - val_f1_score: 0.6788
Epoch 351/500
28/28 [=====] - 2s 89ms/step - loss: 0.5426 - f1_score: 0.8300 - val_loss: 1.3035 - val_f1_score: 0.6511
Epoch 352/500
28/28 [=====] - 3s 91ms/step - loss: 0.5451 - f1_score:
```

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0.8256 - val_loss: 1.2086 - val_f1_score: 0.6901
Epoch 353/500
28/28 [=====] - 3s 90ms/step - loss: 0.5010 - f1_score:
0.8448 - val_loss: 1.2867 - val_f1_score: 0.6593
Epoch 354/500
28/28 [=====] - 3s 90ms/step - loss: 0.5304 - f1_score:
0.8373 - val_loss: 1.2279 - val_f1_score: 0.6693
Epoch 355/500
28/28 [=====] - 3s 91ms/step - loss: 0.5364 - f1_score:
0.8282 - val_loss: 1.2811 - val_f1_score: 0.6655
Epoch 356/500
28/28 [=====] - 3s 94ms/step - loss: 0.5199 - f1_score:
0.8344 - val_loss: 1.1388 - val_f1_score: 0.7020
Epoch 357/500
28/28 [=====] - 3s 91ms/step - loss: 0.5155 - f1_score:
0.8412 - val_loss: 1.2856 - val_f1_score: 0.6853
Epoch 358/500
28/28 [=====] - 3s 90ms/step - loss: 0.5297 - f1_score:
0.8379 - val_loss: 1.2753 - val_f1_score: 0.6746
Epoch 359/500
28/28 [=====] - 3s 91ms/step - loss: 0.5117 - f1_score:
0.8407 - val_loss: 1.2274 - val_f1_score: 0.6823
Epoch 360/500
28/28 [=====] - 3s 91ms/step - loss: 0.5188 - f1_score:
0.8390 - val_loss: 1.3154 - val_f1_score: 0.6639
Epoch 361/500
28/28 [=====] - 3s 91ms/step - loss: 0.5321 - f1_score:
0.8317 - val_loss: 1.3291 - val_f1_score: 0.6796
Epoch 362/500
28/28 [=====] - 3s 92ms/step - loss: 0.4907 - f1_score:
0.8486 - val_loss: 1.1686 - val_f1_score: 0.7163
Epoch 363/500
28/28 [=====] - 3s 92ms/step - loss: 0.5019 - f1_score:
0.8494 - val_loss: 1.2496 - val_f1_score: 0.6929
Epoch 364/500
28/28 [=====] - 3s 90ms/step - loss: 0.5147 - f1_score:
0.8378 - val_loss: 1.2353 - val_f1_score: 0.6646
Epoch 365/500
28/28 [=====] - 3s 91ms/step - loss: 0.4822 - f1_score:
0.8490 - val_loss: 1.2874 - val_f1_score: 0.6662
Epoch 366/500
28/28 [=====] - 3s 90ms/step - loss: 0.5227 - f1_score:
0.8380 - val_loss: 1.1588 - val_f1_score: 0.6819
Epoch 367/500
28/28 [=====] - 3s 91ms/step - loss: 0.5027 - f1_score:
0.8448 - val_loss: 1.2398 - val_f1_score: 0.6923
Epoch 368/500
28/28 [=====] - 3s 91ms/step - loss: 0.4978 - f1_score:
```

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0.8478 - val_loss: 1.2116 - val_f1_score: 0.6884
Epoch 369/500
28/28 [=====] - 3s 92ms/step - loss: 0.5003 - f1_score: 0.8441 - val_loss: 1.1783 - val_f1_score: 0.6796
Epoch 370/500
28/28 [=====] - 3s 91ms/step - loss: 0.5065 - f1_score: 0.8385 - val_loss: 1.3099 - val_f1_score: 0.6531
Epoch 371/500
28/28 [=====] - 3s 92ms/step - loss: 0.5022 - f1_score: 0.8437 - val_loss: 1.2401 - val_f1_score: 0.6755
Epoch 372/500
28/28 [=====] - 3s 92ms/step - loss: 0.4827 - f1_score: 0.8524 - val_loss: 1.3203 - val_f1_score: 0.6647
Epoch 373/500
28/28 [=====] - 3s 90ms/step - loss: 0.5024 - f1_score: 0.8476 - val_loss: 1.3534 - val_f1_score: 0.6498
Epoch 374/500
28/28 [=====] - 3s 94ms/step - loss: 0.4744 - f1_score: 0.8545 - val_loss: 1.1836 - val_f1_score: 0.6783
Epoch 375/500
28/28 [=====] - 3s 95ms/step - loss: 0.4978 - f1_score: 0.8417 - val_loss: 1.3456 - val_f1_score: 0.6403
Epoch 376/500
28/28 [=====] - 3s 96ms/step - loss: 0.4791 - f1_score: 0.8528 - val_loss: 1.1434 - val_f1_score: 0.7178
Epoch 377/500
28/28 [=====] - 3s 97ms/step - loss: 0.4859 - f1_score: 0.8481 - val_loss: 1.2998 - val_f1_score: 0.6677
Epoch 378/500
28/28 [=====] - 3s 94ms/step - loss: 0.4791 - f1_score: 0.8562 - val_loss: 1.2093 - val_f1_score: 0.6719
Epoch 379/500
28/28 [=====] - 3s 93ms/step - loss: 0.4632 - f1_score: 0.8599 - val_loss: 1.2991 - val_f1_score: 0.6722
Epoch 380/500
28/28 [=====] - 3s 92ms/step - loss: 0.5051 - f1_score: 0.8349 - val_loss: 1.2337 - val_f1_score: 0.6756
Epoch 381/500
28/28 [=====] - 3s 91ms/step - loss: 0.4773 - f1_score: 0.8550 - val_loss: 1.2554 - val_f1_score: 0.6895
Epoch 382/500
28/28 [=====] - 3s 91ms/step - loss: 0.4779 - f1_score: 0.8512 - val_loss: 1.1890 - val_f1_score: 0.6935
Epoch 383/500
28/28 [=====] - 3s 93ms/step - loss: 0.4936 - f1_score: 0.8399 - val_loss: 1.3257 - val_f1_score: 0.6534
Epoch 384/500
28/28 [=====] - 3s 92ms/step - loss: 0.4715 - f1_score:
```

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0.8508 - val_loss: 1.2926 - val_f1_score: 0.6898
Epoch 385/500
28/28 [=====] - 3s 91ms/step - loss: 0.4699 - f1_score:
0.8537 - val_loss: 1.3479 - val_f1_score: 0.6720
Epoch 386/500
28/28 [=====] - 3s 91ms/step - loss: 0.4610 - f1_score:
0.8577 - val_loss: 1.2336 - val_f1_score: 0.6880
Epoch 387/500
28/28 [=====] - 3s 92ms/step - loss: 0.4627 - f1_score:
0.8585 - val_loss: 1.2636 - val_f1_score: 0.6975
Epoch 388/500
28/28 [=====] - 3s 91ms/step - loss: 0.4824 - f1_score:
0.8486 - val_loss: 1.2682 - val_f1_score: 0.6803
Epoch 389/500
28/28 [=====] - 3s 91ms/step - loss: 0.4465 - f1_score:
0.8651 - val_loss: 1.3252 - val_f1_score: 0.6797
Epoch 390/500
28/28 [=====] - 3s 91ms/step - loss: 0.4518 - f1_score:
0.8605 - val_loss: 1.3488 - val_f1_score: 0.6773
Epoch 391/500
28/28 [=====] - 3s 90ms/step - loss: 0.4547 - f1_score:
0.8702 - val_loss: 1.3901 - val_f1_score: 0.6511
Epoch 392/500
28/28 [=====] - 3s 90ms/step - loss: 0.4869 - f1_score:
0.8418 - val_loss: 1.2137 - val_f1_score: 0.7022
Epoch 393/500
28/28 [=====] - 3s 91ms/step - loss: 0.4454 - f1_score:
0.8589 - val_loss: 1.3263 - val_f1_score: 0.6617
Epoch 394/500
28/28 [=====] - 3s 91ms/step - loss: 0.4315 - f1_score:
0.8603 - val_loss: 1.2503 - val_f1_score: 0.7066
Epoch 395/500
28/28 [=====] - 3s 91ms/step - loss: 0.4787 - f1_score:
0.8484 - val_loss: 1.3140 - val_f1_score: 0.6627
Epoch 396/500
28/28 [=====] - 3s 91ms/step - loss: 0.4943 - f1_score:
0.8476 - val_loss: 1.3670 - val_f1_score: 0.6683
Epoch 397/500
28/28 [=====] - 3s 91ms/step - loss: 0.4707 - f1_score:
0.8559 - val_loss: 1.3928 - val_f1_score: 0.6469
Epoch 398/500
28/28 [=====] - 3s 91ms/step - loss: 0.4441 - f1_score:
0.8661 - val_loss: 1.3176 - val_f1_score: 0.6506
Epoch 399/500
28/28 [=====] - 3s 91ms/step - loss: 0.4460 - f1_score:
0.8579 - val_loss: 1.2388 - val_f1_score: 0.6847
Epoch 400/500
28/28 [=====] - 3s 92ms/step - loss: 0.4794 - f1_score:
```

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0.8548 - val_loss: 1.3496 - val_f1_score: 0.6641
Epoch 401/500
28/28 [=====] - 3s 90ms/step - loss: 0.4703 - f1_score:
0.8578 - val_loss: 1.2629 - val_f1_score: 0.6712
Epoch 402/500
28/28 [=====] - 3s 91ms/step - loss: 0.4512 - f1_score:
0.8595 - val_loss: 1.2487 - val_f1_score: 0.6878
Epoch 403/500
28/28 [=====] - 3s 90ms/step - loss: 0.4434 - f1_score:
0.8699 - val_loss: 1.3691 - val_f1_score: 0.6467
Epoch 404/500
28/28 [=====] - 3s 90ms/step - loss: 0.4739 - f1_score:
0.8482 - val_loss: 1.2281 - val_f1_score: 0.7017
Epoch 405/500
28/28 [=====] - 3s 98ms/step - loss: 0.4672 - f1_score:
0.8576 - val_loss: 1.3698 - val_f1_score: 0.6469
Epoch 406/500
28/28 [=====] - 3s 92ms/step - loss: 0.4480 - f1_score:
0.8603 - val_loss: 1.4288 - val_f1_score: 0.6581
Epoch 407/500
28/28 [=====] - 3s 91ms/step - loss: 0.4305 - f1_score:
0.8671 - val_loss: 1.3382 - val_f1_score: 0.6703
Epoch 408/500
28/28 [=====] - 3s 90ms/step - loss: 0.4456 - f1_score:
0.8590 - val_loss: 1.2704 - val_f1_score: 0.6926
Epoch 409/500
28/28 [=====] - 3s 90ms/step - loss: 0.4633 - f1_score:
0.8556 - val_loss: 1.3495 - val_f1_score: 0.6674
Epoch 410/500
28/28 [=====] - 3s 92ms/step - loss: 0.4457 - f1_score:
0.8596 - val_loss: 1.3449 - val_f1_score: 0.6662
Epoch 411/500
28/28 [=====] - 3s 91ms/step - loss: 0.4537 - f1_score:
0.8560 - val_loss: 1.2966 - val_f1_score: 0.6738
Epoch 412/500
28/28 [=====] - 3s 91ms/step - loss: 0.4272 - f1_score:
0.8687 - val_loss: 1.2922 - val_f1_score: 0.6741
Epoch 413/500
28/28 [=====] - 3s 91ms/step - loss: 0.4482 - f1_score:
0.8547 - val_loss: 1.2576 - val_f1_score: 0.6848
Epoch 414/500
28/28 [=====] - 3s 90ms/step - loss: 0.4257 - f1_score:
0.8645 - val_loss: 1.2765 - val_f1_score: 0.6848
Epoch 415/500
28/28 [=====] - ETA: 0s - loss: 0.4288 - f1_score:
0.8620
```

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 484ms/step - loss: 0.4288 - f1_score: 0.8620 - val_loss: 1.0799 - val_f1_score: 0.7367
Epoch 416/500
28/28 [=====] - 2s 86ms/step - loss: 0.4336 - f1_score: 0.8642 - val_loss: 1.2129 - val_f1_score: 0.6958
Epoch 417/500
28/28 [=====] - 2s 89ms/step - loss: 0.4356 - f1_score: 0.8651 - val_loss: 1.3611 - val_f1_score: 0.6760
Epoch 418/500
28/28 [=====] - 2s 89ms/step - loss: 0.4179 - f1_score: 0.8753 - val_loss: 1.2342 - val_f1_score: 0.6938
Epoch 419/500
28/28 [=====] - 2s 89ms/step - loss: 0.4424 - f1_score: 0.8600 - val_loss: 1.1908 - val_f1_score: 0.6822
Epoch 420/500
28/28 [=====] - 2s 89ms/step - loss: 0.4259 - f1_score: 0.8692 - val_loss: 1.3335 - val_f1_score: 0.6530
Epoch 421/500
28/28 [=====] - 3s 90ms/step - loss: 0.4525 - f1_score: 0.8604 - val_loss: 1.3545 - val_f1_score: 0.6566
Epoch 422/500
28/28 [=====] - 3s 92ms/step - loss: 0.4366 - f1_score: 0.8647 - val_loss: 1.2870 - val_f1_score: 0.6742
Epoch 423/500
28/28 [=====] - 3s 92ms/step - loss: 0.4317 - f1_score: 0.8635 - val_loss: 1.4414 - val_f1_score: 0.6465
Epoch 424/500
28/28 [=====] - 3s 90ms/step - loss: 0.4395 - f1_score: 0.8664 - val_loss: 1.3317 - val_f1_score: 0.6813
Epoch 425/500
28/28 [=====] - 3s 90ms/step - loss: 0.4303 - f1_score: 0.8735 - val_loss: 1.3262 - val_f1_score: 0.6789
Epoch 426/500
28/28 [=====] - 3s 91ms/step - loss: 0.4234 - f1_score: 0.8719 - val_loss: 1.4986 - val_f1_score: 0.6413
Epoch 427/500
28/28 [=====] - 3s 90ms/step - loss: 0.4340 - f1_score: 0.8692 - val_loss: 1.5334 - val_f1_score: 0.6525
Epoch 428/500
28/28 [=====] - 3s 92ms/step - loss: 0.4408 - f1_score: 0.8602 - val_loss: 1.3804 - val_f1_score: 0.6510
```

```
Epoch 429/500
28/28 [=====] - 3s 93ms/step - loss: 0.4501 - f1_score: 0.8620 - val_loss: 1.4312 - val_f1_score: 0.6606
Epoch 430/500
28/28 [=====] - 3s 90ms/step - loss: 0.4338 - f1_score: 0.8687 - val_loss: 1.4373 - val_f1_score: 0.6275
Epoch 431/500
28/28 [=====] - 3s 92ms/step - loss: 0.4272 - f1_score: 0.8658 - val_loss: 1.3727 - val_f1_score: 0.6581
Epoch 432/500
28/28 [=====] - 3s 90ms/step - loss: 0.4135 - f1_score: 0.8676 - val_loss: 1.2173 - val_f1_score: 0.6910
Epoch 433/500
28/28 [=====] - 3s 91ms/step - loss: 0.4120 - f1_score: 0.8742 - val_loss: 1.3588 - val_f1_score: 0.6520
Epoch 434/500
28/28 [=====] - 3s 90ms/step - loss: 0.4262 - f1_score: 0.8677 - val_loss: 1.5285 - val_f1_score: 0.6053
Epoch 435/500
28/28 [=====] - 3s 90ms/step - loss: 0.4123 - f1_score: 0.8752 - val_loss: 1.2897 - val_f1_score: 0.6467
Epoch 436/500
28/28 [=====] - 3s 90ms/step - loss: 0.4227 - f1_score: 0.8692 - val_loss: 1.2406 - val_f1_score: 0.6885
Epoch 437/500
28/28 [=====] - 3s 93ms/step - loss: 0.4328 - f1_score: 0.8688 - val_loss: 1.3168 - val_f1_score: 0.6849
Epoch 438/500
28/28 [=====] - 3s 93ms/step - loss: 0.3871 - f1_score: 0.8835 - val_loss: 1.3399 - val_f1_score: 0.6674
Epoch 439/500
28/28 [=====] - 3s 95ms/step - loss: 0.4162 - f1_score: 0.8739 - val_loss: 1.3727 - val_f1_score: 0.6642
Epoch 440/500
28/28 [=====] - 3s 98ms/step - loss: 0.4460 - f1_score: 0.8644 - val_loss: 1.5606 - val_f1_score: 0.6242
Epoch 441/500
28/28 [=====] - 3s 97ms/step - loss: 0.3886 - f1_score: 0.8774 - val_loss: 1.3502 - val_f1_score: 0.6781
Epoch 442/500
28/28 [=====] - 3s 99ms/step - loss: 0.3993 - f1_score: 0.8810 - val_loss: 1.3708 - val_f1_score: 0.6474
Epoch 443/500
28/28 [=====] - 3s 95ms/step - loss: 0.3986 - f1_score: 0.8773 - val_loss: 1.2016 - val_f1_score: 0.7013
Epoch 444/500
28/28 [=====] - 3s 93ms/step - loss: 0.4169 - f1_score: 0.8776 - val_loss: 1.3533 - val_f1_score: 0.6739
```

```
Epoch 445/500
28/28 [=====] - 3s 92ms/step - loss: 0.4157 - f1_score: 0.8671 - val_loss: 1.3838 - val_f1_score: 0.6597
Epoch 446/500
28/28 [=====] - 3s 91ms/step - loss: 0.4064 - f1_score: 0.8753 - val_loss: 1.3639 - val_f1_score: 0.6587
Epoch 447/500
28/28 [=====] - 3s 90ms/step - loss: 0.3892 - f1_score: 0.8785 - val_loss: 1.3421 - val_f1_score: 0.6455
Epoch 448/500
28/28 [=====] - 3s 91ms/step - loss: 0.4198 - f1_score: 0.8633 - val_loss: 1.4007 - val_f1_score: 0.6626
Epoch 449/500
28/28 [=====] - 3s 91ms/step - loss: 0.4164 - f1_score: 0.8652 - val_loss: 1.4430 - val_f1_score: 0.6569
Epoch 450/500
28/28 [=====] - 3s 90ms/step - loss: 0.4288 - f1_score: 0.8663 - val_loss: 1.3012 - val_f1_score: 0.6794
Epoch 451/500
28/28 [=====] - 3s 91ms/step - loss: 0.3912 - f1_score: 0.8844 - val_loss: 1.3317 - val_f1_score: 0.6660
Epoch 452/500
28/28 [=====] - 3s 92ms/step - loss: 0.4175 - f1_score: 0.8691 - val_loss: 1.2743 - val_f1_score: 0.6574
Epoch 453/500
28/28 [=====] - 3s 91ms/step - loss: 0.3997 - f1_score: 0.8809 - val_loss: 1.3187 - val_f1_score: 0.6529
Epoch 454/500
28/28 [=====] - 3s 92ms/step - loss: 0.4022 - f1_score: 0.8778 - val_loss: 1.4808 - val_f1_score: 0.6249
Epoch 455/500
28/28 [=====] - 3s 92ms/step - loss: 0.4328 - f1_score: 0.8603 - val_loss: 1.3242 - val_f1_score: 0.6620
Epoch 456/500
28/28 [=====] - 3s 91ms/step - loss: 0.3745 - f1_score: 0.8852 - val_loss: 1.2902 - val_f1_score: 0.6935
Epoch 457/500
28/28 [=====] - 3s 91ms/step - loss: 0.3903 - f1_score: 0.8787 - val_loss: 1.4151 - val_f1_score: 0.6398
Epoch 458/500
28/28 [=====] - 3s 92ms/step - loss: 0.3767 - f1_score: 0.8862 - val_loss: 1.3518 - val_f1_score: 0.6706
Epoch 459/500
28/28 [=====] - 3s 90ms/step - loss: 0.3953 - f1_score: 0.8784 - val_loss: 1.4842 - val_f1_score: 0.6242
Epoch 460/500
28/28 [=====] - 3s 91ms/step - loss: 0.4235 - f1_score: 0.8738 - val_loss: 1.4670 - val_f1_score: 0.6650
```

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Epoch 461/500
28/28 [=====] - 3s 91ms/step - loss: 0.3934 - f1_score: 0.8785 - val_loss: 1.4867 - val_f1_score: 0.6591
Epoch 462/500
28/28 [=====] - 3s 90ms/step - loss: 0.3915 - f1_score: 0.8749 - val_loss: 1.3537 - val_f1_score: 0.6738
Epoch 463/500
28/28 [=====] - 3s 91ms/step - loss: 0.3932 - f1_score: 0.8775 - val_loss: 1.3595 - val_f1_score: 0.6625
Epoch 464/500
28/28 [=====] - 3s 91ms/step - loss: 0.4013 - f1_score: 0.8687 - val_loss: 1.4896 - val_f1_score: 0.6355
Epoch 465/500
28/28 [=====] - 3s 91ms/step - loss: 0.4175 - f1_score: 0.8729 - val_loss: 1.4329 - val_f1_score: 0.6298
Epoch 466/500
28/28 [=====] - 3s 93ms/step - loss: 0.3915 - f1_score: 0.8775 - val_loss: 1.5339 - val_f1_score: 0.6126
Epoch 467/500
28/28 [=====] - 3s 91ms/step - loss: 0.3859 - f1_score: 0.8834 - val_loss: 1.3977 - val_f1_score: 0.6149
Epoch 468/500
28/28 [=====] - 3s 91ms/step - loss: 0.4034 - f1_score: 0.8728 - val_loss: 1.3883 - val_f1_score: 0.6215
Epoch 469/500
28/28 [=====] - 3s 91ms/step - loss: 0.3994 - f1_score: 0.8756 - val_loss: 1.3295 - val_f1_score: 0.6770
Epoch 470/500
28/28 [=====] - 3s 91ms/step - loss: 0.3791 - f1_score: 0.8848 - val_loss: 1.3072 - val_f1_score: 0.6678
Epoch 471/500
28/28 [=====] - 3s 91ms/step - loss: 0.3666 - f1_score: 0.8883 - val_loss: 1.4644 - val_f1_score: 0.6512
Epoch 472/500
28/28 [=====] - 3s 91ms/step - loss: 0.3706 - f1_score: 0.8923 - val_loss: 1.4099 - val_f1_score: 0.6638
Epoch 473/500
28/28 [=====] - 3s 94ms/step - loss: 0.4003 - f1_score: 0.8805 - val_loss: 1.4747 - val_f1_score: 0.6481
Epoch 474/500
28/28 [=====] - 3s 92ms/step - loss: 0.3705 - f1_score: 0.8863 - val_loss: 1.2791 - val_f1_score: 0.6799
Epoch 475/500
28/28 [=====] - 3s 91ms/step - loss: 0.3736 - f1_score: 0.8894 - val_loss: 1.2566 - val_f1_score: 0.6916
Epoch 476/500
28/28 [=====] - 3s 91ms/step - loss: 0.3853 - f1_score: 0.8831 - val_loss: 1.4132 - val_f1_score: 0.6521
```

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Epoch 477/500
28/28 [=====] - 3s 91ms/step - loss: 0.3845 - f1_score: 0.8758 - val_loss: 1.3624 - val_f1_score: 0.6405
Epoch 478/500
28/28 [=====] - 3s 92ms/step - loss: 0.3964 - f1_score: 0.8764 - val_loss: 1.2736 - val_f1_score: 0.6484
Epoch 479/500
28/28 [=====] - 3s 91ms/step - loss: 0.3801 - f1_score: 0.8842 - val_loss: 1.3608 - val_f1_score: 0.6549
Epoch 480/500
28/28 [=====] - 3s 91ms/step - loss: 0.3658 - f1_score: 0.8787 - val_loss: 1.4287 - val_f1_score: 0.6662
Epoch 481/500
28/28 [=====] - 3s 91ms/step - loss: 0.3796 - f1_score: 0.8887 - val_loss: 1.5579 - val_f1_score: 0.6236
Epoch 482/500
28/28 [=====] - 3s 91ms/step - loss: 0.3681 - f1_score: 0.8851 - val_loss: 1.2309 - val_f1_score: 0.6952
Epoch 483/500
28/28 [=====] - 3s 94ms/step - loss: 0.3689 - f1_score: 0.8774 - val_loss: 1.4045 - val_f1_score: 0.6550
Epoch 484/500
28/28 [=====] - 3s 91ms/step - loss: 0.3923 - f1_score: 0.8801 - val_loss: 1.6366 - val_f1_score: 0.6225
Epoch 485/500
28/28 [=====] - 3s 91ms/step - loss: 0.3989 - f1_score: 0.8760 - val_loss: 1.3234 - val_f1_score: 0.6625
Epoch 486/500
28/28 [=====] - 3s 91ms/step - loss: 0.3687 - f1_score: 0.8853 - val_loss: 1.4247 - val_f1_score: 0.6487
Epoch 487/500
28/28 [=====] - 3s 91ms/step - loss: 0.3825 - f1_score: 0.8881 - val_loss: 1.4247 - val_f1_score: 0.6737
Epoch 488/500
28/28 [=====] - 3s 92ms/step - loss: 0.3909 - f1_score: 0.8823 - val_loss: 1.3464 - val_f1_score: 0.6608
Epoch 489/500
28/28 [=====] - 3s 91ms/step - loss: 0.3727 - f1_score: 0.8916 - val_loss: 1.3771 - val_f1_score: 0.6486
Epoch 490/500
28/28 [=====] - 3s 91ms/step - loss: 0.3489 - f1_score: 0.8890 - val_loss: 1.3246 - val_f1_score: 0.6785
Epoch 491/500
28/28 [=====] - 3s 91ms/step - loss: 0.3750 - f1_score: 0.8843 - val_loss: 1.4148 - val_f1_score: 0.6373
Epoch 492/500
28/28 [=====] - 3s 91ms/step - loss: 0.3461 - f1_score: 0.9000 - val_loss: 1.3229 - val_f1_score: 0.6946
```

```

Epoch 493/500
28/28 [=====] - 3s 91ms/step - loss: 0.3312 - f1_score: 0.9031 - val_loss: 1.2879 - val_f1_score: 0.6512
Epoch 494/500
28/28 [=====] - 3s 91ms/step - loss: 0.3426 - f1_score: 0.8937 - val_loss: 1.3079 - val_f1_score: 0.6665
Epoch 495/500
28/28 [=====] - 3s 92ms/step - loss: 0.3757 - f1_score: 0.8794 - val_loss: 1.3393 - val_f1_score: 0.6433
Epoch 496/500
28/28 [=====] - 3s 93ms/step - loss: 0.3596 - f1_score: 0.8937 - val_loss: 1.2983 - val_f1_score: 0.6748
Epoch 497/500
28/28 [=====] - 3s 91ms/step - loss: 0.3331 - f1_score: 0.9008 - val_loss: 1.4124 - val_f1_score: 0.6471
Epoch 498/500
28/28 [=====] - 3s 91ms/step - loss: 0.3501 - f1_score: 0.8933 - val_loss: 1.3842 - val_f1_score: 0.6464
Epoch 499/500
28/28 [=====] - 3s 91ms/step - loss: 0.3383 - f1_score: 0.8927 - val_loss: 1.4409 - val_f1_score: 0.6408
Epoch 500/500
28/28 [=====] - 3s 91ms/step - loss: 0.3529 - f1_score: 0.8943 - val_loss: 1.3897 - val_f1_score: 0.6486

```

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

	precision	recall	f1-score	support
AXE	1.000	0.625	0.769	8
BACKPACK	0.667	0.667	0.667	6
BASKETBALL	0.692	0.900	0.783	10
BEE	0.500	0.200	0.286	10
BELT	0.667	1.000	0.800	4
BITE	0.778	0.875	0.824	8
BREAKFAST	0.600	1.000	0.750	6
CANCER	1.000	0.875	0.933	8
CHRISTMAS	0.545	1.000	0.706	6
CONFUSED	0.571	0.667	0.615	6
DARK	1.000	1.000	1.000	4
DEAF	0.200	0.167	0.182	6
DECIDE	0.800	0.667	0.727	6
DEMAND	1.000	0.875	0.933	8

DEVELOP	0.667	0.333	0.444	6
DINNER	1.000	0.875	0.933	8
DOG	0.500	0.167	0.250	6
DOWNSIZE	0.889	1.000	0.941	8
DRAG	1.000	0.500	0.667	4
EAT	1.000	0.500	0.667	6
EDIT	0.545	1.000	0.706	6
ELEVATOR	0.500	1.000	0.667	8
FINE	0.400	0.500	0.444	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	0.833	0.833	0.833	6
GUESS	0.625	0.625	0.625	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	1.000	0.833	0.909	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.667	0.500	0.571	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.667	0.750	0.706	8
LUNCH	0.600	0.375	0.462	8
MAPLE	0.333	0.500	0.400	4
MEAT	0.500	1.000	0.667	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.250	0.400	8
MOVIE	0.667	1.000	0.800	8
NOON	1.000	1.000	1.000	8
PARTY	0.714	0.625	0.667	8
PATIENT	0.286	0.333	0.308	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.700	0.700	0.700	10
SINK	0.500	0.333	0.400	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.750	0.750	0.750	4
TWINS	0.462	0.750	0.571	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.685	324
macro avg	0.684	0.669	0.649	324
weighted avg	0.708	0.685	0.667	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 GRU Trial 722/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 GRU Trial 722/history.csv', index\_col=0)  
hist\_df.tail()

[128]:

	loss	f1_score	val_loss	val_f1_score
495	0.359604	0.893685	1.298336	0.674821
496	0.333113	0.900814	1.412384	0.647118
497	0.350062	0.893293	1.384183	0.646391
498	0.338324	0.892717	1.440888	0.640762
499	0.352888	0.894293	1.389706	0.648604

[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',

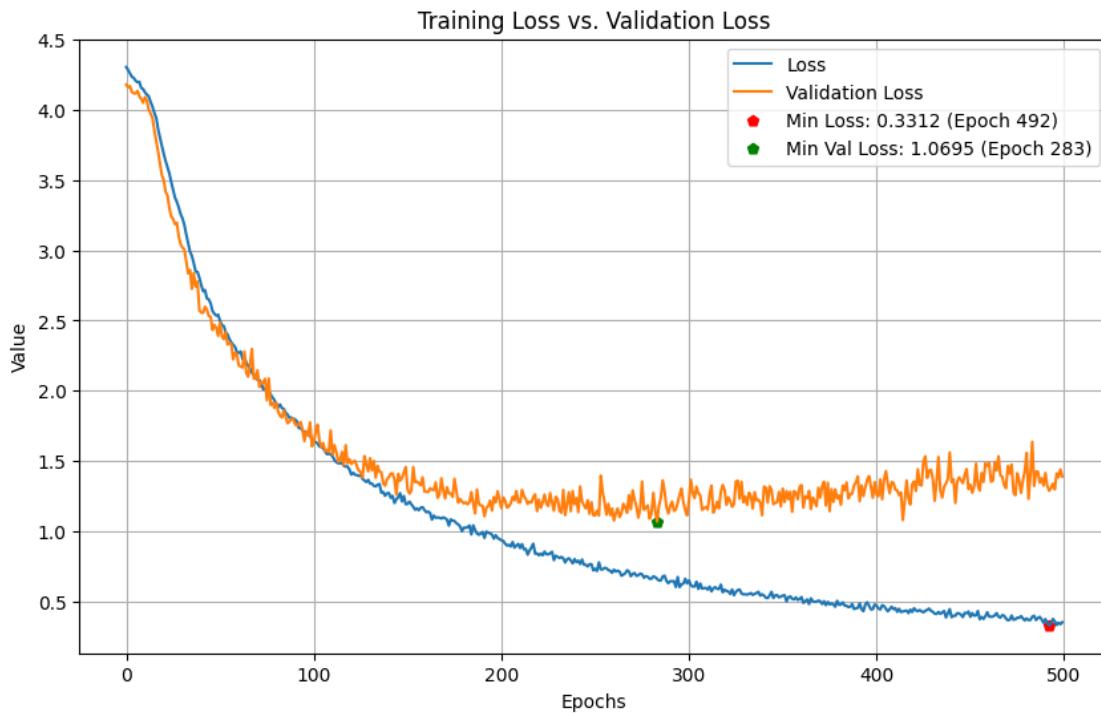
```

```

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,

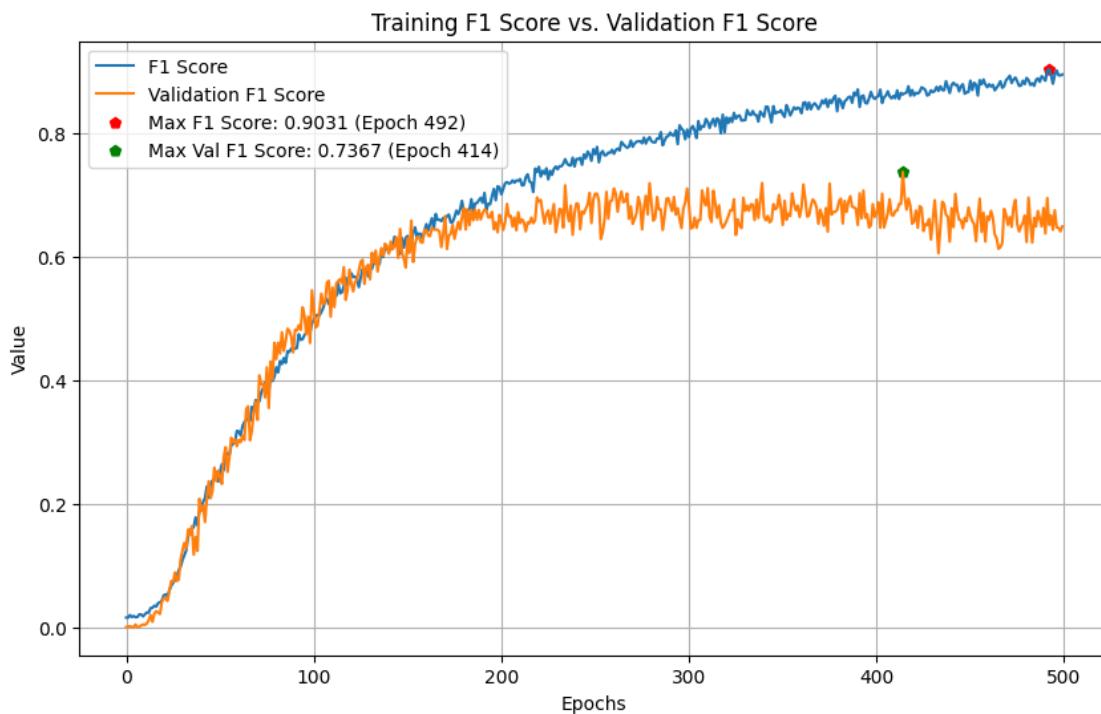
```

```

        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 GRU Trial 722")

[132]: reconstructed\_model.summary()

Model: "sequential\_1"

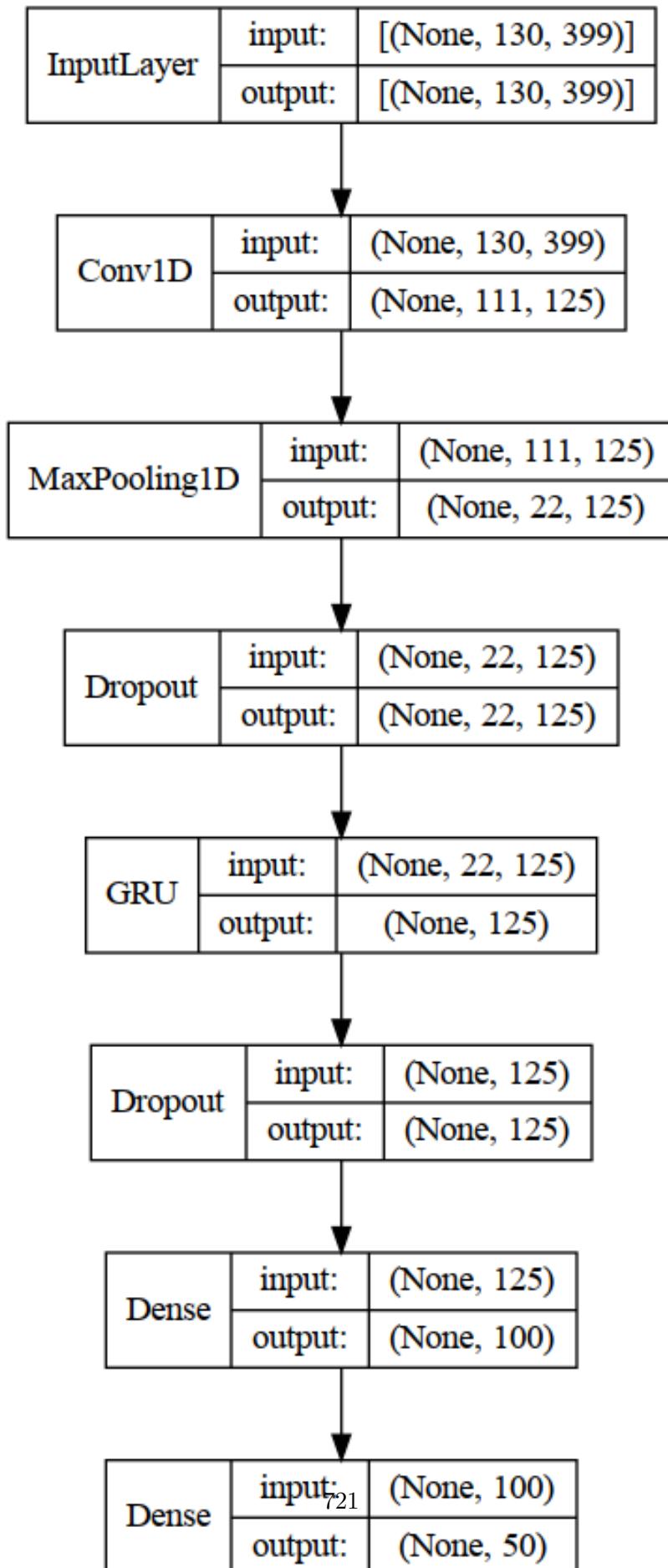
Layer (type)	Output Shape	Param #
conv1d_1 (Conv1D)	(None, 126, 175)	349300
max_pooling1d_1 (MaxPooling 1D)	(None, 8, 175)	0
dropout_2 (Dropout)	(None, 8, 175)	0
lstm_1 (LSTM)	(None, 200)	300800
dropout_3 (Dropout)	(None, 200)	0
dense_2 (Dense)	(None, 70)	14070
dense_3 (Dense)	(None, 50)	3550

=====

Total params: 667,720  
Trainable params: 667,720  
Non-trainable params: 0

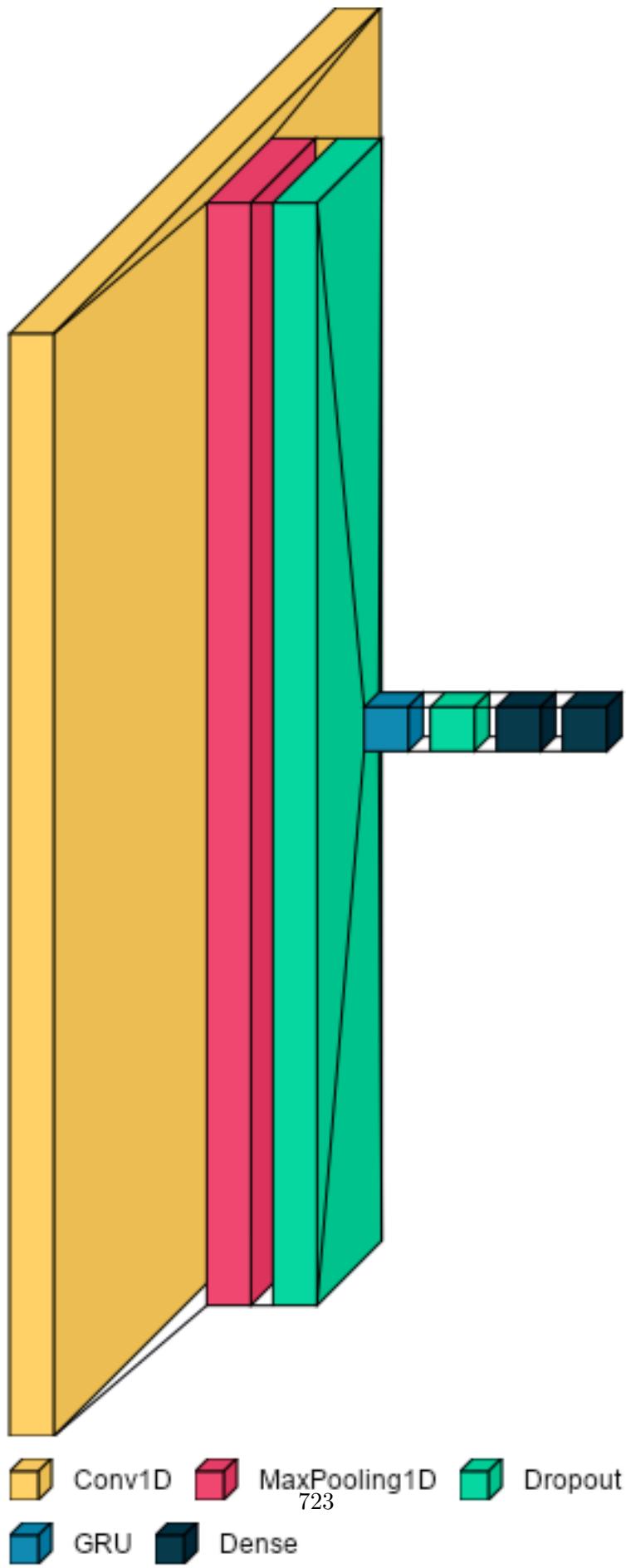
-----

```
[132]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
[132]:
```



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

```
[133]:
```



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

11/11 [=====] - 1s 15ms/step - loss: 1.0799 - f1_score: 0.7367
```

[134]: [1.0799285173416138, 0.7366651892662048]

```
[135]: reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)

28/28 [=====] - 1s 29ms/step - loss: 0.1594 - f1_score: 0.9734
```

[135]: [0.15944387018680573, 0.9733548164367676]

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

	precision	recall	f1-score	support
AXE	0.889	1.000	0.941	8
BACKPACK	0.667	0.667	0.667	6
BASKETBALL	0.818	0.900	0.857	10
BEE	0.571	0.400	0.471	10
BELT	1.000	0.750	0.857	4
BITE	0.875	0.875	0.875	8
BREAKFAST	0.571	0.667	0.615	6
CANCER	1.000	1.000	1.000	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	1.000	0.500	0.667	6
DARK	1.000	1.000	1.000	4
DEAF	0.417	0.833	0.556	6
DECIDE	0.857	1.000	0.923	6
DEMAND	1.000	0.750	0.857	8
DEVELOP	1.000	0.667	0.800	6
DINNER	1.000	0.875	0.933	8
DOG	0.500	0.333	0.400	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	1.000	1.000	1.000	4
EAT	1.000	0.500	0.667	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	0.250	0.400	4
FOREIGNER	1.000	0.667	0.800	6
GUESS	0.571	0.500	0.533	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	1.000	1.000	1.000	6
HURDLE/TRIP	1.000	0.250	0.400	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	1.000	0.500	0.667	8
MAPLE	0.400	0.500	0.444	4
MEAT	0.667	1.000	0.800	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.636	0.875	0.737	8
NOON	1.000	0.875	0.933	8
PARTY	0.600	0.750	0.667	8
PATIENT	0.444	0.667	0.533	6
RAZOR	0.500	0.500	0.500	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.643	0.900	0.750	10
SINK	0.750	0.500	0.600	6
SQUEEZE	0.400	0.500	0.444	4
THEY	0.667	1.000	0.800	4
TWINS	0.778	0.875	0.824	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.756	324
macro avg	0.792	0.742	0.737	324
weighted avg	0.797	0.756	0.749	324

```
[137]: 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)
```

```
[139]: 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])

```

Model: "sequential\_3"

Layer (type)	Output Shape	Param #
conv1d_3 (Conv1D)	(None, 116, 150)	897900
max_pooling1d_3 (MaxPooling 1D)	(None, 11, 150)	0
dropout_6 (Dropout)	(None, 11, 150)	0
gru_3 (GRU)	(None, 150)	135900
dropout_7 (Dropout)	(None, 150)	0
dense_6 (Dense)	(None, 110)	16610
dense_7 (Dense)	(None, 50)	5550

Total params: 1,055,960  
Trainable params: 1,055,960  
Non-trainable params: 0

Epoch 1/500  
28/28 [=====] - ETA: 0s - loss: 4.1127 - f1\_score: 0.0167

```
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 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 564ms/step - loss: 4.1127 -
```

```
f1_score: 0.0167 - val_loss: 4.0059 - val_f1_score: 0.0050
```

```
Epoch 2/500
```

```
28/28 [=====] - 3s 108ms/step - loss: 4.0276 -
```

```
f1_score: 0.0178 - val_loss: 4.0042 - val_f1_score: 7.5949e-04
```

```
Epoch 3/500
```

```
28/28 [=====] - ETA: 0s - loss: 4.0165 - f1_score:
```

```
0.0176
```

```
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 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 387ms/step - loss: 4.0165 -
```

```
f1_score: 0.0176 - val_loss: 3.9943 - val_f1_score: 0.0068
```

```
Epoch 4/500
```

```
28/28 [=====] - 3s 108ms/step - loss: 3.9990 -
```

```
f1_score: 0.0204 - val_loss: 3.9883 - val_f1_score: 0.0062
```

```
Epoch 5/500
```

```
28/28 [=====] - 3s 108ms/step - loss: 3.9896 -
```

```
f1_score: 0.0201 - val_loss: 3.9784 - val_f1_score: 0.0029
```

```
Epoch 6/500
```

```
28/28 [=====] - 3s 109ms/step - loss: 3.9726 -
```

```
f1_score: 0.0205 - val_loss: 3.9640 - val_f1_score: 0.0030
```

```
Epoch 7/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.9559 - f1_score:
```

```
0.0187
```

```
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 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: 3.9559 -
```

```
f1_score: 0.0187 - val_loss: 3.9340 - val_f1_score: 0.0102
```

```
Epoch 8/500
28/28 [=====] - 3s 109ms/step - loss: 3.9284 -
f1_score: 0.0225 - val_loss: 3.8911 - val_f1_score: 0.0043
Epoch 9/500
28/28 [=====] - 3s 109ms/step - loss: 3.8864 -
f1_score: 0.0202 - val_loss: 3.8323 - val_f1_score: 0.0037
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 3.8209 - f1_score:
0.0285

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 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 392ms/step - loss: 3.8209 -
f1_score: 0.0285 - val_loss: 3.7343 - val_f1_score: 0.0110
Epoch 11/500
28/28 [=====] - ETA: 0s - loss: 3.7642 - f1_score:
0.0253

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 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: 3.7642 -
f1_score: 0.0253 - val_loss: 3.6630 - val_f1_score: 0.0118
Epoch 12/500
28/28 [=====] - 3s 109ms/step - loss: 3.7303 -
f1_score: 0.0308 - val_loss: 3.6080 - val_f1_score: 0.0096
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 3.6920 - f1_score:
0.0318

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 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 407ms/step - loss: 3.6920 -
f1_score: 0.0318 - val_loss: 3.5726 - val_f1_score: 0.0160
```

```
Epoch 14/500
28/28 [=====] - 3s 109ms/step - loss: 3.6680 -
f1_score: 0.0265 - val_loss: 3.5801 - val_f1_score: 0.0102
Epoch 15/500
28/28 [=====] - ETA: 0s - loss: 3.6423 - f1_score:
0.0371

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 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: 3.6423 -
f1_score: 0.0371 - val_loss: 3.5282 - val_f1_score: 0.0189
Epoch 16/500
28/28 [=====] - 3s 110ms/step - loss: 3.6303 -
f1_score: 0.0325 - val_loss: 3.5151 - val_f1_score: 0.0132
Epoch 17/500
28/28 [=====] - 3s 111ms/step - loss: 3.5954 -
f1_score: 0.0317 - val_loss: 3.4811 - val_f1_score: 0.0161
Epoch 18/500
28/28 [=====] - ETA: 0s - loss: 3.5870 - f1_score:
0.0376

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 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: 3.5870 -
f1_score: 0.0376 - val_loss: 3.4945 - val_f1_score: 0.0435
Epoch 19/500
28/28 [=====] - ETA: 0s - loss: 3.5789 - f1_score:
0.0444

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 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 451ms/step - loss: 3.5789 -
f1_score: 0.0444 - val_loss: 3.4431 - val_f1_score: 0.0480
```

```
Epoch 20/500
28/28 [=====] - 3s 110ms/step - loss: 3.5587 -
f1_score: 0.0407 - val_loss: 3.4314 - val_f1_score: 0.0380
Epoch 21/500
28/28 [=====] - ETA: 0s - loss: 3.5329 - f1_score:
0.0425

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 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: 3.5329 -
f1_score: 0.0425 - val_loss: 3.4125 - val_f1_score: 0.0631
Epoch 22/500
28/28 [=====] - 3s 109ms/step - loss: 3.5086 -
f1_score: 0.0449 - val_loss: 3.3846 - val_f1_score: 0.0457
Epoch 23/500
28/28 [=====] - 3s 109ms/step - loss: 3.4816 -
f1_score: 0.0475 - val_loss: 3.3431 - val_f1_score: 0.0492
Epoch 24/500
28/28 [=====] - ETA: 0s - loss: 3.4648 - f1_score:
0.0592

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 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 404ms/step - loss: 3.4648 -
f1_score: 0.0592 - val_loss: 3.3272 - val_f1_score: 0.0650
Epoch 25/500
28/28 [=====] - 3s 109ms/step - loss: 3.4356 -
f1_score: 0.0645 - val_loss: 3.2823 - val_f1_score: 0.0644
Epoch 26/500
28/28 [=====] - ETA: 0s - loss: 3.3955 - f1_score:
0.0591

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 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: 3.3955 -
f1_score: 0.0591 - val_loss: 3.2124 - val_f1_score: 0.0721
Epoch 27/500
28/28 [=====] - ETA: 0s - loss: 3.3755 - f1_score:
0.0661

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 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: 3.3755 -
f1_score: 0.0661 - val_loss: 3.1721 - val_f1_score: 0.0735
Epoch 28/500
28/28 [=====] - ETA: 0s - loss: 3.3596 - f1_score:
0.0634

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 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 400ms/step - loss: 3.3596 -
f1_score: 0.0634 - val_loss: 3.1643 - val_f1_score: 0.0747
Epoch 29/500
28/28 [=====] - ETA: 0s - loss: 3.3266 - f1_score:
0.0745

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 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 413ms/step - loss: 3.3266 -
f1_score: 0.0745 - val_loss: 3.1435 - val_f1_score: 0.1106
Epoch 30/500
28/28 [=====] - 3s 109ms/step - loss: 3.3166 -
f1_score: 0.0709 - val_loss: 3.1439 - val_f1_score: 0.1035
Epoch 31/500
28/28 [=====] - 3s 108ms/step - loss: 3.2964 -
```

```
f1_score: 0.0842 - val_loss: 3.0907 - val_f1_score: 0.0844
Epoch 32/500
28/28 [=====] - 3s 110ms/step - loss: 3.2686 -
f1_score: 0.0869 - val_loss: 3.0398 - val_f1_score: 0.1034
Epoch 33/500
28/28 [=====] - 3s 109ms/step - loss: 3.2458 -
f1_score: 0.0832 - val_loss: 3.0323 - val_f1_score: 0.1075
Epoch 34/500
28/28 [=====] - 3s 109ms/step - loss: 3.2305 -
f1_score: 0.0817 - val_loss: 3.0082 - val_f1_score: 0.1021
Epoch 35/500
28/28 [=====] - ETA: 0s - loss: 3.2118 - f1_score:
0.0895

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 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: 3.2118 -
f1_score: 0.0895 - val_loss: 2.9629 - val_f1_score: 0.1287
Epoch 36/500
28/28 [=====] - ETA: 0s - loss: 3.1710 - f1_score:
0.0936

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 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: 3.1710 -
f1_score: 0.0936 - val_loss: 2.9522 - val_f1_score: 0.1326
Epoch 37/500
28/28 [=====] - 3s 108ms/step - loss: 3.1480 -
f1_score: 0.0999 - val_loss: 3.0241 - val_f1_score: 0.0776
Epoch 38/500
28/28 [=====] - 3s 109ms/step - loss: 3.1508 -
f1_score: 0.0883 - val_loss: 2.9185 - val_f1_score: 0.1011
Epoch 39/500
28/28 [=====] - 3s 109ms/step - loss: 3.1205 -
f1_score: 0.1089 - val_loss: 2.8779 - val_f1_score: 0.0904
Epoch 40/500
28/28 [=====] - ETA: 0s - loss: 3.0811 - f1_score:
0.1058
```

```
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 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 417ms/step - loss: 3.0811 -
f1_score: 0.1058 - val_loss: 2.9454 - val_f1_score: 0.1330
```

```
Epoch 41/500
```

```
28/28 [=====] - 3s 109ms/step - loss: 3.0747 -
f1_score: 0.1034 - val_loss: 2.8788 - val_f1_score: 0.0895
```

```
Epoch 42/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 3.0571 -
f1_score: 0.1168 - val_loss: 2.8148 - val_f1_score: 0.1191
```

```
Epoch 43/500
```

```
28/28 [=====] - 3s 109ms/step - loss: 3.0350 -
f1_score: 0.1157 - val_loss: 2.8419 - val_f1_score: 0.1223
```

```
Epoch 44/500
```

```
28/28 [=====] - ETA: 0s - loss: 3.0258 - f1_score:
0.1139
```

```
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 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 454ms/step - loss: 3.0258 -
f1_score: 0.1139 - val_loss: 2.7739 - val_f1_score: 0.1399
```

```
Epoch 45/500
```

```
28/28 [=====] - 3s 109ms/step - loss: 2.9918 -
f1_score: 0.1169 - val_loss: 2.7721 - val_f1_score: 0.1117
```

```
Epoch 46/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 2.9657 -
f1_score: 0.1286 - val_loss: 2.7517 - val_f1_score: 0.1145
```

```
Epoch 47/500
```

```
28/28 [=====] - 3s 109ms/step - loss: 2.9689 -
f1_score: 0.1264 - val_loss: 2.7360 - val_f1_score: 0.1308
```

```
Epoch 48/500
```

```
28/28 [=====] - 3s 111ms/step - loss: 2.9504 -
f1_score: 0.1287 - val_loss: 2.7433 - val_f1_score: 0.1250
```

```
Epoch 49/500
```

```
28/28 [=====] - 3s 111ms/step - loss: 2.9102 -
f1_score: 0.1422 - val_loss: 2.7691 - val_f1_score: 0.1319
```

```
Epoch 50/500
```

```
28/28 [=====] - 3s 111ms/step - loss: 2.9185 -
f1_score: 0.1448 - val_loss: 2.7090 - val_f1_score: 0.1337
Epoch 51/500
28/28 [=====] - 3s 110ms/step - loss: 2.9122 -
f1_score: 0.1294 - val_loss: 2.6990 - val_f1_score: 0.1232
Epoch 52/500
28/28 [=====] - ETA: 0s - loss: 2.8460 - f1_score:
0.1495

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 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 455ms/step - loss: 2.8460 -
f1_score: 0.1495 - val_loss: 2.6827 - val_f1_score: 0.1615
Epoch 53/500
28/28 [=====] - ETA: 0s - loss: 2.8669 - f1_score:
0.1430

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 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 398ms/step - loss: 2.8669 -
f1_score: 0.1430 - val_loss: 2.6681 - val_f1_score: 0.1624
Epoch 54/500
28/28 [=====] - 3s 109ms/step - loss: 2.8697 -
f1_score: 0.1407 - val_loss: 2.7197 - val_f1_score: 0.1464
Epoch 55/500
28/28 [=====] - 3s 109ms/step - loss: 2.8132 -
f1_score: 0.1654 - val_loss: 2.6210 - val_f1_score: 0.1364
Epoch 56/500
28/28 [=====] - 3s 109ms/step - loss: 2.8463 -
f1_score: 0.1402 - val_loss: 2.7557 - val_f1_score: 0.1307
Epoch 57/500
28/28 [=====] - 3s 109ms/step - loss: 2.8332 -
f1_score: 0.1547 - val_loss: 2.6290 - val_f1_score: 0.1475
Epoch 58/500
28/28 [=====] - ETA: 0s - loss: 2.7914 - f1_score:
0.1518

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 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 416ms/step - loss: 2.7914 -
f1_score: 0.1518 - val_loss: 2.5900 - val_f1_score: 0.1851
Epoch 59/500
28/28 [=====] - ETA: 0s - loss: 2.8070 - f1_score:
0.1496

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 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: 2.8070 -
f1_score: 0.1496 - val_loss: 2.6407 - val_f1_score: 0.1854
Epoch 60/500
28/28 [=====] - 3s 109ms/step - loss: 2.7796 -
f1_score: 0.1654 - val_loss: 2.6543 - val_f1_score: 0.1341
Epoch 61/500
28/28 [=====] - 3s 109ms/step - loss: 2.7716 -
f1_score: 0.1539 - val_loss: 2.5889 - val_f1_score: 0.1736
Epoch 62/500
28/28 [=====] - ETA: 0s - loss: 2.7760 - f1_score:
0.1583

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 1D-CNN + 1 GRU Trial 722 Mish/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
28/28 [=====] - 37s 1s/step - loss: 2.7760 - f1_score:
0.1583 - val_loss: 2.6067 - val_f1_score: 0.1869
Epoch 63/500
28/28 [=====] - 3s 109ms/step - loss: 2.7650 -
f1_score: 0.1632 - val_loss: 2.6015 - val_f1_score: 0.1711
Epoch 64/500
28/28 [=====] - 3s 109ms/step - loss: 2.7644 -
f1_score: 0.1668 - val_loss: 2.6193 - val_f1_score: 0.1747
Epoch 65/500
```

```
28/28 [=====] - ETA: 0s - loss: 2.7016 - f1_score: 0.1614
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 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 444ms/step - loss: 2.7016 - f1_score: 0.1614 - val_loss: 2.6571 - val_f1_score: 0.1974
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 2.6931 - f1_score: 0.1801
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 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 380ms/step - loss: 2.6931 - f1_score: 0.1801 - val_loss: 2.5715 - val_f1_score: 0.2311
Epoch 67/500
28/28 [=====] - 3s 109ms/step - loss: 2.6985 - f1_score: 0.1762 - val_loss: 2.5604 - val_f1_score: 0.2080
Epoch 68/500
28/28 [=====] - 3s 109ms/step - loss: 2.7252 - f1_score: 0.1761 - val_loss: 2.6227 - val_f1_score: 0.1945
Epoch 69/500
28/28 [=====] - 3s 109ms/step - loss: 2.6942 - f1_score: 0.1717 - val_loss: 2.6065 - val_f1_score: 0.1964
Epoch 70/500
28/28 [=====] - 3s 110ms/step - loss: 2.6854 - f1_score: 0.1877 - val_loss: 2.5937 - val_f1_score: 0.1978
Epoch 71/500
28/28 [=====] - 3s 109ms/step - loss: 2.6869 - f1_score: 0.1774 - val_loss: 2.4949 - val_f1_score: 0.2292
Epoch 72/500
28/28 [=====] - 3s 109ms/step - loss: 2.6715 - f1_score: 0.1840 - val_loss: 2.5820 - val_f1_score: 0.1918
Epoch 73/500
28/28 [=====] - 3s 109ms/step - loss: 2.6609 - f1_score: 0.1961 - val_loss: 2.6364 - val_f1_score: 0.1614
Epoch 74/500
28/28 [=====] - 3s 109ms/step - loss: 2.6396 -
```

```

f1_score: 0.1929 - val_loss: 2.6220 - val_f1_score: 0.1779
Epoch 75/500
28/28 [=====] - 3s 110ms/step - loss: 2.6408 -
f1_score: 0.1910 - val_loss: 2.4872 - val_f1_score: 0.2097
Epoch 76/500
28/28 [=====] - 3s 110ms/step - loss: 2.6160 -
f1_score: 0.2004 - val_loss: 2.5584 - val_f1_score: 0.1896
Epoch 77/500
28/28 [=====] - 3s 111ms/step - loss: 2.6428 -
f1_score: 0.1962 - val_loss: 2.5670 - val_f1_score: 0.1893
Epoch 78/500
28/28 [=====] - ETA: 0s - loss: 2.5902 - f1_score:
0.1996

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 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 406ms/step - loss: 2.5902 -
f1_score: 0.1996 - val_loss: 2.5271 - val_f1_score: 0.2436
Epoch 79/500
28/28 [=====] - 3s 110ms/step - loss: 2.6023 -
f1_score: 0.1929 - val_loss: 2.4520 - val_f1_score: 0.2012
Epoch 80/500
28/28 [=====] - 3s 110ms/step - loss: 2.5988 -
f1_score: 0.1929 - val_loss: 2.5157 - val_f1_score: 0.2229
Epoch 81/500
28/28 [=====] - 3s 109ms/step - loss: 2.6172 -
f1_score: 0.1945 - val_loss: 2.4968 - val_f1_score: 0.2113
Epoch 82/500
28/28 [=====] - ETA: 0s - loss: 2.5616 - f1_score:
0.2085

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 1D-CNN + 1 GRU Trial 722 Mish/assets
INFO:tensorflow:Assets written to: 1 1D-CNN + 1 GRU Trial 722 Mish/assets
28/28 [=====] - 29s 1s/step - loss: 2.5616 - f1_score:
0.2085 - val_loss: 2.4554 - val_f1_score: 0.2457
Epoch 83/500
28/28 [=====] - 3s 109ms/step - loss: 2.5784 -
f1_score: 0.1989 - val_loss: 2.5495 - val_f1_score: 0.2184

```

```
Epoch 84/500
28/28 [=====] - 3s 108ms/step - loss: 2.5316 -
f1_score: 0.2155 - val_loss: 2.4410 - val_f1_score: 0.2064
Epoch 85/500
28/28 [=====] - 3s 109ms/step - loss: 2.5261 -
f1_score: 0.2100 - val_loss: 2.4569 - val_f1_score: 0.2399
Epoch 86/500
28/28 [=====] - ETA: 0s - loss: 2.5075 - f1_score:
0.2163

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 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 467ms/step - loss: 2.5075 -
f1_score: 0.2163 - val_loss: 2.4110 - val_f1_score: 0.2499
Epoch 87/500
28/28 [=====] - 3s 109ms/step - loss: 2.5263 -
f1_score: 0.2182 - val_loss: 2.4244 - val_f1_score: 0.2285
Epoch 88/500
28/28 [=====] - 3s 109ms/step - loss: 2.5087 -
f1_score: 0.2158 - val_loss: 2.4230 - val_f1_score: 0.2447
Epoch 89/500
28/28 [=====] - 3s 109ms/step - loss: 2.5042 -
f1_score: 0.2218 - val_loss: 2.4817 - val_f1_score: 0.2413
Epoch 90/500
28/28 [=====] - 3s 109ms/step - loss: 2.4886 -
f1_score: 0.2050 - val_loss: 2.4554 - val_f1_score: 0.2189
Epoch 91/500
28/28 [=====] - ETA: 0s - loss: 2.4818 - f1_score:
0.2332

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 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 454ms/step - loss: 2.4818 -
f1_score: 0.2332 - val_loss: 2.4213 - val_f1_score: 0.2679
Epoch 92/500
28/28 [=====] - 3s 109ms/step - loss: 2.4996 -
f1_score: 0.2169 - val_loss: 2.4131 - val_f1_score: 0.2429
Epoch 93/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 2.4880 -  
f1_score: 0.2185 - val_loss: 2.3868 - val_f1_score: 0.2678  
Epoch 94/500  
28/28 [=====] - 3s 110ms/step - loss: 2.5056 -  
f1_score: 0.2129 - val_loss: 2.4813 - val_f1_score: 0.2207  
Epoch 95/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4757 -  
f1_score: 0.2263 - val_loss: 2.4676 - val_f1_score: 0.2433  
Epoch 96/500  
28/28 [=====] - 3s 109ms/step - loss: 2.4390 -  
f1_score: 0.2366 - val_loss: 2.3874 - val_f1_score: 0.2500  
Epoch 97/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4522 -  
f1_score: 0.2375 - val_loss: 2.3751 - val_f1_score: 0.2281  
Epoch 98/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4341 -  
f1_score: 0.2343 - val_loss: 2.5286 - val_f1_score: 0.2472  
Epoch 99/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4608 -  
f1_score: 0.2303 - val_loss: 2.4386 - val_f1_score: 0.2365  
Epoch 100/500  
28/28 [=====] - ETA: 0s - loss: 2.4157 - f1_score:  
0.2446  
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 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 404ms/step - loss: 2.4157 -  
f1_score: 0.2446 - val_loss: 2.3670 - val_f1_score: 0.2851  
Epoch 101/500  
28/28 [=====] - 3s 109ms/step - loss: 2.4243 -  
f1_score: 0.2445 - val_loss: 2.4001 - val_f1_score: 0.2399  
Epoch 102/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4089 -  
f1_score: 0.2517 - val_loss: 2.4066 - val_f1_score: 0.2724  
Epoch 103/500  
28/28 [=====] - 3s 112ms/step - loss: 2.3895 -  
f1_score: 0.2471 - val_loss: 2.3386 - val_f1_score: 0.2825  
Epoch 104/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4160 -  
f1_score: 0.2380 - val_loss: 2.4869 - val_f1_score: 0.2742  
Epoch 105/500  
28/28 [=====] - 3s 110ms/step - loss: 2.4041 -  
f1_score: 0.2596 - val_loss: 2.4470 - val_f1_score: 0.2530
```

```
Epoch 106/500
28/28 [=====] - ETA: 0s - loss: 2.3875 - f1_score: 0.2519

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 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 528ms/step - loss: 2.3875 -
f1_score: 0.2519 - val_loss: 2.3649 - val_f1_score: 0.2953
Epoch 107/500
28/28 [=====] - 3s 109ms/step - loss: 2.3937 -
f1_score: 0.2546 - val_loss: 2.3230 - val_f1_score: 0.2722
Epoch 108/500
28/28 [=====] - 3s 110ms/step - loss: 2.3791 -
f1_score: 0.2591 - val_loss: 2.3415 - val_f1_score: 0.2607
Epoch 109/500
28/28 [=====] - ETA: 0s - loss: 2.3691 - f1_score: 0.2486

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 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: 2.3691 -
f1_score: 0.2486 - val_loss: 2.3415 - val_f1_score: 0.3128
Epoch 110/500
28/28 [=====] - 3s 109ms/step - loss: 2.3913 -
f1_score: 0.2637 - val_loss: 2.5390 - val_f1_score: 0.2705
Epoch 111/500
28/28 [=====] - 3s 110ms/step - loss: 2.3725 -
f1_score: 0.2464 - val_loss: 2.4235 - val_f1_score: 0.2641
Epoch 112/500
28/28 [=====] - 3s 110ms/step - loss: 2.3678 -
f1_score: 0.2616 - val_loss: 2.3652 - val_f1_score: 0.2547
Epoch 113/500
28/28 [=====] - 3s 111ms/step - loss: 2.3410 -
f1_score: 0.2721 - val_loss: 2.3663 - val_f1_score: 0.2509
Epoch 114/500
28/28 [=====] - 3s 113ms/step - loss: 2.3327 -
f1_score: 0.2553 - val_loss: 2.3481 - val_f1_score: 0.2860
Epoch 115/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 2.3278 -  
f1_score: 0.2644 - val_loss: 2.3594 - val_f1_score: 0.2596  
Epoch 116/500  
28/28 [=====] - 3s 111ms/step - loss: 2.3486 -  
f1_score: 0.2646 - val_loss: 2.3666 - val_f1_score: 0.2889  
Epoch 117/500  
28/28 [=====] - 3s 111ms/step - loss: 2.3441 -  
f1_score: 0.2687 - val_loss: 2.4021 - val_f1_score: 0.2734  
Epoch 118/500  
28/28 [=====] - 3s 111ms/step - loss: 2.3394 -  
f1_score: 0.2689 - val_loss: 2.4389 - val_f1_score: 0.2707  
Epoch 119/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2821 -  
f1_score: 0.2766 - val_loss: 2.4525 - val_f1_score: 0.2548  
Epoch 120/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2860 -  
f1_score: 0.2825 - val_loss: 2.3917 - val_f1_score: 0.2870  
Epoch 121/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2932 -  
f1_score: 0.2808 - val_loss: 2.3330 - val_f1_score: 0.2558  
Epoch 122/500  
28/28 [=====] - ETA: 0s - loss: 2.2705 - f1_score:  
0.2772  
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 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 436ms/step - loss: 2.2705 -  
f1_score: 0.2772 - val_loss: 2.2636 - val_f1_score: 0.3254  
Epoch 123/500  
28/28 [=====] - 3s 110ms/step - loss: 2.2797 -  
f1_score: 0.2945 - val_loss: 2.3721 - val_f1_score: 0.2853  
Epoch 124/500  
28/28 [=====] - 3s 113ms/step - loss: 2.2889 -  
f1_score: 0.2789 - val_loss: 2.2715 - val_f1_score: 0.2876  
Epoch 125/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2662 -  
f1_score: 0.2939 - val_loss: 2.2990 - val_f1_score: 0.3080  
Epoch 126/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2830 -  
f1_score: 0.2693 - val_loss: 2.4100 - val_f1_score: 0.2890  
Epoch 127/500  
28/28 [=====] - 3s 111ms/step - loss: 2.2625 -  
f1_score: 0.2738 - val_loss: 2.2817 - val_f1_score: 0.3010
```

```
Epoch 128/500
28/28 [=====] - 3s 111ms/step - loss: 2.2467 -
f1_score: 0.2848 - val_loss: 2.5058 - val_f1_score: 0.2359
Epoch 129/500
28/28 [=====] - 3s 111ms/step - loss: 2.2725 -
f1_score: 0.2928 - val_loss: 2.4262 - val_f1_score: 0.2653
Epoch 130/500
28/28 [=====] - 3s 111ms/step - loss: 2.2562 -
f1_score: 0.2897 - val_loss: 2.3001 - val_f1_score: 0.2960
Epoch 131/500
28/28 [=====] - 3s 111ms/step - loss: 2.2158 -
f1_score: 0.3007 - val_loss: 2.3882 - val_f1_score: 0.2813
Epoch 132/500
28/28 [=====] - 3s 111ms/step - loss: 2.2001 -
f1_score: 0.2933 - val_loss: 2.3297 - val_f1_score: 0.3075
Epoch 133/500
28/28 [=====] - 3s 111ms/step - loss: 2.2361 -
f1_score: 0.2996 - val_loss: 2.4193 - val_f1_score: 0.2586
Epoch 134/500
28/28 [=====] - 3s 111ms/step - loss: 2.2307 -
f1_score: 0.2828 - val_loss: 2.2846 - val_f1_score: 0.2871
Epoch 135/500
28/28 [=====] - ETA: 0s - loss: 2.2130 - f1_score:
0.2972

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 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: 2.2130 -
f1_score: 0.2972 - val_loss: 2.3401 - val_f1_score: 0.3254
Epoch 136/500
28/28 [=====] - 3s 110ms/step - loss: 2.2296 -
f1_score: 0.3011 - val_loss: 2.2648 - val_f1_score: 0.2824
Epoch 137/500
28/28 [=====] - 3s 110ms/step - loss: 2.1892 -
f1_score: 0.3063 - val_loss: 2.3671 - val_f1_score: 0.2900
Epoch 138/500
28/28 [=====] - 3s 110ms/step - loss: 2.1894 -
f1_score: 0.3057 - val_loss: 2.2504 - val_f1_score: 0.3071
Epoch 139/500
28/28 [=====] - 3s 111ms/step - loss: 2.2009 -
f1_score: 0.2948 - val_loss: 2.2474 - val_f1_score: 0.3039
Epoch 140/500
28/28 [=====] - 3s 111ms/step - loss: 2.2106 -
```

```
f1_score: 0.2999 - val_loss: 2.3699 - val_f1_score: 0.2782
Epoch 141/500
28/28 [=====] - 3s 110ms/step - loss: 2.1921 -
f1_score: 0.3156 - val_loss: 2.3397 - val_f1_score: 0.3082
Epoch 142/500
28/28 [=====] - 3s 111ms/step - loss: 2.1737 -
f1_score: 0.2991 - val_loss: 2.3143 - val_f1_score: 0.3179
Epoch 143/500
28/28 [=====] - 3s 111ms/step - loss: 2.1782 -
f1_score: 0.2997 - val_loss: 2.3438 - val_f1_score: 0.2699
Epoch 144/500
28/28 [=====] - 3s 111ms/step - loss: 2.1808 -
f1_score: 0.3008 - val_loss: 2.3318 - val_f1_score: 0.3008
Epoch 145/500
28/28 [=====] - 3s 111ms/step - loss: 2.1460 -
f1_score: 0.3050 - val_loss: 2.3181 - val_f1_score: 0.2991
Epoch 146/500
28/28 [=====] - 3s 111ms/step - loss: 2.1817 -
f1_score: 0.3038 - val_loss: 2.3796 - val_f1_score: 0.2947
Epoch 147/500
28/28 [=====] - 3s 111ms/step - loss: 2.1820 -
f1_score: 0.3174 - val_loss: 2.2101 - val_f1_score: 0.3048
Epoch 148/500
28/28 [=====] - ETA: 0s - loss: 2.1663 - f1_score:
0.3094

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 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: 2.1663 -
f1_score: 0.3094 - val_loss: 2.2281 - val_f1_score: 0.3271
Epoch 149/500
28/28 [=====] - 3s 109ms/step - loss: 2.1690 -
f1_score: 0.3122 - val_loss: 2.4263 - val_f1_score: 0.2921
Epoch 150/500
28/28 [=====] - 3s 110ms/step - loss: 2.1278 -
f1_score: 0.3299 - val_loss: 2.2956 - val_f1_score: 0.3067
Epoch 151/500
28/28 [=====] - 3s 111ms/step - loss: 2.1927 -
f1_score: 0.3082 - val_loss: 2.3505 - val_f1_score: 0.2963
Epoch 152/500
28/28 [=====] - 3s 111ms/step - loss: 2.1257 -
f1_score: 0.3164 - val_loss: 2.2741 - val_f1_score: 0.2957
Epoch 153/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 2.1687 -  
f1_score: 0.3204 - val_loss: 2.4462 - val_f1_score: 0.3120  
Epoch 154/500  
28/28 [=====] - 3s 110ms/step - loss: 2.1327 -  
f1_score: 0.3088 - val_loss: 2.3469 - val_f1_score: 0.3040  
Epoch 155/500  
28/28 [=====] - 3s 110ms/step - loss: 2.1175 -  
f1_score: 0.3211 - val_loss: 2.3282 - val_f1_score: 0.3227  
Epoch 156/500  
28/28 [=====] - 3s 112ms/step - loss: 2.1407 -  
f1_score: 0.3263 - val_loss: 2.3485 - val_f1_score: 0.2960  
Epoch 157/500  
28/28 [=====] - 3s 112ms/step - loss: 2.1449 -  
f1_score: 0.3084 - val_loss: 2.4101 - val_f1_score: 0.3134  
Epoch 158/500  
28/28 [=====] - ETA: 0s - loss: 2.1261 - f1_score:  
0.3262  
  
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 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 411ms/step - loss: 2.1261 -  
f1_score: 0.3262 - val_loss: 2.2020 - val_f1_score: 0.3414  
Epoch 159/500  
28/28 [=====] - 3s 111ms/step - loss: 2.1378 -  
f1_score: 0.3233 - val_loss: 2.2772 - val_f1_score: 0.3294  
Epoch 160/500  
28/28 [=====] - 3s 112ms/step - loss: 2.1164 -  
f1_score: 0.3302 - val_loss: 2.2250 - val_f1_score: 0.3371  
Epoch 161/500  
28/28 [=====] - 3s 112ms/step - loss: 2.0961 -  
f1_score: 0.3295 - val_loss: 2.2953 - val_f1_score: 0.3001  
Epoch 162/500  
28/28 [=====] - 3s 111ms/step - loss: 2.1385 -  
f1_score: 0.3197 - val_loss: 2.2731 - val_f1_score: 0.3215  
Epoch 163/500  
28/28 [=====] - 3s 111ms/step - loss: 2.1113 -  
f1_score: 0.3241 - val_loss: 2.2055 - val_f1_score: 0.3396  
Epoch 164/500  
28/28 [=====] - 3s 111ms/step - loss: 2.0672 -  
f1_score: 0.3331 - val_loss: 2.3022 - val_f1_score: 0.3082  
Epoch 165/500  
28/28 [=====] - 3s 112ms/step - loss: 2.1454 -  
f1_score: 0.3260 - val_loss: 2.2264 - val_f1_score: 0.3321
```

```
Epoch 166/500
28/28 [=====] - 3s 112ms/step - loss: 2.1096 -
f1_score: 0.3160 - val_loss: 2.2675 - val_f1_score: 0.3304
Epoch 167/500
28/28 [=====] - 3s 111ms/step - loss: 2.0944 -
f1_score: 0.3352 - val_loss: 2.3083 - val_f1_score: 0.3025
Epoch 168/500
28/28 [=====] - 3s 112ms/step - loss: 2.1001 -
f1_score: 0.3349 - val_loss: 2.3241 - val_f1_score: 0.3171
Epoch 169/500
28/28 [=====] - 3s 112ms/step - loss: 2.0792 -
f1_score: 0.3449 - val_loss: 2.2612 - val_f1_score: 0.3126
Epoch 170/500
28/28 [=====] - 3s 112ms/step - loss: 2.0743 -
f1_score: 0.3469 - val_loss: 2.3031 - val_f1_score: 0.3296
Epoch 171/500
28/28 [=====] - 3s 112ms/step - loss: 2.0808 -
f1_score: 0.3456 - val_loss: 2.1964 - val_f1_score: 0.3396
Epoch 172/500
28/28 [=====] - 3s 113ms/step - loss: 2.1175 -
f1_score: 0.3283 - val_loss: 2.3701 - val_f1_score: 0.3105
Epoch 173/500
28/28 [=====] - 3s 112ms/step - loss: 2.0802 -
f1_score: 0.3346 - val_loss: 2.4100 - val_f1_score: 0.2901
Epoch 174/500
28/28 [=====] - 3s 112ms/step - loss: 2.0590 -
f1_score: 0.3489 - val_loss: 2.2162 - val_f1_score: 0.3343
Epoch 175/500
28/28 [=====] - 3s 111ms/step - loss: 2.0766 -
f1_score: 0.3365 - val_loss: 2.3536 - val_f1_score: 0.3192
Epoch 176/500
28/28 [=====] - 3s 112ms/step - loss: 2.0506 -
f1_score: 0.3411 - val_loss: 2.2575 - val_f1_score: 0.3406
Epoch 177/500
28/28 [=====] - 3s 113ms/step - loss: 2.0818 -
f1_score: 0.3386 - val_loss: 2.3808 - val_f1_score: 0.2754
Epoch 178/500
28/28 [=====] - ETA: 0s - loss: 2.0542 - f1_score:
0.3460
```

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 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: 2.0542 -
```

```
f1_score: 0.3460 - val_loss: 2.2318 - val_f1_score: 0.3463
Epoch 179/500
28/28 [=====] - ETA: 0s - loss: 2.0648 - f1_score: 0.3408

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 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: 2.0648 -
f1_score: 0.3408 - val_loss: 2.1726 - val_f1_score: 0.3472
Epoch 180/500
28/28 [=====] - 3s 111ms/step - loss: 2.0370 -
f1_score: 0.3366 - val_loss: 2.3718 - val_f1_score: 0.2968
Epoch 181/500
28/28 [=====] - 3s 110ms/step - loss: 2.0509 -
f1_score: 0.3429 - val_loss: 2.2333 - val_f1_score: 0.3163
Epoch 182/500
28/28 [=====] - 3s 110ms/step - loss: 2.0155 -
f1_score: 0.3682 - val_loss: 2.2429 - val_f1_score: 0.3129
Epoch 183/500
28/28 [=====] - 3s 110ms/step - loss: 2.0319 -
f1_score: 0.3526 - val_loss: 2.2832 - val_f1_score: 0.3246
Epoch 184/500
28/28 [=====] - 3s 111ms/step - loss: 2.0625 -
f1_score: 0.3464 - val_loss: 2.3292 - val_f1_score: 0.3112
Epoch 185/500
28/28 [=====] - 3s 111ms/step - loss: 2.0407 -
f1_score: 0.3502 - val_loss: 2.2923 - val_f1_score: 0.3398
Epoch 186/500
28/28 [=====] - ETA: 0s - loss: 2.0517 - f1_score: 0.3563

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 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: 2.0517 -
f1_score: 0.3563 - val_loss: 2.2263 - val_f1_score: 0.3490
Epoch 187/500
28/28 [=====] - ETA: 0s - loss: 2.0374 - f1_score: 0.3541
```

```
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 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: 2.0374 -
f1_score: 0.3541 - val_loss: 2.1779 - val_f1_score: 0.3543
Epoch 188/500
28/28 [=====] - 3s 110ms/step - loss: 2.0405 -
f1_score: 0.3357 - val_loss: 2.3029 - val_f1_score: 0.3130
Epoch 189/500
28/28 [=====] - 3s 110ms/step - loss: 2.0221 -
f1_score: 0.3682 - val_loss: 2.2412 - val_f1_score: 0.3226
Epoch 190/500
28/28 [=====] - 3s 110ms/step - loss: 2.0333 -
f1_score: 0.3545 - val_loss: 2.2575 - val_f1_score: 0.3335
Epoch 191/500
28/28 [=====] - 3s 110ms/step - loss: 2.0184 -
f1_score: 0.3624 - val_loss: 2.2037 - val_f1_score: 0.3466
Epoch 192/500
28/28 [=====] - 3s 110ms/step - loss: 2.0166 -
f1_score: 0.3450 - val_loss: 2.2747 - val_f1_score: 0.3242
Epoch 193/500
28/28 [=====] - 3s 111ms/step - loss: 1.9978 -
f1_score: 0.3540 - val_loss: 2.1972 - val_f1_score: 0.2972
Epoch 194/500
28/28 [=====] - 3s 111ms/step - loss: 1.9937 -
f1_score: 0.3589 - val_loss: 2.2484 - val_f1_score: 0.3344
Epoch 195/500
28/28 [=====] - 3s 111ms/step - loss: 2.0104 -
f1_score: 0.3659 - val_loss: 2.4068 - val_f1_score: 0.2691
Epoch 196/500
28/28 [=====] - 3s 111ms/step - loss: 2.0169 -
f1_score: 0.3682 - val_loss: 2.3797 - val_f1_score: 0.3208
Epoch 197/500
28/28 [=====] - 3s 111ms/step - loss: 1.9897 -
f1_score: 0.3557 - val_loss: 2.2738 - val_f1_score: 0.3185
Epoch 198/500
28/28 [=====] - ETA: 0s - loss: 1.9957 - f1_score:
0.3504
```

```
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 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 493ms/step - loss: 1.9957 -
f1_score: 0.3504 - val_loss: 2.2116 - val_f1_score: 0.3643
Epoch 199/500
28/28 [=====] - 3s 110ms/step - loss: 1.9940 -
f1_score: 0.3700 - val_loss: 2.2181 - val_f1_score: 0.3187
Epoch 200/500
28/28 [=====] - 3s 113ms/step - loss: 1.9822 -
f1_score: 0.3467 - val_loss: 2.2438 - val_f1_score: 0.3288
Epoch 201/500
28/28 [=====] - 3s 111ms/step - loss: 1.9915 -
f1_score: 0.3653 - val_loss: 2.2660 - val_f1_score: 0.3438
Epoch 202/500
28/28 [=====] - 3s 111ms/step - loss: 1.9836 -
f1_score: 0.3591 - val_loss: 2.2793 - val_f1_score: 0.3169
Epoch 203/500
28/28 [=====] - 3s 112ms/step - loss: 1.9808 -
f1_score: 0.3668 - val_loss: 2.2726 - val_f1_score: 0.3210
Epoch 204/500
28/28 [=====] - 3s 114ms/step - loss: 1.9564 -
f1_score: 0.3695 - val_loss: 2.3417 - val_f1_score: 0.3288
Epoch 205/500
28/28 [=====] - 3s 113ms/step - loss: 1.9957 -
f1_score: 0.3548 - val_loss: 2.2042 - val_f1_score: 0.3036
Epoch 206/500
28/28 [=====] - 3s 111ms/step - loss: 1.9466 -
f1_score: 0.3595 - val_loss: 2.2016 - val_f1_score: 0.3224
Epoch 207/500
28/28 [=====] - 3s 112ms/step - loss: 1.9569 -
f1_score: 0.3753 - val_loss: 2.2623 - val_f1_score: 0.3058
Epoch 208/500
28/28 [=====] - 3s 112ms/step - loss: 1.9491 -
f1_score: 0.3710 - val_loss: 2.3028 - val_f1_score: 0.3337
Epoch 209/500
28/28 [=====] - 3s 112ms/step - loss: 1.9341 -
f1_score: 0.3785 - val_loss: 2.3241 - val_f1_score: 0.3347
Epoch 210/500
28/28 [=====] - 3s 112ms/step - loss: 1.9853 -
f1_score: 0.3674 - val_loss: 2.2502 - val_f1_score: 0.3379
Epoch 211/500
28/28 [=====] - 3s 112ms/step - loss: 1.9779 -
f1_score: 0.3651 - val_loss: 2.3955 - val_f1_score: 0.3146
Epoch 212/500
28/28 [=====] - 3s 111ms/step - loss: 1.9647 -
f1_score: 0.3709 - val_loss: 2.3715 - val_f1_score: 0.3128
Epoch 213/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 1.9191 -
f1_score: 0.3828 - val_loss: 2.2539 - val_f1_score: 0.3427
Epoch 214/500
28/28 [=====] - 3s 112ms/step - loss: 1.9628 -
f1_score: 0.3692 - val_loss: 2.2586 - val_f1_score: 0.3359
Epoch 215/500
28/28 [=====] - 3s 113ms/step - loss: 1.9793 -
f1_score: 0.3716 - val_loss: 2.1499 - val_f1_score: 0.3404
Epoch 216/500
28/28 [=====] - 3s 112ms/step - loss: 1.9087 -
f1_score: 0.3859 - val_loss: 2.3154 - val_f1_score: 0.3302
Epoch 217/500
28/28 [=====] - 3s 112ms/step - loss: 1.9780 -
f1_score: 0.3676 - val_loss: 2.2525 - val_f1_score: 0.3242
Epoch 218/500
28/28 [=====] - 3s 111ms/step - loss: 1.9208 -
f1_score: 0.3817 - val_loss: 2.2541 - val_f1_score: 0.3478
Epoch 219/500
28/28 [=====] - 3s 112ms/step - loss: 1.9156 -
f1_score: 0.3745 - val_loss: 2.2616 - val_f1_score: 0.3244
Epoch 220/500
28/28 [=====] - 3s 112ms/step - loss: 1.9589 -
f1_score: 0.3808 - val_loss: 2.2772 - val_f1_score: 0.3321
Epoch 221/500
28/28 [=====] - 3s 112ms/step - loss: 1.9501 -
f1_score: 0.3747 - val_loss: 2.1394 - val_f1_score: 0.3611
Epoch 222/500
28/28 [=====] - 3s 112ms/step - loss: 1.9421 -
f1_score: 0.3747 - val_loss: 2.2338 - val_f1_score: 0.3383
Epoch 223/500
28/28 [=====] - 3s 112ms/step - loss: 1.8829 -
f1_score: 0.3984 - val_loss: 2.2141 - val_f1_score: 0.3336
Epoch 224/500
28/28 [=====] - 3s 112ms/step - loss: 1.8935 -
f1_score: 0.3995 - val_loss: 2.3255 - val_f1_score: 0.3137
Epoch 225/500
28/28 [=====] - ETA: 0s - loss: 1.9285 - f1_score:
0.3708
```

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 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 450ms/step - loss: 1.9285 -
f1_score: 0.3708 - val_loss: 2.1482 - val_f1_score: 0.3844
```

Epoch 226/500  
28/28 [=====] - 3s 110ms/step - loss: 1.9336 -  
f1\_score: 0.3744 - val\_loss: 2.2425 - val\_f1\_score: 0.3284  
Epoch 227/500  
28/28 [=====] - 3s 111ms/step - loss: 1.8892 -  
f1\_score: 0.3907 - val\_loss: 2.3571 - val\_f1\_score: 0.3102  
Epoch 228/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9000 -  
f1\_score: 0.3908 - val\_loss: 2.4205 - val\_f1\_score: 0.3022  
Epoch 229/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9007 -  
f1\_score: 0.3852 - val\_loss: 2.2642 - val\_f1\_score: 0.3301  
Epoch 230/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9013 -  
f1\_score: 0.3923 - val\_loss: 2.3165 - val\_f1\_score: 0.3373  
Epoch 231/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8866 -  
f1\_score: 0.3980 - val\_loss: 2.1943 - val\_f1\_score: 0.3502  
Epoch 232/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9439 -  
f1\_score: 0.3721 - val\_loss: 2.3239 - val\_f1\_score: 0.3258  
Epoch 233/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9563 -  
f1\_score: 0.3790 - val\_loss: 2.2347 - val\_f1\_score: 0.3240  
Epoch 234/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9023 -  
f1\_score: 0.3887 - val\_loss: 2.1508 - val\_f1\_score: 0.3535  
Epoch 235/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8650 -  
f1\_score: 0.4004 - val\_loss: 2.2238 - val\_f1\_score: 0.3545  
Epoch 236/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9247 -  
f1\_score: 0.3809 - val\_loss: 2.2171 - val\_f1\_score: 0.3583  
Epoch 237/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9078 -  
f1\_score: 0.3819 - val\_loss: 2.3333 - val\_f1\_score: 0.3399  
Epoch 238/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9232 -  
f1\_score: 0.3829 - val\_loss: 2.4302 - val\_f1\_score: 0.3405  
Epoch 239/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9475 -  
f1\_score: 0.3867 - val\_loss: 2.3408 - val\_f1\_score: 0.3452  
Epoch 240/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8902 -  
f1\_score: 0.3844 - val\_loss: 2.2813 - val\_f1\_score: 0.3576  
Epoch 241/500  
28/28 [=====] - 3s 111ms/step - loss: 1.9218 -  
f1\_score: 0.3768 - val\_loss: 2.2817 - val\_f1\_score: 0.3227

Epoch 242/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8950 -  
f1\_score: 0.3896 - val\_loss: 2.2763 - val\_f1\_score: 0.3422  
Epoch 243/500  
28/28 [=====] - 3s 111ms/step - loss: 1.8955 -  
f1\_score: 0.3891 - val\_loss: 2.2345 - val\_f1\_score: 0.3456  
Epoch 244/500  
28/28 [=====] - 3s 113ms/step - loss: 1.9162 -  
f1\_score: 0.3915 - val\_loss: 2.1495 - val\_f1\_score: 0.3506  
Epoch 245/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8653 -  
f1\_score: 0.3887 - val\_loss: 2.1790 - val\_f1\_score: 0.3592  
Epoch 246/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8859 -  
f1\_score: 0.3922 - val\_loss: 2.3330 - val\_f1\_score: 0.3405  
Epoch 247/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8864 -  
f1\_score: 0.3948 - val\_loss: 2.2407 - val\_f1\_score: 0.3322  
Epoch 248/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8842 -  
f1\_score: 0.3972 - val\_loss: 2.2160 - val\_f1\_score: 0.3271  
Epoch 249/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9091 -  
f1\_score: 0.3877 - val\_loss: 2.2148 - val\_f1\_score: 0.3236  
Epoch 250/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8976 -  
f1\_score: 0.3927 - val\_loss: 2.1704 - val\_f1\_score: 0.3695  
Epoch 251/500  
28/28 [=====] - 3s 113ms/step - loss: 1.9319 -  
f1\_score: 0.3931 - val\_loss: 2.2121 - val\_f1\_score: 0.3690  
Epoch 252/500  
28/28 [=====] - 3s 111ms/step - loss: 1.8817 -  
f1\_score: 0.3870 - val\_loss: 2.2702 - val\_f1\_score: 0.3302  
Epoch 253/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8513 -  
f1\_score: 0.4048 - val\_loss: 2.1499 - val\_f1\_score: 0.3807  
Epoch 254/500  
28/28 [=====] - 3s 114ms/step - loss: 1.8627 -  
f1\_score: 0.3948 - val\_loss: 2.2369 - val\_f1\_score: 0.3227  
Epoch 255/500  
28/28 [=====] - 3s 112ms/step - loss: 1.9041 -  
f1\_score: 0.3968 - val\_loss: 2.3371 - val\_f1\_score: 0.3403  
Epoch 256/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8950 -  
f1\_score: 0.3829 - val\_loss: 2.2623 - val\_f1\_score: 0.3226  
Epoch 257/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8827 -  
f1\_score: 0.4001 - val\_loss: 2.1630 - val\_f1\_score: 0.3614

Epoch 258/500  
28/28 [=====] - 3s 115ms/step - loss: 1.8911 -  
f1\_score: 0.3964 - val\_loss: 2.2782 - val\_f1\_score: 0.3250  
Epoch 259/500  
28/28 [=====] - 3s 116ms/step - loss: 1.8990 -  
f1\_score: 0.3829 - val\_loss: 2.3022 - val\_f1\_score: 0.3452  
Epoch 260/500  
28/28 [=====] - 3s 114ms/step - loss: 1.8900 -  
f1\_score: 0.4013 - val\_loss: 2.2169 - val\_f1\_score: 0.3379  
Epoch 261/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8273 -  
f1\_score: 0.4214 - val\_loss: 2.3017 - val\_f1\_score: 0.3321  
Epoch 262/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8419 -  
f1\_score: 0.4119 - val\_loss: 2.3271 - val\_f1\_score: 0.3473  
Epoch 263/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8121 -  
f1\_score: 0.4158 - val\_loss: 2.2822 - val\_f1\_score: 0.3466  
Epoch 264/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8395 -  
f1\_score: 0.4088 - val\_loss: 2.1402 - val\_f1\_score: 0.3647  
Epoch 265/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8955 -  
f1\_score: 0.3929 - val\_loss: 2.1861 - val\_f1\_score: 0.3830  
Epoch 266/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8282 -  
f1\_score: 0.4126 - val\_loss: 2.1972 - val\_f1\_score: 0.3733  
Epoch 267/500  
28/28 [=====] - 3s 112ms/step - loss: 1.8247 -  
f1\_score: 0.4171 - val\_loss: 2.1581 - val\_f1\_score: 0.3603  
Epoch 268/500  
28/28 [=====] - 3s 113ms/step - loss: 1.8123 -  
f1\_score: 0.4137 - val\_loss: 2.2207 - val\_f1\_score: 0.3553  
Epoch 269/500  
28/28 [=====] - 3s 113ms/step - loss: 1.7915 -  
f1\_score: 0.4289 - val\_loss: 2.1703 - val\_f1\_score: 0.3581  
Epoch 270/500  
28/28 [=====] - 3s 113ms/step - loss: 1.7967 -  
f1\_score: 0.4361 - val\_loss: 2.2535 - val\_f1\_score: 0.3435  
Epoch 271/500  
28/28 [=====] - 3s 113ms/step - loss: 1.7878 -  
f1\_score: 0.4175 - val\_loss: 2.3416 - val\_f1\_score: 0.3340  
Epoch 272/500  
28/28 [=====] - 3s 112ms/step - loss: 1.7627 -  
f1\_score: 0.4286 - val\_loss: 2.3620 - val\_f1\_score: 0.3340  
Epoch 273/500  
28/28 [=====] - 3s 112ms/step - loss: 1.7983 -  
f1\_score: 0.4294 - val\_loss: 2.3067 - val\_f1\_score: 0.3512

```
Epoch 274/500
28/28 [=====] - 3s 115ms/step - loss: 1.7586 -
f1_score: 0.4356 - val_loss: 2.2116 - val_f1_score: 0.3621
Epoch 275/500
28/28 [=====] - 3s 113ms/step - loss: 1.8038 -
f1_score: 0.4033 - val_loss: 2.2274 - val_f1_score: 0.3529
Epoch 276/500
28/28 [=====] - 3s 113ms/step - loss: 1.7730 -
f1_score: 0.4305 - val_loss: 2.3185 - val_f1_score: 0.3473
Epoch 277/500
28/28 [=====] - 3s 112ms/step - loss: 1.8244 -
f1_score: 0.4089 - val_loss: 2.1794 - val_f1_score: 0.3554
Epoch 278/500
28/28 [=====] - 3s 112ms/step - loss: 1.8308 -
f1_score: 0.4272 - val_loss: 2.2673 - val_f1_score: 0.3691
Epoch 279/500
28/28 [=====] - 3s 112ms/step - loss: 1.7925 -
f1_score: 0.4286 - val_loss: 2.1827 - val_f1_score: 0.3654
Epoch 280/500
28/28 [=====] - 3s 112ms/step - loss: 1.8004 -
f1_score: 0.4133 - val_loss: 2.3003 - val_f1_score: 0.3543
Epoch 281/500
28/28 [=====] - 3s 112ms/step - loss: 1.7911 -
f1_score: 0.4327 - val_loss: 2.3620 - val_f1_score: 0.3447
Epoch 282/500
28/28 [=====] - 3s 112ms/step - loss: 1.7517 -
f1_score: 0.4405 - val_loss: 2.2132 - val_f1_score: 0.3697
Epoch 283/500
28/28 [=====] - 3s 113ms/step - loss: 1.7927 -
f1_score: 0.4204 - val_loss: 2.3284 - val_f1_score: 0.3514
Epoch 284/500
28/28 [=====] - 3s 113ms/step - loss: 1.8186 -
f1_score: 0.4139 - val_loss: 2.3615 - val_f1_score: 0.3604
Epoch 285/500
28/28 [=====] - 3s 112ms/step - loss: 1.7689 -
f1_score: 0.4285 - val_loss: 2.1992 - val_f1_score: 0.3730
Epoch 286/500
28/28 [=====] - 3s 112ms/step - loss: 1.7576 -
f1_score: 0.4279 - val_loss: 2.2192 - val_f1_score: 0.3645
Epoch 287/500
28/28 [=====] - 3s 112ms/step - loss: 1.7463 -
f1_score: 0.4370 - val_loss: 2.2319 - val_f1_score: 0.3789
Epoch 288/500
28/28 [=====] - ETA: 0s - loss: 1.7604 - f1_score:
0.4278
```

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

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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 [=====] - 13s 473ms/step - loss: 1.7604 -
f1_score: 0.4278 - val_loss: 2.1739 - val_f1_score: 0.4088
Epoch 289/500
28/28 [=====] - 3s 110ms/step - loss: 1.7776 -
f1_score: 0.4254 - val_loss: 2.2835 - val_f1_score: 0.3763
Epoch 290/500
28/28 [=====] - 3s 111ms/step - loss: 1.7697 -
f1_score: 0.4230 - val_loss: 2.2609 - val_f1_score: 0.3523
Epoch 291/500
28/28 [=====] - 3s 115ms/step - loss: 1.7754 -
f1_score: 0.4211 - val_loss: 2.1870 - val_f1_score: 0.3601
Epoch 292/500
28/28 [=====] - 3s 111ms/step - loss: 1.7638 -
f1_score: 0.4289 - val_loss: 2.1902 - val_f1_score: 0.3642
Epoch 293/500
28/28 [=====] - 3s 112ms/step - loss: 1.8207 -
f1_score: 0.4165 - val_loss: 2.2951 - val_f1_score: 0.3721
Epoch 294/500
28/28 [=====] - 3s 111ms/step - loss: 1.7534 -
f1_score: 0.4371 - val_loss: 2.1006 - val_f1_score: 0.3749
Epoch 295/500
28/28 [=====] - 3s 112ms/step - loss: 1.7520 -
f1_score: 0.4306 - val_loss: 2.2631 - val_f1_score: 0.3781
Epoch 296/500
28/28 [=====] - 3s 112ms/step - loss: 1.7531 -
f1_score: 0.4355 - val_loss: 2.3767 - val_f1_score: 0.3559
Epoch 297/500
28/28 [=====] - 3s 112ms/step - loss: 1.7815 -
f1_score: 0.4292 - val_loss: 2.3458 - val_f1_score: 0.3535
Epoch 298/500
28/28 [=====] - 3s 111ms/step - loss: 1.7446 -
f1_score: 0.4372 - val_loss: 2.1813 - val_f1_score: 0.3546
Epoch 299/500
28/28 [=====] - 3s 113ms/step - loss: 1.8046 -
f1_score: 0.4237 - val_loss: 2.2842 - val_f1_score: 0.3712
Epoch 300/500
28/28 [=====] - 3s 112ms/step - loss: 1.7483 -
f1_score: 0.4375 - val_loss: 2.1407 - val_f1_score: 0.4071
Epoch 301/500
28/28 [=====] - 3s 112ms/step - loss: 1.7427 -
f1_score: 0.4324 - val_loss: 2.1120 - val_f1_score: 0.3686
Epoch 302/500
```

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28/28 [=====] - 3s 113ms/step - loss: 1.7465 -
f1_score: 0.4359 - val_loss: 2.1790 - val_f1_score: 0.3584
Epoch 303/500
28/28 [=====] - 3s 111ms/step - loss: 1.7616 -
f1_score: 0.4217 - val_loss: 2.1185 - val_f1_score: 0.3844
Epoch 304/500
28/28 [=====] - 3s 112ms/step - loss: 1.7435 -
f1_score: 0.4266 - val_loss: 2.1823 - val_f1_score: 0.3503
Epoch 305/500
28/28 [=====] - 3s 113ms/step - loss: 1.7482 -
f1_score: 0.4319 - val_loss: 2.2269 - val_f1_score: 0.3548
Epoch 306/500
28/28 [=====] - 3s 113ms/step - loss: 1.7297 -
f1_score: 0.4333 - val_loss: 2.2639 - val_f1_score: 0.3607
Epoch 307/500
28/28 [=====] - 3s 112ms/step - loss: 1.7685 -
f1_score: 0.4323 - val_loss: 2.1759 - val_f1_score: 0.3813
Epoch 308/500
28/28 [=====] - 3s 112ms/step - loss: 1.7585 -
f1_score: 0.4306 - val_loss: 2.3007 - val_f1_score: 0.3816
Epoch 309/500
28/28 [=====] - 3s 113ms/step - loss: 1.7610 -
f1_score: 0.4304 - val_loss: 2.1680 - val_f1_score: 0.3882
Epoch 310/500
28/28 [=====] - 3s 112ms/step - loss: 1.7582 -
f1_score: 0.4312 - val_loss: 2.1742 - val_f1_score: 0.3835
Epoch 311/500
28/28 [=====] - 3s 113ms/step - loss: 1.7493 -
f1_score: 0.4434 - val_loss: 2.1876 - val_f1_score: 0.3721
Epoch 312/500
28/28 [=====] - 3s 114ms/step - loss: 1.7799 -
f1_score: 0.4193 - val_loss: 2.2764 - val_f1_score: 0.3521
Epoch 313/500
28/28 [=====] - 3s 115ms/step - loss: 1.7022 -
f1_score: 0.4583 - val_loss: 2.2833 - val_f1_score: 0.3464
Epoch 314/500
28/28 [=====] - 3s 115ms/step - loss: 1.7270 -
f1_score: 0.4437 - val_loss: 2.2597 - val_f1_score: 0.3416
Epoch 315/500
28/28 [=====] - 3s 113ms/step - loss: 1.7327 -
f1_score: 0.4348 - val_loss: 2.2380 - val_f1_score: 0.3743
Epoch 316/500
28/28 [=====] - 3s 112ms/step - loss: 1.7640 -
f1_score: 0.4318 - val_loss: 2.2489 - val_f1_score: 0.3668
Epoch 317/500
28/28 [=====] - 3s 113ms/step - loss: 1.7315 -
f1_score: 0.4546 - val_loss: 2.1534 - val_f1_score: 0.3711
Epoch 318/500
```

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28/28 [=====] - 3s 113ms/step - loss: 1.7224 -
f1_score: 0.4392 - val_loss: 2.2932 - val_f1_score: 0.3494
Epoch 319/500
28/28 [=====] - 3s 113ms/step - loss: 1.7586 -
f1_score: 0.4400 - val_loss: 2.3620 - val_f1_score: 0.3382
Epoch 320/500
28/28 [=====] - 3s 113ms/step - loss: 1.7545 -
f1_score: 0.4365 - val_loss: 2.2512 - val_f1_score: 0.3735
Epoch 321/500
28/28 [=====] - 3s 112ms/step - loss: 1.7515 -
f1_score: 0.4389 - val_loss: 2.2582 - val_f1_score: 0.3279
Epoch 322/500
28/28 [=====] - 3s 112ms/step - loss: 1.7604 -
f1_score: 0.4278 - val_loss: 2.1752 - val_f1_score: 0.3812
Epoch 323/500
28/28 [=====] - 3s 112ms/step - loss: 1.7232 -
f1_score: 0.4355 - val_loss: 2.1971 - val_f1_score: 0.3732
Epoch 324/500
28/28 [=====] - 3s 113ms/step - loss: 1.7130 -
f1_score: 0.4342 - val_loss: 2.1228 - val_f1_score: 0.3790
Epoch 325/500
28/28 [=====] - 3s 113ms/step - loss: 1.6987 -
f1_score: 0.4396 - val_loss: 2.1451 - val_f1_score: 0.3671
Epoch 326/500
28/28 [=====] - 3s 113ms/step - loss: 1.6994 -
f1_score: 0.4456 - val_loss: 2.2354 - val_f1_score: 0.3605
Epoch 327/500
28/28 [=====] - 3s 112ms/step - loss: 1.6773 -
f1_score: 0.4623 - val_loss: 2.1596 - val_f1_score: 0.3849
Epoch 328/500
28/28 [=====] - 3s 113ms/step - loss: 1.6987 -
f1_score: 0.4408 - val_loss: 2.1485 - val_f1_score: 0.3809
Epoch 329/500
28/28 [=====] - 3s 113ms/step - loss: 1.7406 -
f1_score: 0.4415 - val_loss: 2.2496 - val_f1_score: 0.3678
Epoch 330/500
28/28 [=====] - 3s 112ms/step - loss: 1.7047 -
f1_score: 0.4413 - val_loss: 2.2910 - val_f1_score: 0.3803
Epoch 331/500
28/28 [=====] - 3s 113ms/step - loss: 1.7271 -
f1_score: 0.4413 - val_loss: 2.4350 - val_f1_score: 0.3022
Epoch 332/500
28/28 [=====] - 3s 113ms/step - loss: 1.7117 -
f1_score: 0.4563 - val_loss: 2.1620 - val_f1_score: 0.3791
Epoch 333/500
28/28 [=====] - 3s 112ms/step - loss: 1.6493 -
f1_score: 0.4742 - val_loss: 2.2375 - val_f1_score: 0.3580
Epoch 334/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 1.7176 -
f1_score: 0.4432 - val_loss: 2.2994 - val_f1_score: 0.3742
Epoch 335/500
28/28 [=====] - 3s 112ms/step - loss: 1.6981 -
f1_score: 0.4634 - val_loss: 2.1452 - val_f1_score: 0.3828
Epoch 336/500
28/28 [=====] - 3s 112ms/step - loss: 1.6905 -
f1_score: 0.4622 - val_loss: 2.1790 - val_f1_score: 0.3717
Epoch 337/500
28/28 [=====] - 3s 112ms/step - loss: 1.7223 -
f1_score: 0.4443 - val_loss: 2.2752 - val_f1_score: 0.3495
Epoch 338/500
28/28 [=====] - 3s 115ms/step - loss: 1.6546 -
f1_score: 0.4654 - val_loss: 2.1172 - val_f1_score: 0.3847
Epoch 339/500
28/28 [=====] - 3s 112ms/step - loss: 1.7008 -
f1_score: 0.4515 - val_loss: 2.3388 - val_f1_score: 0.3785
Epoch 340/500
28/28 [=====] - 3s 112ms/step - loss: 1.6612 -
f1_score: 0.4561 - val_loss: 2.1978 - val_f1_score: 0.3907
Epoch 341/500
28/28 [=====] - 3s 112ms/step - loss: 1.7118 -
f1_score: 0.4397 - val_loss: 2.4545 - val_f1_score: 0.3455
Epoch 342/500
28/28 [=====] - 3s 113ms/step - loss: 1.7257 -
f1_score: 0.4438 - val_loss: 2.3463 - val_f1_score: 0.3514
Epoch 343/500
28/28 [=====] - 3s 112ms/step - loss: 1.7141 -
f1_score: 0.4468 - val_loss: 2.3483 - val_f1_score: 0.3615
Epoch 344/500
28/28 [=====] - 3s 112ms/step - loss: 1.7045 -
f1_score: 0.4463 - val_loss: 2.2503 - val_f1_score: 0.3554
Epoch 345/500
28/28 [=====] - 3s 112ms/step - loss: 1.7190 -
f1_score: 0.4464 - val_loss: 2.2805 - val_f1_score: 0.3432
Epoch 346/500
28/28 [=====] - 3s 112ms/step - loss: 1.7353 -
f1_score: 0.4482 - val_loss: 2.1030 - val_f1_score: 0.3855
Epoch 347/500
28/28 [=====] - 3s 112ms/step - loss: 1.7122 -
f1_score: 0.4523 - val_loss: 2.2204 - val_f1_score: 0.3590
Epoch 348/500
28/28 [=====] - 3s 112ms/step - loss: 1.6866 -
f1_score: 0.4534 - val_loss: 2.1628 - val_f1_score: 0.3583
Epoch 349/500
28/28 [=====] - 3s 113ms/step - loss: 1.7114 -
f1_score: 0.4565 - val_loss: 2.1767 - val_f1_score: 0.3695
Epoch 350/500
```

```
28/28 [=====] - 3s 113ms/step - loss: 1.7400 -
f1_score: 0.4426 - val_loss: 2.2687 - val_f1_score: 0.3328
Epoch 351/500
28/28 [=====] - 3s 113ms/step - loss: 1.7277 -
f1_score: 0.4537 - val_loss: 2.1867 - val_f1_score: 0.3542
Epoch 352/500
28/28 [=====] - 3s 112ms/step - loss: 1.7094 -
f1_score: 0.4515 - val_loss: 2.1566 - val_f1_score: 0.3617
Epoch 353/500
28/28 [=====] - 3s 112ms/step - loss: 1.6978 -
f1_score: 0.4491 - val_loss: 2.1399 - val_f1_score: 0.3843
Epoch 354/500
28/28 [=====] - 3s 112ms/step - loss: 1.6374 -
f1_score: 0.4689 - val_loss: 2.2863 - val_f1_score: 0.3338
Epoch 355/500
28/28 [=====] - 3s 113ms/step - loss: 1.6857 -
f1_score: 0.4479 - val_loss: 2.3664 - val_f1_score: 0.3466
Epoch 356/500
28/28 [=====] - 3s 112ms/step - loss: 1.7132 -
f1_score: 0.4545 - val_loss: 2.3134 - val_f1_score: 0.3512
Epoch 357/500
28/28 [=====] - 3s 112ms/step - loss: 1.6843 -
f1_score: 0.4507 - val_loss: 2.1788 - val_f1_score: 0.3496
Epoch 358/500
28/28 [=====] - 3s 114ms/step - loss: 1.6957 -
f1_score: 0.4556 - val_loss: 2.2661 - val_f1_score: 0.3675
Epoch 359/500
28/28 [=====] - 3s 112ms/step - loss: 1.6708 -
f1_score: 0.4653 - val_loss: 2.2487 - val_f1_score: 0.3458
Epoch 360/500
28/28 [=====] - 3s 113ms/step - loss: 1.7364 -
f1_score: 0.4532 - val_loss: 2.1668 - val_f1_score: 0.3779
Epoch 361/500
28/28 [=====] - 3s 113ms/step - loss: 1.6497 -
f1_score: 0.4605 - val_loss: 2.3238 - val_f1_score: 0.3291
Epoch 362/500
28/28 [=====] - 3s 112ms/step - loss: 1.6609 -
f1_score: 0.4601 - val_loss: 2.2529 - val_f1_score: 0.3902
Epoch 363/500
28/28 [=====] - 3s 113ms/step - loss: 1.6562 -
f1_score: 0.4647 - val_loss: 2.1759 - val_f1_score: 0.3605
Epoch 364/500
28/28 [=====] - 3s 114ms/step - loss: 1.6752 -
f1_score: 0.4582 - val_loss: 2.4504 - val_f1_score: 0.3108
Epoch 365/500
28/28 [=====] - 3s 112ms/step - loss: 1.6662 -
f1_score: 0.4711 - val_loss: 2.2201 - val_f1_score: 0.3658
Epoch 366/500
```

```
28/28 [=====] - 3s 112ms/step - loss: 1.6619 -
f1_score: 0.4686 - val_loss: 2.1504 - val_f1_score: 0.3705
Epoch 367/500
28/28 [=====] - 3s 112ms/step - loss: 1.6542 -
f1_score: 0.4626 - val_loss: 2.2264 - val_f1_score: 0.3675
Epoch 368/500
28/28 [=====] - 3s 112ms/step - loss: 1.6208 -
f1_score: 0.4627 - val_loss: 2.2642 - val_f1_score: 0.3581
Epoch 369/500
28/28 [=====] - 3s 115ms/step - loss: 1.6287 -
f1_score: 0.4662 - val_loss: 2.2194 - val_f1_score: 0.3591
Epoch 370/500
28/28 [=====] - 3s 115ms/step - loss: 1.6211 -
f1_score: 0.4783 - val_loss: 2.2332 - val_f1_score: 0.3685
Epoch 371/500
28/28 [=====] - 3s 116ms/step - loss: 1.6504 -
f1_score: 0.4702 - val_loss: 2.3390 - val_f1_score: 0.3457
Epoch 372/500
28/28 [=====] - 3s 113ms/step - loss: 1.7069 -
f1_score: 0.4460 - val_loss: 2.1666 - val_f1_score: 0.3877
Epoch 373/500
28/28 [=====] - 3s 112ms/step - loss: 1.6490 -
f1_score: 0.4585 - val_loss: 2.1653 - val_f1_score: 0.3580
Epoch 374/500
28/28 [=====] - 3s 112ms/step - loss: 1.6656 -
f1_score: 0.4713 - val_loss: 2.2938 - val_f1_score: 0.3438
Epoch 375/500
28/28 [=====] - 3s 113ms/step - loss: 1.6406 -
f1_score: 0.4715 - val_loss: 2.0878 - val_f1_score: 0.3769
Epoch 376/500
28/28 [=====] - 3s 112ms/step - loss: 1.6447 -
f1_score: 0.4744 - val_loss: 2.1136 - val_f1_score: 0.3695
Epoch 377/500
28/28 [=====] - 3s 112ms/step - loss: 1.6321 -
f1_score: 0.4702 - val_loss: 2.1625 - val_f1_score: 0.3775
Epoch 378/500
28/28 [=====] - 3s 112ms/step - loss: 1.6704 -
f1_score: 0.4666 - val_loss: 2.1575 - val_f1_score: 0.3534
Epoch 379/500
28/28 [=====] - 3s 113ms/step - loss: 1.6805 -
f1_score: 0.4594 - val_loss: 2.1964 - val_f1_score: 0.3487
Epoch 380/500
28/28 [=====] - 3s 113ms/step - loss: 1.7223 -
f1_score: 0.4562 - val_loss: 2.1680 - val_f1_score: 0.3490
Epoch 381/500
28/28 [=====] - 3s 112ms/step - loss: 1.6842 -
f1_score: 0.4669 - val_loss: 2.2893 - val_f1_score: 0.3759
Epoch 382/500
```

```
28/28 [=====] - 3s 113ms/step - loss: 1.6597 -
f1_score: 0.4723 - val_loss: 2.1971 - val_f1_score: 0.3985
Epoch 383/500
28/28 [=====] - 3s 113ms/step - loss: 1.6408 -
f1_score: 0.4643 - val_loss: 2.1902 - val_f1_score: 0.3679
Epoch 384/500
28/28 [=====] - 3s 112ms/step - loss: 1.6517 -
f1_score: 0.4589 - val_loss: 2.3405 - val_f1_score: 0.3410
Epoch 385/500
28/28 [=====] - 3s 112ms/step - loss: 1.6851 -
f1_score: 0.4499 - val_loss: 2.1987 - val_f1_score: 0.3690
Epoch 386/500
28/28 [=====] - 3s 113ms/step - loss: 1.6232 -
f1_score: 0.4743 - val_loss: 2.1438 - val_f1_score: 0.3829
Epoch 387/500
28/28 [=====] - 3s 112ms/step - loss: 1.6667 -
f1_score: 0.4578 - val_loss: 2.1469 - val_f1_score: 0.3709
Epoch 388/500
28/28 [=====] - 3s 112ms/step - loss: 1.6148 -
f1_score: 0.4791 - val_loss: 2.1581 - val_f1_score: 0.3766
Epoch 389/500
28/28 [=====] - 3s 116ms/step - loss: 1.6667 -
f1_score: 0.4661 - val_loss: 2.1113 - val_f1_score: 0.3606
Epoch 390/500
28/28 [=====] - 3s 112ms/step - loss: 1.6702 -
f1_score: 0.4571 - val_loss: 2.1754 - val_f1_score: 0.3706
Epoch 391/500
28/28 [=====] - 3s 113ms/step - loss: 1.6445 -
f1_score: 0.4733 - val_loss: 2.1620 - val_f1_score: 0.3897
Epoch 392/500
28/28 [=====] - 3s 113ms/step - loss: 1.6057 -
f1_score: 0.4772 - val_loss: 2.1351 - val_f1_score: 0.3781
Epoch 393/500
28/28 [=====] - 3s 113ms/step - loss: 1.6212 -
f1_score: 0.4731 - val_loss: 2.2041 - val_f1_score: 0.3809
Epoch 394/500
28/28 [=====] - 3s 112ms/step - loss: 1.6756 -
f1_score: 0.4717 - val_loss: 2.1554 - val_f1_score: 0.3839
Epoch 395/500
28/28 [=====] - 3s 113ms/step - loss: 1.6276 -
f1_score: 0.4839 - val_loss: 2.3184 - val_f1_score: 0.3422
Epoch 396/500
28/28 [=====] - 3s 112ms/step - loss: 1.6132 -
f1_score: 0.4800 - val_loss: 2.2721 - val_f1_score: 0.3465
Epoch 397/500
28/28 [=====] - 3s 113ms/step - loss: 1.6343 -
f1_score: 0.4650 - val_loss: 2.1705 - val_f1_score: 0.3713
Epoch 398/500
```

```
28/28 [=====] - 3s 113ms/step - loss: 1.6119 -
f1_score: 0.4874 - val_loss: 2.1693 - val_f1_score: 0.3853
Epoch 399/500
28/28 [=====] - 3s 113ms/step - loss: 1.5762 -
f1_score: 0.4936 - val_loss: 2.2728 - val_f1_score: 0.3742
Epoch 400/500
28/28 [=====] - 3s 113ms/step - loss: 1.5921 -
f1_score: 0.4811 - val_loss: 2.2293 - val_f1_score: 0.3927
Epoch 401/500
28/28 [=====] - 3s 112ms/step - loss: 1.5575 -
f1_score: 0.4991 - val_loss: 2.0896 - val_f1_score: 0.3714
Epoch 402/500
28/28 [=====] - 3s 112ms/step - loss: 1.5905 -
f1_score: 0.4933 - val_loss: 2.3254 - val_f1_score: 0.3548
Epoch 403/500
28/28 [=====] - 3s 112ms/step - loss: 1.6124 -
f1_score: 0.4847 - val_loss: 2.0844 - val_f1_score: 0.4044
Epoch 404/500
28/28 [=====] - 3s 114ms/step - loss: 1.5779 -
f1_score: 0.4921 - val_loss: 2.2675 - val_f1_score: 0.3851
Epoch 405/500
28/28 [=====] - 3s 113ms/step - loss: 1.5502 -
f1_score: 0.4973 - val_loss: 2.2357 - val_f1_score: 0.3986
Epoch 406/500
28/28 [=====] - 3s 114ms/step - loss: 1.5698 -
f1_score: 0.4958 - val_loss: 2.2432 - val_f1_score: 0.3666
Epoch 407/500
28/28 [=====] - 3s 112ms/step - loss: 1.5971 -
f1_score: 0.4952 - val_loss: 2.2041 - val_f1_score: 0.3552
Epoch 408/500
28/28 [=====] - 3s 112ms/step - loss: 1.5904 -
f1_score: 0.4890 - val_loss: 2.3216 - val_f1_score: 0.3453
Epoch 409/500
28/28 [=====] - 3s 113ms/step - loss: 1.5921 -
f1_score: 0.4991 - val_loss: 2.3650 - val_f1_score: 0.3778
Epoch 410/500
28/28 [=====] - 3s 113ms/step - loss: 1.6064 -
f1_score: 0.4753 - val_loss: 2.2342 - val_f1_score: 0.3836
Epoch 411/500
28/28 [=====] - 3s 112ms/step - loss: 1.5521 -
f1_score: 0.4887 - val_loss: 2.1500 - val_f1_score: 0.3905
Epoch 412/500
28/28 [=====] - 3s 113ms/step - loss: 1.5562 -
f1_score: 0.5094 - val_loss: 2.1596 - val_f1_score: 0.3747
Epoch 413/500
28/28 [=====] - 3s 113ms/step - loss: 1.6226 -
f1_score: 0.4874 - val_loss: 2.3256 - val_f1_score: 0.3745
Epoch 414/500
```

```
28/28 [=====] - 3s 113ms/step - loss: 1.5972 -
f1_score: 0.4863 - val_loss: 2.2747 - val_f1_score: 0.3668
Epoch 415/500
28/28 [=====] - 3s 113ms/step - loss: 1.5517 -
f1_score: 0.5104 - val_loss: 2.1918 - val_f1_score: 0.3687
Epoch 416/500
28/28 [=====] - 3s 112ms/step - loss: 1.5300 -
f1_score: 0.4923 - val_loss: 2.1585 - val_f1_score: 0.3842
Epoch 417/500
28/28 [=====] - 3s 112ms/step - loss: 1.5910 -
f1_score: 0.4818 - val_loss: 2.2188 - val_f1_score: 0.3856
Epoch 418/500
28/28 [=====] - 3s 112ms/step - loss: 1.5857 -
f1_score: 0.4802 - val_loss: 2.2131 - val_f1_score: 0.3559
Epoch 419/500
28/28 [=====] - 3s 113ms/step - loss: 1.5716 -
f1_score: 0.4965 - val_loss: 2.1495 - val_f1_score: 0.3695
Epoch 420/500
28/28 [=====] - 3s 114ms/step - loss: 1.6103 -
f1_score: 0.4782 - val_loss: 2.2194 - val_f1_score: 0.3841
Epoch 421/500
28/28 [=====] - 3s 113ms/step - loss: 1.5795 -
f1_score: 0.4897 - val_loss: 2.2302 - val_f1_score: 0.3786
Epoch 422/500
28/28 [=====] - ETA: 0s - loss: 1.5898 - f1_score:
0.4721

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 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 483ms/step - loss: 1.5898 -
f1_score: 0.4721 - val_loss: 2.3276 - val_f1_score: 0.4172
Epoch 423/500
28/28 [=====] - 3s 111ms/step - loss: 1.5694 -
f1_score: 0.4912 - val_loss: 2.2771 - val_f1_score: 0.3510
Epoch 424/500
28/28 [=====] - 3s 114ms/step - loss: 1.5679 -
f1_score: 0.5005 - val_loss: 2.2250 - val_f1_score: 0.3966
Epoch 425/500
28/28 [=====] - 3s 113ms/step - loss: 1.5719 -
f1_score: 0.4847 - val_loss: 2.1908 - val_f1_score: 0.3929
Epoch 426/500
28/28 [=====] - 3s 112ms/step - loss: 1.5756 -
f1_score: 0.5002 - val_loss: 2.2376 - val_f1_score: 0.3784
```

Epoch 427/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5458 -  
f1\_score: 0.5023 - val\_loss: 2.2383 - val\_f1\_score: 0.3879  
Epoch 428/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5624 -  
f1\_score: 0.4770 - val\_loss: 2.3522 - val\_f1\_score: 0.3689  
Epoch 429/500  
28/28 [=====] - 3s 112ms/step - loss: 1.6060 -  
f1\_score: 0.4834 - val\_loss: 2.1802 - val\_f1\_score: 0.3865  
Epoch 430/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5832 -  
f1\_score: 0.4924 - val\_loss: 2.3102 - val\_f1\_score: 0.3821  
Epoch 431/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5740 -  
f1\_score: 0.4952 - val\_loss: 2.2466 - val\_f1\_score: 0.3870  
Epoch 432/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5806 -  
f1\_score: 0.4811 - val\_loss: 2.1617 - val\_f1\_score: 0.3861  
Epoch 433/500  
28/28 [=====] - 3s 112ms/step - loss: 1.6246 -  
f1\_score: 0.4744 - val\_loss: 2.1637 - val\_f1\_score: 0.3813  
Epoch 434/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5913 -  
f1\_score: 0.4871 - val\_loss: 2.3177 - val\_f1\_score: 0.3660  
Epoch 435/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5453 -  
f1\_score: 0.4975 - val\_loss: 2.3066 - val\_f1\_score: 0.3521  
Epoch 436/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5380 -  
f1\_score: 0.4990 - val\_loss: 2.2260 - val\_f1\_score: 0.3913  
Epoch 437/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5865 -  
f1\_score: 0.4943 - val\_loss: 2.2015 - val\_f1\_score: 0.3859  
Epoch 438/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5368 -  
f1\_score: 0.5081 - val\_loss: 2.3327 - val\_f1\_score: 0.3806  
Epoch 439/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5520 -  
f1\_score: 0.5082 - val\_loss: 2.1494 - val\_f1\_score: 0.3784  
Epoch 440/500  
28/28 [=====] - 3s 111ms/step - loss: 1.5326 -  
f1\_score: 0.5138 - val\_loss: 2.1540 - val\_f1\_score: 0.3950  
Epoch 441/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5235 -  
f1\_score: 0.5094 - val\_loss: 2.2833 - val\_f1\_score: 0.3794  
Epoch 442/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5510 -  
f1\_score: 0.5067 - val\_loss: 2.2877 - val\_f1\_score: 0.3961

Epoch 443/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5590 -  
f1\_score: 0.4980 - val\_loss: 2.2711 - val\_f1\_score: 0.4165  
Epoch 444/500  
28/28 [=====] - 3s 112ms/step - loss: 1.6176 -  
f1\_score: 0.4873 - val\_loss: 2.2518 - val\_f1\_score: 0.4066  
Epoch 445/500  
28/28 [=====] - 3s 112ms/step - loss: 1.6065 -  
f1\_score: 0.4776 - val\_loss: 2.1349 - val\_f1\_score: 0.3730  
Epoch 446/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5356 -  
f1\_score: 0.5115 - val\_loss: 2.1840 - val\_f1\_score: 0.4062  
Epoch 447/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5531 -  
f1\_score: 0.4993 - val\_loss: 2.2182 - val\_f1\_score: 0.4004  
Epoch 448/500  
28/28 [=====] - 3s 113ms/step - loss: 1.4992 -  
f1\_score: 0.5123 - val\_loss: 2.3145 - val\_f1\_score: 0.3854  
Epoch 449/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5313 -  
f1\_score: 0.5131 - val\_loss: 2.2235 - val\_f1\_score: 0.3939  
Epoch 450/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5292 -  
f1\_score: 0.4974 - val\_loss: 2.3154 - val\_f1\_score: 0.3954  
Epoch 451/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5173 -  
f1\_score: 0.5023 - val\_loss: 2.2030 - val\_f1\_score: 0.3930  
Epoch 452/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5195 -  
f1\_score: 0.5027 - val\_loss: 2.1357 - val\_f1\_score: 0.3813  
Epoch 453/500  
28/28 [=====] - 3s 114ms/step - loss: 1.5055 -  
f1\_score: 0.5084 - val\_loss: 2.2573 - val\_f1\_score: 0.4021  
Epoch 454/500  
28/28 [=====] - 3s 114ms/step - loss: 1.5268 -  
f1\_score: 0.5062 - val\_loss: 2.1797 - val\_f1\_score: 0.4073  
Epoch 455/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5271 -  
f1\_score: 0.5051 - val\_loss: 2.3629 - val\_f1\_score: 0.3959  
Epoch 456/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5101 -  
f1\_score: 0.5040 - val\_loss: 2.2264 - val\_f1\_score: 0.4009  
Epoch 457/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5291 -  
f1\_score: 0.5017 - val\_loss: 2.2890 - val\_f1\_score: 0.3836  
Epoch 458/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5410 -  
f1\_score: 0.5111 - val\_loss: 2.3630 - val\_f1\_score: 0.3825

Epoch 459/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5488 -  
f1\_score: 0.5064 - val\_loss: 2.3184 - val\_f1\_score: 0.3866  
Epoch 460/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5598 -  
f1\_score: 0.4886 - val\_loss: 2.1713 - val\_f1\_score: 0.3789  
Epoch 461/500  
28/28 [=====] - 3s 115ms/step - loss: 1.5382 -  
f1\_score: 0.5057 - val\_loss: 2.3217 - val\_f1\_score: 0.3909  
Epoch 462/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5396 -  
f1\_score: 0.4970 - val\_loss: 2.2713 - val\_f1\_score: 0.3851  
Epoch 463/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5300 -  
f1\_score: 0.4956 - val\_loss: 2.3039 - val\_f1\_score: 0.3725  
Epoch 464/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5270 -  
f1\_score: 0.5050 - val\_loss: 2.3809 - val\_f1\_score: 0.3886  
Epoch 465/500  
28/28 [=====] - 3s 112ms/step - loss: 1.4964 -  
f1\_score: 0.5112 - val\_loss: 2.2332 - val\_f1\_score: 0.3911  
Epoch 466/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5734 -  
f1\_score: 0.4969 - val\_loss: 2.2983 - val\_f1\_score: 0.3950  
Epoch 467/500  
28/28 [=====] - 3s 113ms/step - loss: 1.6039 -  
f1\_score: 0.4912 - val\_loss: 2.6246 - val\_f1\_score: 0.3077  
Epoch 468/500  
28/28 [=====] - 3s 112ms/step - loss: 1.6167 -  
f1\_score: 0.4776 - val\_loss: 2.2099 - val\_f1\_score: 0.3716  
Epoch 469/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5596 -  
f1\_score: 0.5068 - val\_loss: 2.3211 - val\_f1\_score: 0.4075  
Epoch 470/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5177 -  
f1\_score: 0.5006 - val\_loss: 2.2844 - val\_f1\_score: 0.3987  
Epoch 471/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5626 -  
f1\_score: 0.4995 - val\_loss: 2.2845 - val\_f1\_score: 0.3810  
Epoch 472/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5053 -  
f1\_score: 0.5001 - val\_loss: 2.4518 - val\_f1\_score: 0.3724  
Epoch 473/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5260 -  
f1\_score: 0.5123 - val\_loss: 2.3300 - val\_f1\_score: 0.3706  
Epoch 474/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5204 -  
f1\_score: 0.5124 - val\_loss: 2.1633 - val\_f1\_score: 0.4036

Epoch 475/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5268 -  
f1\_score: 0.5026 - val\_loss: 2.1680 - val\_f1\_score: 0.3838  
Epoch 476/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5397 -  
f1\_score: 0.5114 - val\_loss: 2.3537 - val\_f1\_score: 0.3905  
Epoch 477/500  
28/28 [=====] - 3s 111ms/step - loss: 1.5114 -  
f1\_score: 0.5039 - val\_loss: 2.2848 - val\_f1\_score: 0.3882  
Epoch 478/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5062 -  
f1\_score: 0.5159 - val\_loss: 2.2085 - val\_f1\_score: 0.3913  
Epoch 479/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5023 -  
f1\_score: 0.5033 - val\_loss: 2.2391 - val\_f1\_score: 0.3845  
Epoch 480/500  
28/28 [=====] - 3s 114ms/step - loss: 1.5026 -  
f1\_score: 0.5097 - val\_loss: 2.1379 - val\_f1\_score: 0.4054  
Epoch 481/500  
28/28 [=====] - 3s 116ms/step - loss: 1.4909 -  
f1\_score: 0.5076 - val\_loss: 2.4055 - val\_f1\_score: 0.3813  
Epoch 482/500  
28/28 [=====] - 3s 115ms/step - loss: 1.4901 -  
f1\_score: 0.5133 - val\_loss: 2.2864 - val\_f1\_score: 0.3884  
Epoch 483/500  
28/28 [=====] - 3s 118ms/step - loss: 1.4814 -  
f1\_score: 0.5210 - val\_loss: 2.2299 - val\_f1\_score: 0.3899  
Epoch 484/500  
28/28 [=====] - 3s 114ms/step - loss: 1.5048 -  
f1\_score: 0.5135 - val\_loss: 2.1929 - val\_f1\_score: 0.4157  
Epoch 485/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5230 -  
f1\_score: 0.5090 - val\_loss: 2.3509 - val\_f1\_score: 0.3784  
Epoch 486/500  
28/28 [=====] - 3s 113ms/step - loss: 1.5720 -  
f1\_score: 0.4865 - val\_loss: 2.2176 - val\_f1\_score: 0.3964  
Epoch 487/500  
28/28 [=====] - 3s 114ms/step - loss: 1.5376 -  
f1\_score: 0.5073 - val\_loss: 2.4547 - val\_f1\_score: 0.3601  
Epoch 488/500  
28/28 [=====] - 3s 112ms/step - loss: 1.5307 -  
f1\_score: 0.5152 - val\_loss: 2.3510 - val\_f1\_score: 0.3757  
Epoch 489/500  
28/28 [=====] - 3s 114ms/step - loss: 1.4888 -  
f1\_score: 0.5254 - val\_loss: 2.2529 - val\_f1\_score: 0.3882  
Epoch 490/500  
28/28 [=====] - 3s 113ms/step - loss: 1.4995 -  
f1\_score: 0.5177 - val\_loss: 2.2512 - val\_f1\_score: 0.3927

```
Epoch 491/500
28/28 [=====] - 3s 112ms/step - loss: 1.5186 -
f1_score: 0.5026 - val_loss: 2.2153 - val_f1_score: 0.3749
Epoch 492/500
28/28 [=====] - 3s 112ms/step - loss: 1.5064 -
f1_score: 0.5055 - val_loss: 2.2505 - val_f1_score: 0.3738
Epoch 493/500
28/28 [=====] - 3s 112ms/step - loss: 1.4640 -
f1_score: 0.5369 - val_loss: 2.2743 - val_f1_score: 0.3770
Epoch 494/500
28/28 [=====] - ETA: 0s - loss: 1.4675 - f1_score:
0.5308

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 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 515ms/step - loss: 1.4675 -
f1_score: 0.5308 - val_loss: 2.1723 - val_f1_score: 0.4207
Epoch 495/500
28/28 [=====] - 3s 110ms/step - loss: 1.4943 -
f1_score: 0.5239 - val_loss: 2.2169 - val_f1_score: 0.3968
Epoch 496/500
28/28 [=====] - 3s 111ms/step - loss: 1.5582 -
f1_score: 0.5036 - val_loss: 2.2740 - val_f1_score: 0.3966
Epoch 497/500
28/28 [=====] - 3s 111ms/step - loss: 1.4795 -
f1_score: 0.5206 - val_loss: 2.2818 - val_f1_score: 0.3711
Epoch 498/500
28/28 [=====] - 3s 112ms/step - loss: 1.4720 -
f1_score: 0.5245 - val_loss: 2.5083 - val_f1_score: 0.3613
Epoch 499/500
28/28 [=====] - ETA: 0s - loss: 1.4783 - f1_score:
0.5323

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 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 436ms/step - loss: 1.4783 -
f1_score: 0.5323 - val_loss: 2.1568 - val_f1_score: 0.4246
Epoch 500/500
```

```
28/28 [=====] - 3s 110ms/step - loss: 1.5468 -
f1_score: 0.5115 - val_loss: 2.2231 - val_f1_score: 0.4211
```

```
[141]: # 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)
```

```
[142]: hist_df = pd.read_csv('1 1D-CNN + 1 GRU Trial 722 Mish/history.csv',
                           index_col=0)
hist_df.tail()
```

```
[142]:      loss  f1_score  val_loss  val_f1_score
495  1.558240  0.503602  2.274049  0.396593
496  1.479465  0.520557  2.281791  0.371081
497  1.471968  0.524543  2.508329  0.361290
498  1.478252  0.532272  2.156772  0.424551
499  1.546807  0.511469  2.223134  0.421123
```

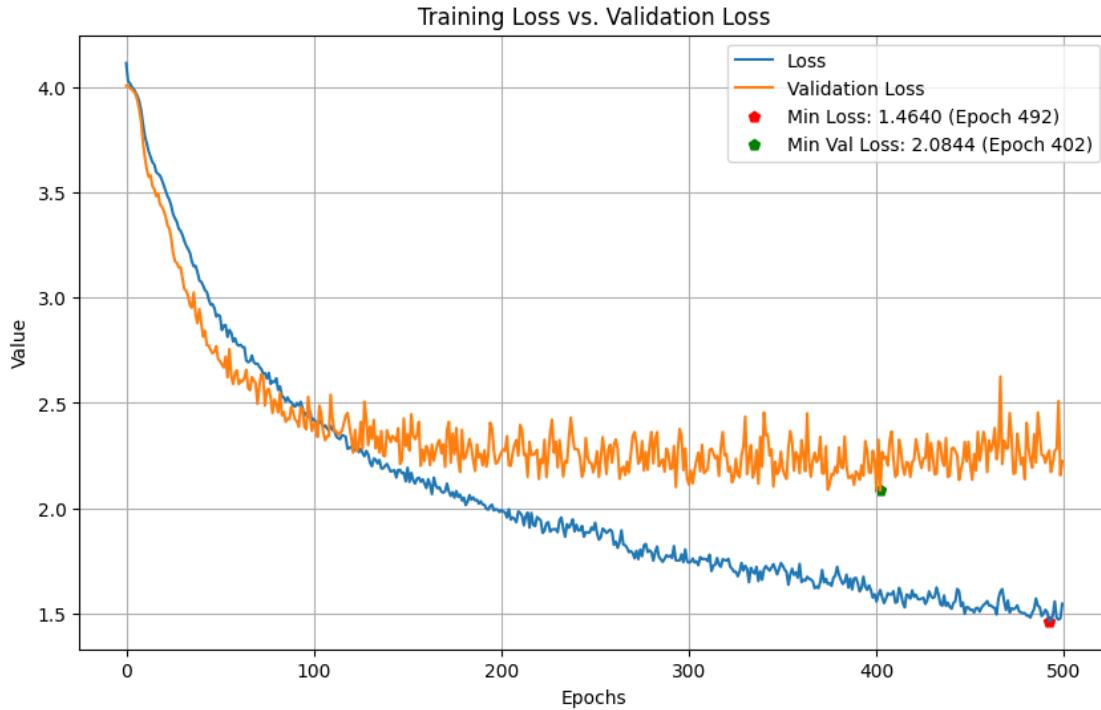
```
[143]: # Find the epoch with the lowest loss and validation loss
min_loss_epoch = hist_df['loss'].idxmin()
min_val_loss_epoch = hist_df['val_loss'].idxmin()

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()
```



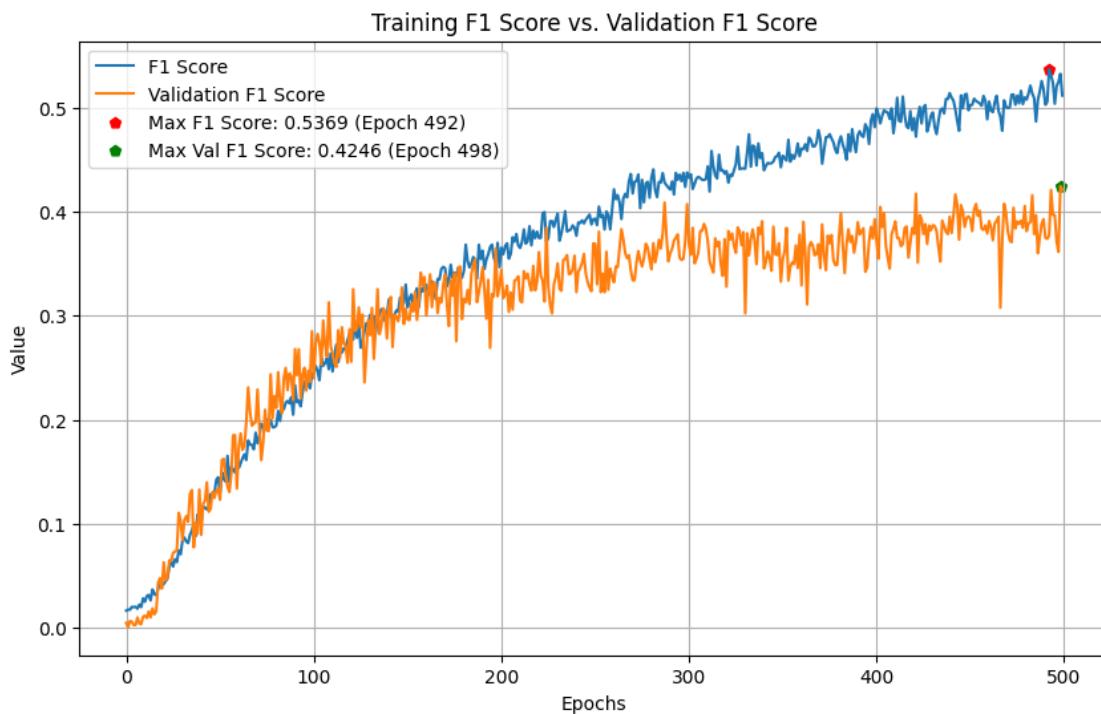
```
[144]: # Find the epoch with the highest F1 Score and Validation F1 Score  
max_f1_epoch = hist_df['f1_score'].idxmax()  
max_val_f1_epoch = hist_df['val_f1_score'].idxmax()  
  
max_f1 = hist_df['f1_score'][max_f1_epoch]  
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]  
  
# Plotting  
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()

```



```
[145]: 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        0.000     0.000     0.000       8
    BACKPACK     0.000     0.000     0.000       6
  BASKETBALL     0.000     0.000     0.000      10
```

BEE	0.000	0.000	0.000	10
BELT	0.000	0.000	0.000	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.000	0.000	0.000	6
CANCER	0.000	0.000	0.000	8
CHRISTMAS	0.000	0.000	0.000	6
CONFUSED	0.000	0.000	0.000	6
DARK	0.000	0.000	0.000	4
DEAF	0.000	0.000	0.000	6
DECIDE	0.000	0.000	0.000	6
DEMAND	0.000	0.000	0.000	8
DEVELOP	0.021	0.667	0.040	6
DINNER	0.000	0.000	0.000	8
DOG	0.000	0.000	0.000	6
DOWNSIZE	0.000	0.000	0.000	8
DRAG	0.000	0.000	0.000	4
EAT	0.000	0.000	0.000	6
EDIT	0.000	0.000	0.000	6
ELEVATOR	0.000	0.000	0.000	8
FINE	0.000	0.000	0.000	4
FLOAT	0.000	0.000	0.000	4
FOREIGNER	0.000	0.000	0.000	6
GUESS	0.000	0.000	0.000	8
HALLOWEEN	0.000	0.000	0.000	8
HOSPITAL	0.000	0.000	0.000	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	0.000	0.000	0.000	4
KNIGHT	0.000	0.000	0.000	4
LOCK	0.000	0.000	0.000	8
LUNCH	0.000	0.000	0.000	8
MAPLE	0.000	0.000	0.000	4
MEAT	0.000	0.000	0.000	6
MECHANIC	0.000	0.000	0.000	4
MICROSCOPE	0.000	0.000	0.000	8
MOVIE	0.000	0.000	0.000	8
NOON	0.000	0.000	0.000	8
PARTY	0.000	0.000	0.000	8
PATIENT	0.000	0.000	0.000	6
RAZOR	0.000	0.000	0.000	4
RIVER	0.000	0.000	0.000	6
ROCKINGCHAIR	0.000	0.000	0.000	8
SHAVE	0.000	0.000	0.000	10
SINK	0.000	0.000	0.000	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.000	0.000	0.000	4
TWINS	0.000	0.000	0.000	8
WHATFOR	0.000	0.000	0.000	10

accuracy			0.012	324
macro avg	0.000	0.013	0.001	324
weighted avg	0.000	0.012	0.001	324

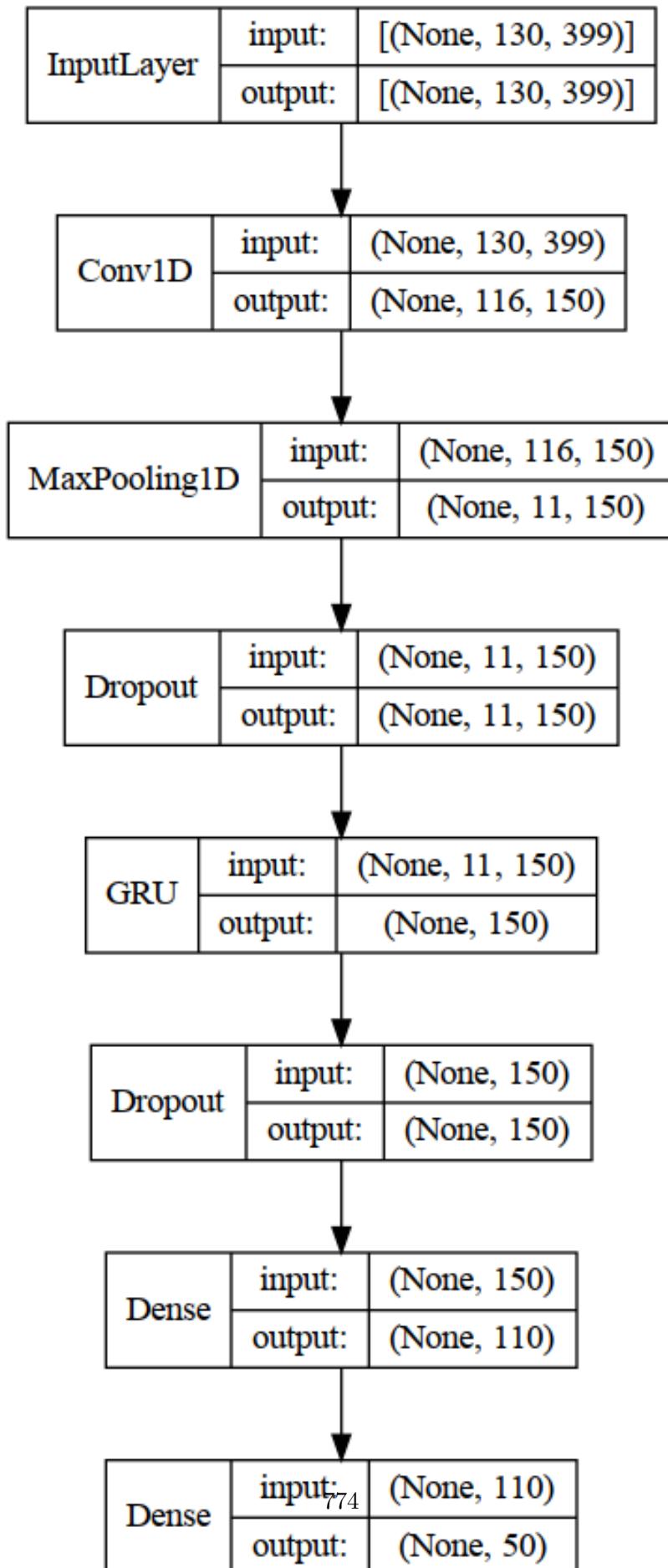
```
/home/kristian/miniconda3/lib/python3.10/site-
packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning:
Precision and F-score are ill-defined and being set to 0.0 in labels with no
predicted samples. Use `zero_division` parameter to control this behavior.
    _warn_prf(average, modifier,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

[146]: reconstructed\_model = tf.keras.models.load\_model(  
       "1 1D-CNN + 1 GRU Trial 722 Mish")

[147]: reconstructed\_model.summary()

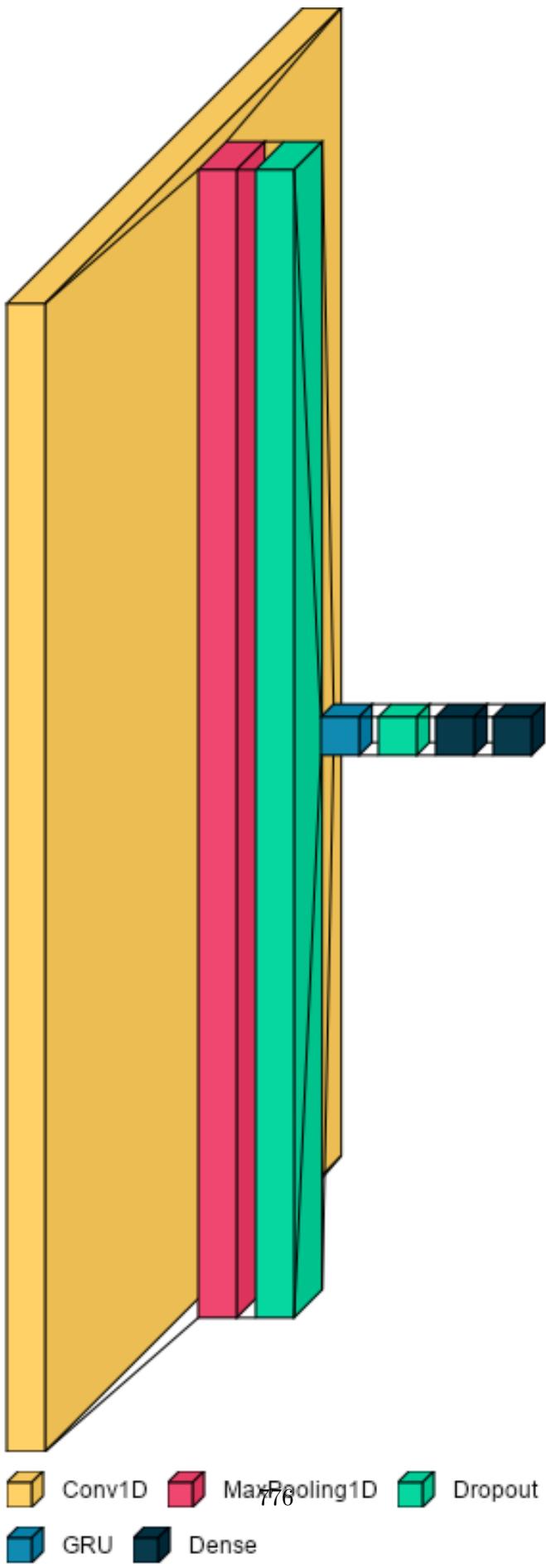
```
Model: "sequential_3"
-----
Layer (type)          Output Shape       Param #
-----
conv1d_3 (Conv1D)     (None, 116, 150)    897900
max_pooling1d_3 (MaxPooling 1D) (None, 11, 150) 0
dropout_6 (Dropout)    (None, 11, 150)    0
gru_3 (GRU)           (None, 150)        135900
dropout_7 (Dropout)    (None, 150)        0
dense_6 (Dense)       (None, 110)        16610
dense_7 (Dense)       (None, 50)         5550
-----
Total params: 1,055,960
Trainable params: 1,055,960
Non-trainable params: 0
```

```
-----  
[148]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)  
[148]:
```



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

```
[149]:
```



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

11/11 [=====] - 1s 15ms/step - loss: 2.1568 - f1_score: 0.4246
```

[150]: [2.156771421432495, 0.4245505928993225]

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

84/84 [=====] - 1s 16ms/step - loss: 0.9273 - f1_score: 0.7344
```

[151]: [0.9273212552070618, 0.734393835067749]

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

	precision	recall	f1-score	support
AXE	0.333	0.125	0.182	8
BACKPACK	0.500	0.667	0.571	6
BASKETBALL	1.000	0.600	0.750	10
BEE	0.250	0.100	0.143	10
BELT	0.800	1.000	0.889	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.500	0.333	0.400	6
CANCER	0.417	0.625	0.500	8
CHRISTMAS	0.545	1.000	0.706	6
CONFUSED	0.667	0.333	0.444	6
DARK	0.600	0.750	0.667	4
DEAF	0.333	0.333	0.333	6
DECIDE	0.500	0.500	0.500	6
DEMAND	0.571	0.500	0.533	8
DEVELOP	0.286	0.333	0.308	6
DINNER	1.000	0.375	0.545	8
DOG	0.200	0.333	0.250	6
DOWNSIZE	0.667	0.500	0.571	8
DRAG	0.200	0.250	0.222	4
EAT	0.125	0.167	0.143	6
EDIT	1.000	0.500	0.667	6
ELEVATOR	0.429	0.375	0.400	8
FINE	0.167	0.500	0.250	4

FLOAT	0.000	0.000	0.000	4
FOREIGNER	1.000	0.500	0.667	6
GUESS	1.000	0.250	0.400	8
HALLOWEEN	0.571	1.000	0.727	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	0.000	0.000	0.000	4
LOCK	0.357	0.625	0.455	8
LUNCH	0.400	0.250	0.308	8
MAPLE	1.000	0.500	0.667	4
MEAT	0.417	0.833	0.556	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.143	0.125	0.133	8
NOON	1.000	0.375	0.545	8
PARTY	0.857	0.750	0.800	8
PATIENT	0.400	0.333	0.364	6
RAZOR	0.000	0.000	0.000	4
RIVER	0.417	0.833	0.556	6
ROCKINGCHAIR	0.615	1.000	0.762	8
SHAVE	0.400	0.600	0.480	10
SINK	0.400	0.333	0.364	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.000	0.000	0.000	4
TWINS	0.312	0.625	0.417	8
WHATFOR	0.455	0.500	0.476	10
accuracy			0.451	324
macro avg	0.483	0.439	0.425	324
weighted avg	0.506	0.451	0.439	324

## 4.8 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_591901/3109640001.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, 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='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)

```

[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/CSPNext/hyperband/',
    project_name='2_1D_CNN+1_GRU',
    overwrite=False)

```

INFO:tensorflow:Reloading Tuner from  
/media/kristian/HDD/ASL\_Citizen/CSPNext/hyperband/2\_1D\_CNN+1\_GRU/tuner0.json

[261]: 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'}

```

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

```
[124]: tuner.search(Xtrain,
                  Ytrain,
                  epochs=1000,
                  validation_data=(Xval, Yval),
                  batch_size=96,
                  callbacks=[es])
```

Trial 711 Complete [00h 06m 56s]  
 val\_f1\_score: 0.6260823607444763

Best val\_f1\_score So Far: 0.7622158825397491  
 Total elapsed time: 10h 39m 49s  
 INFO:tensorflow:Oracle triggered exit

```
[125]: 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](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
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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
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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.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
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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.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
```

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WARNING:tensorflow:Value in checkpoint could not be found in the restored object: (root).optimizer.\_u\_product

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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

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object: (root).optimizer._variables.21
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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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```

```
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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)
```

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

Model: "sequential"

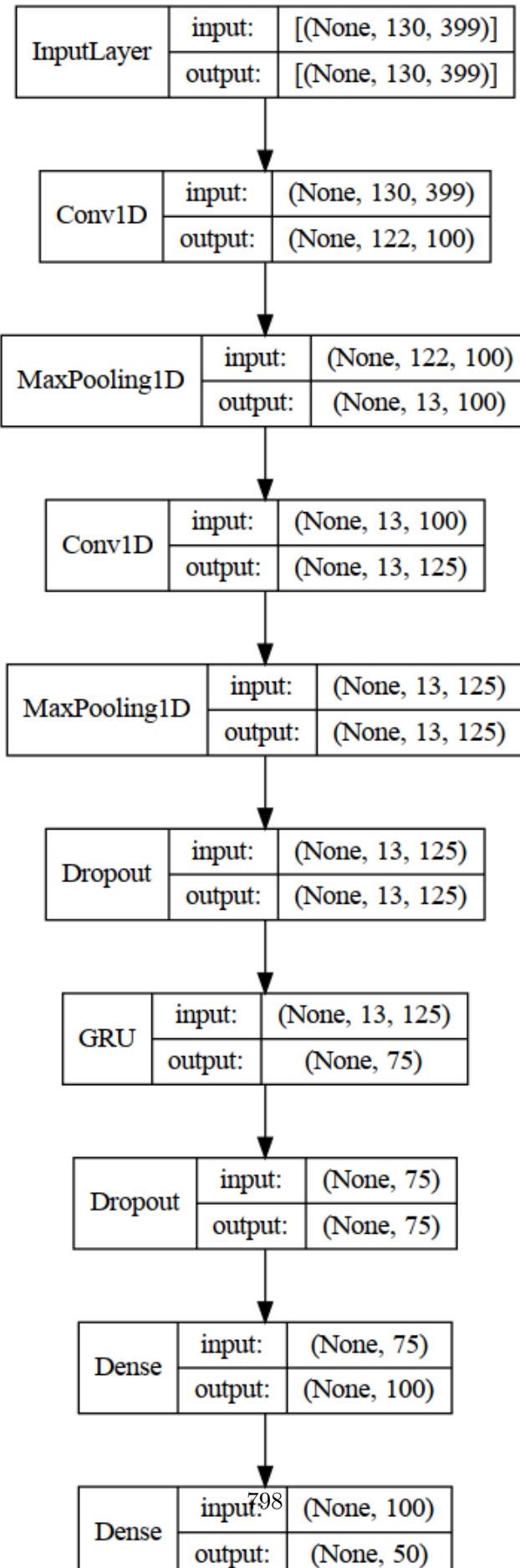
Layer (type)	Output Shape	Param #
conv1d (Conv1D)	(None, 122, 100)	359200
max_pooling1d (MaxPooling1D )	(None, 13, 100)	0
conv1d_1 (Conv1D)	(None, 13, 125)	12625
max_pooling1d_1 (MaxPooling 1D)	(None, 13, 125)	0
dropout (Dropout)	(None, 13, 125)	0
gru (GRU)	(None, 75)	45450
dropout_1 (Dropout)	(None, 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
```

---

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

```
[127]:
```



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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/2_1D_CNN+1_GRU
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

Trial 0705 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: 0.7622158825397491

Trial 0700 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: 0.3000000000000004
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: 0698  
Score: 0.7525536119937897
```

```
Trial 0584 summary  
Hyperparameters:  
dense_activation: gelu  
filters_1: 100  
kernel_1: 4  
pool_1: 5  
filters_2: 75  
kernel_2: 5  
pool_2: 1  
dropout_1: 0.1  
units_1: 125  
regularizer: 0.0010438306464659397  
dropout_2: 0.5  
units_2: 100  
learning_rate: 0.00038218731997308306  
tuner/epochs: 300  
tuner/initial_epoch: 100  
tuner/bracket: 4  
tuner/round: 4  
tuner/trial_id: 0579  
Score: 0.7413071095943451
```

```
Trial 0656 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: 0650  
Score: 0.7257245481014252
```

```
Trial 0579 summary
Hyperparameters:
dense_activation: gelu
filters_1: 100
kernel_1: 4
pool_1: 5
filters_2: 75
kernel_2: 5
pool_2: 1
dropout_1: 0.1
units_1: 125
regularizer: 0.0010438306464659397
dropout_2: 0.5
units_2: 100
learning_rate: 0.00038218731997308306
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0576
Score: 0.7057007253170013
```

```
Trial 0650 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: 0638
Score: 0.7033898532390594
```

```
Trial 0686 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: 0679
Score: 0.7014306485652924
```

```
Trial 0698 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: 0.3000000000000004
units_1: 175
regularizer: 0.001308287664940752
dropout_2: 0.6000000000000001
units_2: 100
learning_rate: 0.00016060165691337782
tuner/epochs: 100
tuner/initial_epoch: 0
tuner/bracket: 1
tuner/round: 0
Score: 0.7006361484527588
```

```
Trial 0657 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: 0653
Score: 0.6943044662475586
```

```
Trial 0701 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: 0.1500000000000002
units_1: 175
regularizer: 0.00014882201555231845
dropout_2: 0.3500000000000003
units_2: 100
learning_rate: 0.00022221143188447883
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0692
Score: 0.6822547912597656
```

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

```
11/11 [=====] - 1s 63ms/step - loss: 1.0408 - f1_score: 0.7682
```

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

```
84/84 [=====] - 1s 10ms/step - loss: 0.2381 - f1_score: 0.9420
```

```
[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 8ms/step

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

AXE	0.800	1.000	0.889	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.714	1.000	0.833	10
BEE	1.000	0.600	0.750	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.750	0.857	8
BREAKFAST	1.000	1.000	1.000	6
CANCER	1.000	1.000	1.000	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.833	0.833	0.833	6
DARK	1.000	1.000	1.000	4
DEAF	0.444	0.667	0.533	6
DECIDE	1.000	0.667	0.800	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.857	1.000	0.923	6
DINNER	1.000	0.750	0.857	8
DOG	0.444	0.667	0.533	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	1.000	0.500	0.667	4
EAT	0.800	0.667	0.727	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.889	1.000	0.941	8
FINE	0.667	0.500	0.571	4
FLOAT	0.400	0.500	0.444	4
FOREIGNER	0.714	0.833	0.769	6
GUESS	1.000	0.875	0.933	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	1.000	0.667	0.800	6
HURDLE/TRIP	0.333	0.250	0.286	4
JEWELRY	0.667	0.500	0.571	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.600	0.750	0.667	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.667	1.000	0.800	4
MEAT	0.462	1.000	0.632	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.750	0.857	8
MOVIE	0.875	0.875	0.875	8
NOON	0.800	1.000	0.889	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.333	0.333	0.333	6

RAZOR	0.667	0.500	0.571	4
RIVER	0.750	1.000	0.857	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.818	0.900	0.857	10
SINK	0.500	0.167	0.250	6
SQUEEZE	1.000	0.250	0.400	4
THEY	1.000	1.000	1.000	4
TWINS	0.700	0.875	0.778	8
WHATFOR	1.000	0.700	0.824	10
accuracy			0.790	324
macro avg	0.812	0.772	0.768	324
weighted avg	0.825	0.790	0.786	324

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

```
[133]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1DCNN + 1 GRU',
    monitor='val_f1_score',
    mode='max',
    save_best_only=True)
```

```
[148]: 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 91ms/step - loss: 4.6899 - f1\_score: 0.0200 - val\_loss: 4.3610 - val\_f1\_score: 0.0033

Epoch 2/500

28/28 [=====] - 2s 60ms/step - loss: 4.5943 - f1\_score: 0.0226 - val\_loss: 4.3263 - val\_f1\_score: 0.0022

Epoch 3/500

28/28 [=====] - 2s 58ms/step - loss: 4.5703 - f1\_score: 0.0168 - val\_loss: 4.2791 - val\_f1\_score: 7.2727e-04

Epoch 4/500

28/28 [=====] - 2s 58ms/step - loss: 4.4969 - f1\_score: 0.0180 - val\_loss: 4.2815 - val\_f1\_score: 0.0012

Epoch 5/500

28/28 [=====] - 2s 62ms/step - loss: 4.4082 - f1\_score:

```
0.0187 - val_loss: 4.1996 - val_f1_score: 0.0057
Epoch 6/500
28/28 [=====] - 2s 60ms/step - loss: 4.3963 - f1_score: 0.0204 - val_loss: 4.2216 - val_f1_score: 0.0034
Epoch 7/500
28/28 [=====] - 2s 60ms/step - loss: 4.3782 - f1_score: 0.0181 - val_loss: 4.2114 - val_f1_score: 9.7561e-04
Epoch 8/500
28/28 [=====] - 2s 65ms/step - loss: 4.3539 - f1_score: 0.0169 - val_loss: 4.2049 - val_f1_score: 7.7922e-04
Epoch 9/500
28/28 [=====] - 2s 61ms/step - loss: 4.3196 - f1_score: 0.0206 - val_loss: 4.1681 - val_f1_score: 0.0022
Epoch 10/500
28/28 [=====] - 2s 60ms/step - loss: 4.2735 - f1_score: 0.0172 - val_loss: 4.1730 - val_f1_score: 0.0017
Epoch 11/500
28/28 [=====] - 2s 66ms/step - loss: 4.2700 - f1_score: 0.0206 - val_loss: 4.1448 - val_f1_score: 0.0024
Epoch 12/500
28/28 [=====] - 2s 65ms/step - loss: 4.2518 - f1_score: 0.0200 - val_loss: 4.1354 - val_f1_score: 0.0020
Epoch 13/500
28/28 [=====] - 2s 68ms/step - loss: 4.2092 - f1_score: 0.0180 - val_loss: 4.1177 - val_f1_score: 0.0081
Epoch 14/500
28/28 [=====] - 2s 62ms/step - loss: 4.1982 - f1_score: 0.0210 - val_loss: 4.1377 - val_f1_score: 0.0086
Epoch 15/500
28/28 [=====] - 2s 63ms/step - loss: 4.1723 - f1_score: 0.0232 - val_loss: 4.0967 - val_f1_score: 0.0046
Epoch 16/500
28/28 [=====] - 2s 68ms/step - loss: 4.1382 - f1_score: 0.0292 - val_loss: 4.0166 - val_f1_score: 0.0154
Epoch 17/500
28/28 [=====] - 2s 62ms/step - loss: 4.0630 - f1_score: 0.0247 - val_loss: 3.9239 - val_f1_score: 0.0055
Epoch 18/500
28/28 [=====] - 2s 62ms/step - loss: 3.9897 - f1_score: 0.0333 - val_loss: 3.8626 - val_f1_score: 0.0097
Epoch 19/500
28/28 [=====] - 2s 67ms/step - loss: 3.9384 - f1_score: 0.0359 - val_loss: 3.7326 - val_f1_score: 0.0097
Epoch 20/500
28/28 [=====] - 2s 62ms/step - loss: 3.8641 - f1_score: 0.0302 - val_loss: 3.7352 - val_f1_score: 0.0132
Epoch 21/500
28/28 [=====] - 2s 62ms/step - loss: 3.8320 - f1_score:
```

```
0.0365 - val_loss: 3.6960 - val_f1_score: 0.0198
Epoch 22/500
28/28 [=====] - 2s 68ms/step - loss: 3.8076 - f1_score: 0.0336 - val_loss: 3.6490 - val_f1_score: 0.0311
Epoch 23/500
28/28 [=====] - 2s 62ms/step - loss: 3.7549 - f1_score: 0.0420 - val_loss: 3.5796 - val_f1_score: 0.0325
Epoch 24/500
28/28 [=====] - 2s 66ms/step - loss: 3.7285 - f1_score: 0.0461 - val_loss: 3.5597 - val_f1_score: 0.0215
Epoch 25/500
28/28 [=====] - 2s 67ms/step - loss: 3.6854 - f1_score: 0.0447 - val_loss: 3.4779 - val_f1_score: 0.0319
Epoch 26/500
28/28 [=====] - 2s 63ms/step - loss: 3.6511 - f1_score: 0.0557 - val_loss: 3.4102 - val_f1_score: 0.0495
Epoch 27/500
28/28 [=====] - 2s 67ms/step - loss: 3.5712 - f1_score: 0.0542 - val_loss: 3.3389 - val_f1_score: 0.0516
Epoch 28/500
28/28 [=====] - 2s 63ms/step - loss: 3.5179 - f1_score: 0.0679 - val_loss: 3.2739 - val_f1_score: 0.0426
Epoch 29/500
28/28 [=====] - 2s 69ms/step - loss: 3.4330 - f1_score: 0.0772 - val_loss: 3.2515 - val_f1_score: 0.0678
Epoch 30/500
28/28 [=====] - 2s 70ms/step - loss: 3.3827 - f1_score: 0.0805 - val_loss: 3.1504 - val_f1_score: 0.0871
Epoch 31/500
28/28 [=====] - 2s 63ms/step - loss: 3.3405 - f1_score: 0.0905 - val_loss: 3.1385 - val_f1_score: 0.0865
Epoch 32/500
28/28 [=====] - 2s 64ms/step - loss: 3.2744 - f1_score: 0.0938 - val_loss: 3.0797 - val_f1_score: 0.1030
Epoch 33/500
28/28 [=====] - 2s 70ms/step - loss: 3.2439 - f1_score: 0.1041 - val_loss: 3.0209 - val_f1_score: 0.1431
Epoch 34/500
28/28 [=====] - 2s 65ms/step - loss: 3.1716 - f1_score: 0.1273 - val_loss: 2.9409 - val_f1_score: 0.1350
Epoch 35/500
28/28 [=====] - 2s 70ms/step - loss: 3.1045 - f1_score: 0.1341 - val_loss: 2.9374 - val_f1_score: 0.1521
Epoch 36/500
28/28 [=====] - 2s 65ms/step - loss: 3.0617 - f1_score: 0.1338 - val_loss: 2.8536 - val_f1_score: 0.1178
Epoch 37/500
28/28 [=====] - 2s 67ms/step - loss: 2.9859 - f1_score:
```

```
0.1570 - val_loss: 2.8658 - val_f1_score: 0.1376
Epoch 38/500
28/28 [=====] - 2s 70ms/step - loss: 2.9550 - f1_score:
0.1663 - val_loss: 2.7566 - val_f1_score: 0.1808
Epoch 39/500
28/28 [=====] - 2s 65ms/step - loss: 2.8864 - f1_score:
0.1749 - val_loss: 2.8016 - val_f1_score: 0.1368
Epoch 40/500
28/28 [=====] - 2s 65ms/step - loss: 2.8647 - f1_score:
0.1793 - val_loss: 2.6384 - val_f1_score: 0.2434
Epoch 41/500
28/28 [=====] - 2s 77ms/step - loss: 2.8220 - f1_score:
0.1869 - val_loss: 2.5972 - val_f1_score: 0.2151
Epoch 42/500
28/28 [=====] - 2s 64ms/step - loss: 2.7778 - f1_score:
0.1963 - val_loss: 2.5771 - val_f1_score: 0.2446
Epoch 43/500
28/28 [=====] - 2s 70ms/step - loss: 2.7602 - f1_score:
0.2025 - val_loss: 2.5700 - val_f1_score: 0.2261
Epoch 44/500
28/28 [=====] - 2s 64ms/step - loss: 2.7311 - f1_score:
0.2159 - val_loss: 2.5551 - val_f1_score: 0.2468
Epoch 45/500
28/28 [=====] - 2s 64ms/step - loss: 2.6958 - f1_score:
0.2258 - val_loss: 2.4929 - val_f1_score: 0.2830
Epoch 46/500
28/28 [=====] - 2s 77ms/step - loss: 2.6568 - f1_score:
0.2324 - val_loss: 2.4944 - val_f1_score: 0.2564
Epoch 47/500
28/28 [=====] - 2s 64ms/step - loss: 2.6157 - f1_score:
0.2360 - val_loss: 2.4264 - val_f1_score: 0.2777
Epoch 48/500
28/28 [=====] - 2s 66ms/step - loss: 2.5458 - f1_score:
0.2592 - val_loss: 2.3934 - val_f1_score: 0.3141
Epoch 49/500
28/28 [=====] - 2s 70ms/step - loss: 2.5535 - f1_score:
0.2437 - val_loss: 2.3518 - val_f1_score: 0.3333
Epoch 50/500
28/28 [=====] - 2s 63ms/step - loss: 2.5201 - f1_score:
0.2763 - val_loss: 2.3339 - val_f1_score: 0.3047
Epoch 51/500
28/28 [=====] - 2s 69ms/step - loss: 2.4996 - f1_score:
0.2781 - val_loss: 2.4037 - val_f1_score: 0.3075
Epoch 52/500
28/28 [=====] - 2s 63ms/step - loss: 2.4609 - f1_score:
0.2854 - val_loss: 2.3564 - val_f1_score: 0.3106
Epoch 53/500
28/28 [=====] - 2s 63ms/step - loss: 2.4271 - f1_score:
```

```
0.2821 - val_loss: 2.3365 - val_f1_score: 0.3379
Epoch 54/500
28/28 [=====] - 2s 74ms/step - loss: 2.3868 - f1_score:
0.2876 - val_loss: 2.2654 - val_f1_score: 0.3306
Epoch 55/500
28/28 [=====] - 2s 64ms/step - loss: 2.3646 - f1_score:
0.3079 - val_loss: 2.2448 - val_f1_score: 0.3566
Epoch 56/500
28/28 [=====] - 2s 65ms/step - loss: 2.3304 - f1_score:
0.3101 - val_loss: 2.2174 - val_f1_score: 0.3516
Epoch 57/500
28/28 [=====] - 2s 66ms/step - loss: 2.3231 - f1_score:
0.3245 - val_loss: 2.2492 - val_f1_score: 0.3467
Epoch 58/500
28/28 [=====] - 2s 63ms/step - loss: 2.2681 - f1_score:
0.3240 - val_loss: 2.1951 - val_f1_score: 0.3618
Epoch 59/500
28/28 [=====] - 2s 74ms/step - loss: 2.2777 - f1_score:
0.3290 - val_loss: 2.0963 - val_f1_score: 0.3826
Epoch 60/500
28/28 [=====] - 2s 64ms/step - loss: 2.2039 - f1_score:
0.3446 - val_loss: 2.1352 - val_f1_score: 0.3796
Epoch 61/500
28/28 [=====] - 2s 63ms/step - loss: 2.2003 - f1_score:
0.3512 - val_loss: 2.0214 - val_f1_score: 0.4213
Epoch 62/500
28/28 [=====] - 2s 68ms/step - loss: 2.1691 - f1_score:
0.3527 - val_loss: 2.0430 - val_f1_score: 0.4027
Epoch 63/500
28/28 [=====] - 2s 64ms/step - loss: 2.1384 - f1_score:
0.3755 - val_loss: 2.0193 - val_f1_score: 0.4318
Epoch 64/500
28/28 [=====] - 2s 64ms/step - loss: 2.1130 - f1_score:
0.3826 - val_loss: 2.0020 - val_f1_score: 0.4065
Epoch 65/500
28/28 [=====] - 2s 73ms/step - loss: 2.1007 - f1_score:
0.3668 - val_loss: 1.9558 - val_f1_score: 0.3953
Epoch 66/500
28/28 [=====] - 2s 64ms/step - loss: 2.0546 - f1_score:
0.3883 - val_loss: 1.9355 - val_f1_score: 0.4410
Epoch 67/500
28/28 [=====] - 2s 69ms/step - loss: 2.0307 - f1_score:
0.3902 - val_loss: 1.9627 - val_f1_score: 0.4290
Epoch 68/500
28/28 [=====] - 2s 64ms/step - loss: 2.0001 - f1_score:
0.4052 - val_loss: 1.9774 - val_f1_score: 0.4245
Epoch 69/500
28/28 [=====] - 2s 64ms/step - loss: 1.9883 - f1_score:
```

```
0.3964 - val_loss: 1.8734 - val_f1_score: 0.4699
Epoch 70/500
28/28 [=====] - 2s 69ms/step - loss: 1.9573 - f1_score: 0.4208 - val_loss: 1.8705 - val_f1_score: 0.4574
Epoch 71/500
28/28 [=====] - 2s 64ms/step - loss: 1.9489 - f1_score: 0.4101 - val_loss: 1.8705 - val_f1_score: 0.4595
Epoch 72/500
28/28 [=====] - 2s 64ms/step - loss: 1.8967 - f1_score: 0.4360 - val_loss: 1.9927 - val_f1_score: 0.4181
Epoch 73/500
28/28 [=====] - 2s 73ms/step - loss: 1.8919 - f1_score: 0.4381 - val_loss: 1.8305 - val_f1_score: 0.4692
Epoch 74/500
28/28 [=====] - 2s 64ms/step - loss: 1.8740 - f1_score: 0.4392 - val_loss: 1.8412 - val_f1_score: 0.4446
Epoch 75/500
28/28 [=====] - 2s 69ms/step - loss: 1.8694 - f1_score: 0.4346 - val_loss: 1.8140 - val_f1_score: 0.4348
Epoch 76/500
28/28 [=====] - 2s 82ms/step - loss: 1.8403 - f1_score: 0.4569 - val_loss: 1.8413 - val_f1_score: 0.4893
Epoch 77/500
28/28 [=====] - 2s 73ms/step - loss: 1.8006 - f1_score: 0.4704 - val_loss: 1.7949 - val_f1_score: 0.4767
Epoch 78/500
28/28 [=====] - 2s 81ms/step - loss: 1.7925 - f1_score: 0.4651 - val_loss: 1.7358 - val_f1_score: 0.5207
Epoch 79/500
28/28 [=====] - 2s 73ms/step - loss: 1.7663 - f1_score: 0.4629 - val_loss: 1.7593 - val_f1_score: 0.5099
Epoch 80/500
28/28 [=====] - 2s 79ms/step - loss: 1.7079 - f1_score: 0.4908 - val_loss: 1.7079 - val_f1_score: 0.4807
Epoch 81/500
28/28 [=====] - 2s 73ms/step - loss: 1.7139 - f1_score: 0.4914 - val_loss: 1.6533 - val_f1_score: 0.5123
Epoch 82/500
28/28 [=====] - 2s 81ms/step - loss: 1.6794 - f1_score: 0.4954 - val_loss: 1.6468 - val_f1_score: 0.5335
Epoch 83/500
28/28 [=====] - 2s 68ms/step - loss: 1.6414 - f1_score: 0.5117 - val_loss: 1.5917 - val_f1_score: 0.5686
Epoch 84/500
28/28 [=====] - 2s 64ms/step - loss: 1.6555 - f1_score: 0.5078 - val_loss: 1.7192 - val_f1_score: 0.5150
Epoch 85/500
28/28 [=====] - 2s 70ms/step - loss: 1.6402 - f1_score:
```

```
0.5039 - val_loss: 1.6162 - val_f1_score: 0.5421
Epoch 86/500
28/28 [=====] - 2s 65ms/step - loss: 1.5974 - f1_score:
0.5255 - val_loss: 1.5836 - val_f1_score: 0.5467
Epoch 87/500
28/28 [=====] - 2s 63ms/step - loss: 1.6253 - f1_score:
0.5004 - val_loss: 1.5418 - val_f1_score: 0.5744
Epoch 88/500
28/28 [=====] - 2s 72ms/step - loss: 1.5815 - f1_score:
0.5260 - val_loss: 1.5307 - val_f1_score: 0.5745
Epoch 89/500
28/28 [=====] - 2s 67ms/step - loss: 1.5609 - f1_score:
0.5409 - val_loss: 1.4864 - val_f1_score: 0.5628
Epoch 90/500
28/28 [=====] - 2s 71ms/step - loss: 1.5642 - f1_score:
0.5355 - val_loss: 1.5100 - val_f1_score: 0.6057
Epoch 91/500
28/28 [=====] - 2s 64ms/step - loss: 1.5727 - f1_score:
0.5233 - val_loss: 1.5478 - val_f1_score: 0.5543
Epoch 92/500
28/28 [=====] - 2s 70ms/step - loss: 1.5039 - f1_score:
0.5531 - val_loss: 1.4700 - val_f1_score: 0.5851
Epoch 93/500
28/28 [=====] - 2s 70ms/step - loss: 1.4906 - f1_score:
0.5440 - val_loss: 1.5197 - val_f1_score: 0.5648
Epoch 94/500
28/28 [=====] - 2s 64ms/step - loss: 1.4985 - f1_score:
0.5476 - val_loss: 1.4913 - val_f1_score: 0.5775
Epoch 95/500
28/28 [=====] - 2s 64ms/step - loss: 1.4888 - f1_score:
0.5509 - val_loss: 1.5079 - val_f1_score: 0.5789
Epoch 96/500
28/28 [=====] - 2s 72ms/step - loss: 1.4769 - f1_score:
0.5563 - val_loss: 1.4836 - val_f1_score: 0.5972
Epoch 97/500
28/28 [=====] - 2s 64ms/step - loss: 1.4428 - f1_score:
0.5699 - val_loss: 1.5252 - val_f1_score: 0.5848
Epoch 98/500
28/28 [=====] - 2s 73ms/step - loss: 1.4538 - f1_score:
0.5517 - val_loss: 1.5171 - val_f1_score: 0.5838
Epoch 99/500
28/28 [=====] - 2s 65ms/step - loss: 1.4208 - f1_score:
0.5795 - val_loss: 1.5441 - val_f1_score: 0.5354
Epoch 100/500
28/28 [=====] - 2s 65ms/step - loss: 1.3867 - f1_score:
0.5852 - val_loss: 1.4731 - val_f1_score: 0.5842
Epoch 101/500
28/28 [=====] - 2s 71ms/step - loss: 1.3611 - f1_score:
```

```
0.5978 - val_loss: 1.4210 - val_f1_score: 0.6186
Epoch 102/500
28/28 [=====] - 2s 64ms/step - loss: 1.3769 - f1_score: 0.5881 - val_loss: 1.4145 - val_f1_score: 0.6098
Epoch 103/500
28/28 [=====] - 2s 65ms/step - loss: 1.3786 - f1_score: 0.5745 - val_loss: 1.4042 - val_f1_score: 0.6247
Epoch 104/500
28/28 [=====] - 2s 78ms/step - loss: 1.3623 - f1_score: 0.5864 - val_loss: 1.4231 - val_f1_score: 0.5926
Epoch 105/500
28/28 [=====] - 2s 65ms/step - loss: 1.3663 - f1_score: 0.5712 - val_loss: 1.3731 - val_f1_score: 0.6278
Epoch 106/500
28/28 [=====] - 2s 70ms/step - loss: 1.3428 - f1_score: 0.5910 - val_loss: 1.4103 - val_f1_score: 0.6071
Epoch 107/500
28/28 [=====] - 2s 67ms/step - loss: 1.3202 - f1_score: 0.6014 - val_loss: 1.4590 - val_f1_score: 0.5768
Epoch 108/500
28/28 [=====] - 2s 65ms/step - loss: 1.3282 - f1_score: 0.6051 - val_loss: 1.3986 - val_f1_score: 0.5958
Epoch 109/500
28/28 [=====] - 2s 75ms/step - loss: 1.3126 - f1_score: 0.5967 - val_loss: 1.4445 - val_f1_score: 0.5712
Epoch 110/500
28/28 [=====] - 2s 64ms/step - loss: 1.2831 - f1_score: 0.6080 - val_loss: 1.4504 - val_f1_score: 0.5804
Epoch 111/500
28/28 [=====] - 2s 71ms/step - loss: 1.2590 - f1_score: 0.6247 - val_loss: 1.3190 - val_f1_score: 0.6233
Epoch 112/500
28/28 [=====] - 2s 64ms/step - loss: 1.2887 - f1_score: 0.6153 - val_loss: 1.3822 - val_f1_score: 0.6051
Epoch 113/500
28/28 [=====] - 2s 64ms/step - loss: 1.2938 - f1_score: 0.6080 - val_loss: 1.3684 - val_f1_score: 0.6121
Epoch 114/500
28/28 [=====] - 2s 70ms/step - loss: 1.2778 - f1_score: 0.6081 - val_loss: 1.3573 - val_f1_score: 0.6340
Epoch 115/500
28/28 [=====] - 2s 74ms/step - loss: 1.2382 - f1_score: 0.6311 - val_loss: 1.3737 - val_f1_score: 0.6031
Epoch 116/500
28/28 [=====] - 2s 64ms/step - loss: 1.2456 - f1_score: 0.6220 - val_loss: 1.4212 - val_f1_score: 0.6083
Epoch 117/500
28/28 [=====] - 2s 69ms/step - loss: 1.2452 - f1_score:
```

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0.6238 - val_loss: 1.3497 - val_f1_score: 0.6197
Epoch 118/500
28/28 [=====] - 2s 69ms/step - loss: 1.2186 - f1_score: 0.6440 - val_loss: 1.3424 - val_f1_score: 0.6301
Epoch 119/500
28/28 [=====] - 2s 71ms/step - loss: 1.1953 - f1_score: 0.6395 - val_loss: 1.3306 - val_f1_score: 0.6318
Epoch 120/500
28/28 [=====] - 2s 64ms/step - loss: 1.1861 - f1_score: 0.6478 - val_loss: 1.3517 - val_f1_score: 0.6019
Epoch 121/500
28/28 [=====] - 2s 64ms/step - loss: 1.1751 - f1_score: 0.6527 - val_loss: 1.3146 - val_f1_score: 0.6527
Epoch 122/500
28/28 [=====] - 2s 72ms/step - loss: 1.1836 - f1_score: 0.6321 - val_loss: 1.2736 - val_f1_score: 0.6363
Epoch 123/500
28/28 [=====] - 2s 65ms/step - loss: 1.1475 - f1_score: 0.6573 - val_loss: 1.3223 - val_f1_score: 0.6219
Epoch 124/500
28/28 [=====] - 2s 66ms/step - loss: 1.1878 - f1_score: 0.6365 - val_loss: 1.2459 - val_f1_score: 0.6610
Epoch 125/500
28/28 [=====] - 2s 70ms/step - loss: 1.1044 - f1_score: 0.6661 - val_loss: 1.2790 - val_f1_score: 0.6436
Epoch 126/500
28/28 [=====] - 2s 63ms/step - loss: 1.1305 - f1_score: 0.6532 - val_loss: 1.3283 - val_f1_score: 0.6448
Epoch 127/500
28/28 [=====] - 2s 70ms/step - loss: 1.1554 - f1_score: 0.6467 - val_loss: 1.2484 - val_f1_score: 0.6706
Epoch 128/500
28/28 [=====] - 2s 63ms/step - loss: 1.1172 - f1_score: 0.6685 - val_loss: 1.3192 - val_f1_score: 0.6309
Epoch 129/500
28/28 [=====] - 2s 66ms/step - loss: 1.1317 - f1_score: 0.6522 - val_loss: 1.2452 - val_f1_score: 0.6567
Epoch 130/500
28/28 [=====] - 2s 69ms/step - loss: 1.1261 - f1_score: 0.6480 - val_loss: 1.2761 - val_f1_score: 0.6511
Epoch 131/500
28/28 [=====] - 2s 65ms/step - loss: 1.0933 - f1_score: 0.6739 - val_loss: 1.3068 - val_f1_score: 0.6456
Epoch 132/500
28/28 [=====] - 2s 67ms/step - loss: 1.1097 - f1_score: 0.6541 - val_loss: 1.3203 - val_f1_score: 0.6555
Epoch 133/500
28/28 [=====] - 2s 75ms/step - loss: 1.1034 - f1_score:
```

```
0.6588 - val_loss: 1.2878 - val_f1_score: 0.6558
Epoch 134/500
28/28 [=====] - 2s 63ms/step - loss: 1.0765 - f1_score:
0.6643 - val_loss: 1.2719 - val_f1_score: 0.6508
Epoch 135/500
28/28 [=====] - 2s 76ms/step - loss: 1.0698 - f1_score:
0.6838 - val_loss: 1.2428 - val_f1_score: 0.6656
Epoch 136/500
28/28 [=====] - 2s 70ms/step - loss: 1.0847 - f1_score:
0.6669 - val_loss: 1.2095 - val_f1_score: 0.6763
Epoch 137/500
28/28 [=====] - 2s 64ms/step - loss: 1.0683 - f1_score:
0.6712 - val_loss: 1.3642 - val_f1_score: 0.6375
Epoch 138/500
28/28 [=====] - 2s 71ms/step - loss: 1.0409 - f1_score:
0.6899 - val_loss: 1.2521 - val_f1_score: 0.6703
Epoch 139/500
28/28 [=====] - 2s 65ms/step - loss: 1.0387 - f1_score:
0.6866 - val_loss: 1.1937 - val_f1_score: 0.6820
Epoch 140/500
28/28 [=====] - 2s 66ms/step - loss: 1.0661 - f1_score:
0.6782 - val_loss: 1.1816 - val_f1_score: 0.6866
Epoch 141/500
28/28 [=====] - 2s 67ms/step - loss: 1.0681 - f1_score:
0.6642 - val_loss: 1.2139 - val_f1_score: 0.6768
Epoch 142/500
28/28 [=====] - 2s 65ms/step - loss: 0.9996 - f1_score:
0.6919 - val_loss: 1.2529 - val_f1_score: 0.6700
Epoch 143/500
28/28 [=====] - 2s 70ms/step - loss: 1.0300 - f1_score:
0.6833 - val_loss: 1.2421 - val_f1_score: 0.6509
Epoch 144/500
28/28 [=====] - 2s 64ms/step - loss: 1.0170 - f1_score:
0.6859 - val_loss: 1.1901 - val_f1_score: 0.6933
Epoch 145/500
28/28 [=====] - 2s 72ms/step - loss: 0.9741 - f1_score:
0.6971 - val_loss: 1.1974 - val_f1_score: 0.6740
Epoch 146/500
28/28 [=====] - 2s 72ms/step - loss: 1.0064 - f1_score:
0.6839 - val_loss: 1.1907 - val_f1_score: 0.6691
Epoch 147/500
28/28 [=====] - 2s 64ms/step - loss: 1.0119 - f1_score:
0.6936 - val_loss: 1.2673 - val_f1_score: 0.6530
Epoch 148/500
28/28 [=====] - 2s 72ms/step - loss: 0.9938 - f1_score:
0.7016 - val_loss: 1.2019 - val_f1_score: 0.6762
Epoch 149/500
28/28 [=====] - 2s 65ms/step - loss: 0.9703 - f1_score:
```

```
0.7125 - val_loss: 1.3050 - val_f1_score: 0.6305
Epoch 150/500
28/28 [=====] - 2s 66ms/step - loss: 0.9867 - f1_score:
0.7020 - val_loss: 1.1442 - val_f1_score: 0.6901
Epoch 151/500
28/28 [=====] - 2s 71ms/step - loss: 0.9780 - f1_score:
0.6945 - val_loss: 1.1765 - val_f1_score: 0.7107
Epoch 152/500
28/28 [=====] - 2s 66ms/step - loss: 0.9713 - f1_score:
0.7040 - val_loss: 1.2256 - val_f1_score: 0.6764
Epoch 153/500
28/28 [=====] - 2s 64ms/step - loss: 0.9535 - f1_score:
0.7077 - val_loss: 1.1577 - val_f1_score: 0.6966
Epoch 154/500
28/28 [=====] - 2s 69ms/step - loss: 0.9768 - f1_score:
0.6926 - val_loss: 1.1472 - val_f1_score: 0.6934
Epoch 155/500
28/28 [=====] - 2s 65ms/step - loss: 0.9409 - f1_score:
0.7056 - val_loss: 1.2177 - val_f1_score: 0.6639
Epoch 156/500
28/28 [=====] - 2s 73ms/step - loss: 0.9641 - f1_score:
0.6984 - val_loss: 1.2145 - val_f1_score: 0.6962
Epoch 157/500
28/28 [=====] - 2s 70ms/step - loss: 0.9383 - f1_score:
0.7056 - val_loss: 1.1419 - val_f1_score: 0.7063
Epoch 158/500
28/28 [=====] - 2s 65ms/step - loss: 0.8973 - f1_score:
0.7272 - val_loss: 1.1586 - val_f1_score: 0.7091
Epoch 159/500
28/28 [=====] - 2s 71ms/step - loss: 0.9247 - f1_score:
0.7203 - val_loss: 1.1702 - val_f1_score: 0.7065
Epoch 160/500
28/28 [=====] - 2s 65ms/step - loss: 0.9105 - f1_score:
0.7148 - val_loss: 1.1485 - val_f1_score: 0.7036
Epoch 161/500
28/28 [=====] - 2s 65ms/step - loss: 0.9162 - f1_score:
0.7307 - val_loss: 1.1703 - val_f1_score: 0.6804
Epoch 162/500
28/28 [=====] - 2s 79ms/step - loss: 0.8881 - f1_score:
0.7192 - val_loss: 1.1564 - val_f1_score: 0.7210
Epoch 163/500
28/28 [=====] - 2s 63ms/step - loss: 0.9010 - f1_score:
0.7210 - val_loss: 1.1262 - val_f1_score: 0.7221
Epoch 164/500
28/28 [=====] - 2s 73ms/step - loss: 0.9025 - f1_score:
0.7216 - val_loss: 1.1851 - val_f1_score: 0.6896
Epoch 165/500
28/28 [=====] - 2s 65ms/step - loss: 0.8909 - f1_score:
```

```
0.7224 - val_loss: 1.1050 - val_f1_score: 0.6889
Epoch 166/500
28/28 [=====] - 2s 77ms/step - loss: 0.9000 - f1_score:
0.7272 - val_loss: 1.2050 - val_f1_score: 0.6747
Epoch 167/500
28/28 [=====] - 2s 81ms/step - loss: 0.8469 - f1_score:
0.7509 - val_loss: 1.2212 - val_f1_score: 0.6801
Epoch 168/500
28/28 [=====] - 2s 65ms/step - loss: 0.8698 - f1_score:
0.7356 - val_loss: 1.1670 - val_f1_score: 0.6911
Epoch 169/500
28/28 [=====] - 2s 72ms/step - loss: 0.8934 - f1_score:
0.7148 - val_loss: 1.3984 - val_f1_score: 0.6385
Epoch 170/500
28/28 [=====] - 2s 75ms/step - loss: 0.8856 - f1_score:
0.7225 - val_loss: 1.1087 - val_f1_score: 0.7250
Epoch 171/500
28/28 [=====] - 2s 76ms/step - loss: 0.8318 - f1_score:
0.7467 - val_loss: 1.1053 - val_f1_score: 0.7130
Epoch 172/500
28/28 [=====] - 2s 75ms/step - loss: 0.8426 - f1_score:
0.7478 - val_loss: 1.3826 - val_f1_score: 0.6504
Epoch 173/500
28/28 [=====] - 2s 76ms/step - loss: 0.8561 - f1_score:
0.7366 - val_loss: 1.0981 - val_f1_score: 0.7200
Epoch 174/500
28/28 [=====] - 2s 87ms/step - loss: 0.8408 - f1_score:
0.7402 - val_loss: 1.1601 - val_f1_score: 0.7217
Epoch 175/500
28/28 [=====] - 2s 74ms/step - loss: 0.8567 - f1_score:
0.7407 - val_loss: 1.2480 - val_f1_score: 0.6884
Epoch 176/500
28/28 [=====] - 2s 79ms/step - loss: 0.8413 - f1_score:
0.7430 - val_loss: 1.1858 - val_f1_score: 0.6982
Epoch 177/500
28/28 [=====] - 2s 65ms/step - loss: 0.8270 - f1_score:
0.7436 - val_loss: 1.1821 - val_f1_score: 0.7060
Epoch 178/500
28/28 [=====] - 2s 64ms/step - loss: 0.8543 - f1_score:
0.7406 - val_loss: 1.1389 - val_f1_score: 0.6900
Epoch 179/500
28/28 [=====] - 2s 74ms/step - loss: 0.7979 - f1_score:
0.7532 - val_loss: 1.2437 - val_f1_score: 0.6870
Epoch 180/500
28/28 [=====] - 2s 65ms/step - loss: 0.8292 - f1_score:
0.7393 - val_loss: 1.2797 - val_f1_score: 0.6779
Epoch 181/500
28/28 [=====] - 2s 71ms/step - loss: 0.7979 - f1_score:
```

```
0.7621 - val_loss: 1.1628 - val_f1_score: 0.7195
Epoch 182/500
28/28 [=====] - 2s 70ms/step - loss: 0.7822 - f1_score:
0.7581 - val_loss: 1.2216 - val_f1_score: 0.6980
Epoch 183/500
28/28 [=====] - 2s 64ms/step - loss: 0.8216 - f1_score:
0.7436 - val_loss: 1.1421 - val_f1_score: 0.7025
Epoch 184/500
28/28 [=====] - 2s 71ms/step - loss: 0.8202 - f1_score:
0.7471 - val_loss: 1.1222 - val_f1_score: 0.7205
Epoch 185/500
28/28 [=====] - 2s 65ms/step - loss: 0.7936 - f1_score:
0.7573 - val_loss: 1.1124 - val_f1_score: 0.7203
Epoch 186/500
28/28 [=====] - 2s 64ms/step - loss: 0.7891 - f1_score:
0.7614 - val_loss: 1.1528 - val_f1_score: 0.6993
Epoch 187/500
28/28 [=====] - 2s 71ms/step - loss: 0.7952 - f1_score:
0.7571 - val_loss: 1.0668 - val_f1_score: 0.7422
Epoch 188/500
28/28 [=====] - 2s 65ms/step - loss: 0.7826 - f1_score:
0.7592 - val_loss: 1.1835 - val_f1_score: 0.7110
Epoch 189/500
28/28 [=====] - 2s 70ms/step - loss: 0.7801 - f1_score:
0.7563 - val_loss: 1.1709 - val_f1_score: 0.7140
Epoch 190/500
28/28 [=====] - 2s 64ms/step - loss: 0.7899 - f1_score:
0.7537 - val_loss: 1.1709 - val_f1_score: 0.7017
Epoch 191/500
28/28 [=====] - 2s 65ms/step - loss: 0.7592 - f1_score:
0.7764 - val_loss: 1.1198 - val_f1_score: 0.7470
Epoch 192/500
28/28 [=====] - 2s 70ms/step - loss: 0.7682 - f1_score:
0.7661 - val_loss: 1.1312 - val_f1_score: 0.7279
Epoch 193/500
28/28 [=====] - 2s 72ms/step - loss: 0.7771 - f1_score:
0.7713 - val_loss: 1.1964 - val_f1_score: 0.7231
Epoch 194/500
28/28 [=====] - 2s 69ms/step - loss: 0.7349 - f1_score:
0.7710 - val_loss: 1.0753 - val_f1_score: 0.7311
Epoch 195/500
28/28 [=====] - 2s 66ms/step - loss: 0.7560 - f1_score:
0.7766 - val_loss: 1.1715 - val_f1_score: 0.7091
Epoch 196/500
28/28 [=====] - 2s 65ms/step - loss: 0.7452 - f1_score:
0.7685 - val_loss: 1.1525 - val_f1_score: 0.6952
Epoch 197/500
28/28 [=====] - 2s 76ms/step - loss: 0.7446 - f1_score:
```

```
0.7773 - val_loss: 1.0748 - val_f1_score: 0.7001
Epoch 198/500
28/28 [=====] - 2s 65ms/step - loss: 0.7459 - f1_score:
0.7725 - val_loss: 1.0747 - val_f1_score: 0.6975
Epoch 199/500
28/28 [=====] - 2s 64ms/step - loss: 0.7585 - f1_score:
0.7615 - val_loss: 1.2892 - val_f1_score: 0.6666
Epoch 200/500
28/28 [=====] - 2s 70ms/step - loss: 0.7527 - f1_score:
0.7724 - val_loss: 1.1366 - val_f1_score: 0.7042
Epoch 201/500
28/28 [=====] - 2s 64ms/step - loss: 0.7137 - f1_score:
0.7829 - val_loss: 1.1349 - val_f1_score: 0.7199
Epoch 202/500
28/28 [=====] - 2s 75ms/step - loss: 0.7255 - f1_score:
0.7831 - val_loss: 1.2126 - val_f1_score: 0.7016
Epoch 203/500
28/28 [=====] - 2s 64ms/step - loss: 0.7319 - f1_score:
0.7807 - val_loss: 1.1540 - val_f1_score: 0.7090
Epoch 204/500
28/28 [=====] - 2s 65ms/step - loss: 0.7291 - f1_score:
0.7675 - val_loss: 1.0897 - val_f1_score: 0.7364
Epoch 205/500
28/28 [=====] - 2s 71ms/step - loss: 0.7161 - f1_score:
0.7788 - val_loss: 1.1769 - val_f1_score: 0.6871
Epoch 206/500
28/28 [=====] - 2s 64ms/step - loss: 0.6913 - f1_score:
0.7999 - val_loss: 1.0591 - val_f1_score: 0.7389
Epoch 207/500
28/28 [=====] - 2s 65ms/step - loss: 0.7045 - f1_score:
0.7828 - val_loss: 1.1524 - val_f1_score: 0.6995
Epoch 208/500
28/28 [=====] - 2s 72ms/step - loss: 0.7375 - f1_score:
0.7773 - val_loss: 1.1611 - val_f1_score: 0.7089
Epoch 209/500
28/28 [=====] - 2s 64ms/step - loss: 0.7142 - f1_score:
0.7752 - val_loss: 1.1677 - val_f1_score: 0.7258
Epoch 210/500
28/28 [=====] - 2s 75ms/step - loss: 0.7187 - f1_score:
0.7695 - val_loss: 1.1070 - val_f1_score: 0.7308
Epoch 211/500
28/28 [=====] - 2s 65ms/step - loss: 0.6842 - f1_score:
0.7984 - val_loss: 1.1818 - val_f1_score: 0.6779
Epoch 212/500
28/28 [=====] - 2s 66ms/step - loss: 0.6840 - f1_score:
0.7864 - val_loss: 1.1755 - val_f1_score: 0.7066
Epoch 213/500
28/28 [=====] - 2s 73ms/step - loss: 0.7063 - f1_score:
```

```
0.7901 - val_loss: 1.1105 - val_f1_score: 0.7210
Epoch 214/500
28/28 [=====] - 2s 66ms/step - loss: 0.6789 - f1_score:
0.7905 - val_loss: 1.0500 - val_f1_score: 0.7429
Epoch 215/500
28/28 [=====] - 2s 66ms/step - loss: 0.6644 - f1_score:
0.8075 - val_loss: 1.0722 - val_f1_score: 0.7159
Epoch 216/500
28/28 [=====] - 2s 71ms/step - loss: 0.6818 - f1_score:
0.8029 - val_loss: 1.0732 - val_f1_score: 0.7248
Epoch 217/500
28/28 [=====] - 2s 66ms/step - loss: 0.6586 - f1_score:
0.8000 - val_loss: 1.1431 - val_f1_score: 0.6994
Epoch 218/500
28/28 [=====] - 2s 72ms/step - loss: 0.6624 - f1_score:
0.8003 - val_loss: 1.0917 - val_f1_score: 0.7254
Epoch 219/500
28/28 [=====] - 2s 67ms/step - loss: 0.6553 - f1_score:
0.8003 - val_loss: 1.0465 - val_f1_score: 0.7319
Epoch 220/500
28/28 [=====] - 2s 71ms/step - loss: 0.6640 - f1_score:
0.7890 - val_loss: 1.1381 - val_f1_score: 0.7210
Epoch 221/500
28/28 [=====] - 2s 72ms/step - loss: 0.6257 - f1_score:
0.8097 - val_loss: 1.1470 - val_f1_score: 0.6883
Epoch 222/500
28/28 [=====] - 2s 65ms/step - loss: 0.6399 - f1_score:
0.7978 - val_loss: 1.1212 - val_f1_score: 0.7170
Epoch 223/500
28/28 [=====] - 2s 77ms/step - loss: 0.6821 - f1_score:
0.7915 - val_loss: 1.1828 - val_f1_score: 0.7295
Epoch 224/500
28/28 [=====] - 2s 66ms/step - loss: 0.6410 - f1_score:
0.8032 - val_loss: 1.2760 - val_f1_score: 0.6724
Epoch 225/500
28/28 [=====] - 2s 66ms/step - loss: 0.6589 - f1_score:
0.7981 - val_loss: 1.1066 - val_f1_score: 0.7364
Epoch 226/500
28/28 [=====] - 2s 74ms/step - loss: 0.6504 - f1_score:
0.8019 - val_loss: 1.1144 - val_f1_score: 0.7133
Epoch 227/500
28/28 [=====] - 2s 65ms/step - loss: 0.6484 - f1_score:
0.7877 - val_loss: 1.0950 - val_f1_score: 0.7262
Epoch 228/500
28/28 [=====] - 2s 68ms/step - loss: 0.6795 - f1_score:
0.7863 - val_loss: 1.1596 - val_f1_score: 0.7367
Epoch 229/500
28/28 [=====] - 2s 72ms/step - loss: 0.6383 - f1_score:
```

```
0.7990 - val_loss: 1.1412 - val_f1_score: 0.7188
Epoch 230/500
28/28 [=====] - 2s 65ms/step - loss: 0.6401 - f1_score: 0.8044 - val_loss: 1.2654 - val_f1_score: 0.6968
Epoch 231/500
28/28 [=====] - 2s 73ms/step - loss: 0.6213 - f1_score: 0.8105 - val_loss: 1.2526 - val_f1_score: 0.6841
Epoch 232/500
28/28 [=====] - 2s 70ms/step - loss: 0.6539 - f1_score: 0.7949 - val_loss: 1.0764 - val_f1_score: 0.7234
Epoch 233/500
28/28 [=====] - 2s 71ms/step - loss: 0.6349 - f1_score: 0.8098 - val_loss: 1.1069 - val_f1_score: 0.7358
Epoch 234/500
28/28 [=====] - 2s 73ms/step - loss: 0.6220 - f1_score: 0.8118 - val_loss: 1.1146 - val_f1_score: 0.7111
Epoch 235/500
28/28 [=====] - 2s 64ms/step - loss: 0.6136 - f1_score: 0.8154 - val_loss: 1.0794 - val_f1_score: 0.7384
Epoch 236/500
28/28 [=====] - 2s 70ms/step - loss: 0.6271 - f1_score: 0.8083 - val_loss: 1.2258 - val_f1_score: 0.6615
Epoch 237/500
28/28 [=====] - 2s 66ms/step - loss: 0.6013 - f1_score: 0.8199 - val_loss: 1.1777 - val_f1_score: 0.7119
Epoch 238/500
28/28 [=====] - 2s 65ms/step - loss: 0.6075 - f1_score: 0.8151 - val_loss: 1.1495 - val_f1_score: 0.7142
Epoch 239/500
28/28 [=====] - 2s 70ms/step - loss: 0.6107 - f1_score: 0.8171 - val_loss: 1.1412 - val_f1_score: 0.7299
Epoch 240/500
28/28 [=====] - 2s 64ms/step - loss: 0.6268 - f1_score: 0.8041 - val_loss: 1.2184 - val_f1_score: 0.7082
Epoch 241/500
28/28 [=====] - 2s 66ms/step - loss: 0.6102 - f1_score: 0.8009 - val_loss: 1.1688 - val_f1_score: 0.7043
Epoch 242/500
28/28 [=====] - 2s 69ms/step - loss: 0.6044 - f1_score: 0.8144 - val_loss: 1.1281 - val_f1_score: 0.7264
Epoch 243/500
28/28 [=====] - 2s 66ms/step - loss: 0.5750 - f1_score: 0.8264 - val_loss: 1.1967 - val_f1_score: 0.7225
Epoch 244/500
28/28 [=====] - 2s 71ms/step - loss: 0.5774 - f1_score: 0.8224 - val_loss: 1.1126 - val_f1_score: 0.7211
Epoch 245/500
28/28 [=====] - 2s 64ms/step - loss: 0.5972 - f1_score:
```

```
0.8110 - val_loss: 1.1883 - val_f1_score: 0.7001
Epoch 246/500
28/28 [=====] - 2s 65ms/step - loss: 0.5904 - f1_score:
0.8205 - val_loss: 1.1724 - val_f1_score: 0.7088
Epoch 247/500
28/28 [=====] - 2s 70ms/step - loss: 0.5734 - f1_score:
0.8211 - val_loss: 1.2897 - val_f1_score: 0.6934
Epoch 248/500
28/28 [=====] - 2s 70ms/step - loss: 0.5670 - f1_score:
0.8167 - val_loss: 1.1824 - val_f1_score: 0.7092
Epoch 249/500
28/28 [=====] - 2s 69ms/step - loss: 0.5958 - f1_score:
0.8234 - val_loss: 1.1213 - val_f1_score: 0.7316
Epoch 250/500
28/28 [=====] - 2s 66ms/step - loss: 0.5897 - f1_score:
0.8150 - val_loss: 1.0901 - val_f1_score: 0.7267
Epoch 251/500
28/28 [=====] - 2s 70ms/step - loss: 0.6036 - f1_score:
0.8109 - val_loss: 1.1393 - val_f1_score: 0.7324
Epoch 252/500
28/28 [=====] - 2s 71ms/step - loss: 0.5580 - f1_score:
0.8302 - val_loss: 1.1093 - val_f1_score: 0.7212
Epoch 253/500
28/28 [=====] - 2s 64ms/step - loss: 0.5945 - f1_score:
0.8139 - val_loss: 1.1290 - val_f1_score: 0.7245
Epoch 254/500
28/28 [=====] - 2s 65ms/step - loss: 0.5760 - f1_score:
0.8234 - val_loss: 1.1768 - val_f1_score: 0.7058
Epoch 255/500
28/28 [=====] - 2s 71ms/step - loss: 0.5775 - f1_score:
0.8288 - val_loss: 1.2042 - val_f1_score: 0.7049
Epoch 256/500
28/28 [=====] - 2s 75ms/step - loss: 0.5673 - f1_score:
0.8257 - val_loss: 1.1312 - val_f1_score: 0.7179
Epoch 257/500
28/28 [=====] - 2s 73ms/step - loss: 0.5873 - f1_score:
0.8204 - val_loss: 1.1305 - val_f1_score: 0.7246
Epoch 258/500
28/28 [=====] - 2s 65ms/step - loss: 0.5380 - f1_score:
0.8345 - val_loss: 1.1099 - val_f1_score: 0.7244
Epoch 259/500
28/28 [=====] - 2s 65ms/step - loss: 0.5664 - f1_score:
0.8183 - val_loss: 1.1695 - val_f1_score: 0.7104
Epoch 260/500
28/28 [=====] - 2s 73ms/step - loss: 0.5890 - f1_score:
0.8163 - val_loss: 1.0470 - val_f1_score: 0.7396
Epoch 261/500
28/28 [=====] - 2s 65ms/step - loss: 0.5511 - f1_score:
```

```
0.8327 - val_loss: 1.1101 - val_f1_score: 0.7407
Epoch 262/500
28/28 [=====] - 2s 64ms/step - loss: 0.5773 - f1_score: 0.8171 - val_loss: 1.1098 - val_f1_score: 0.7505
Epoch 263/500
28/28 [=====] - 2s 80ms/step - loss: 0.5572 - f1_score: 0.8286 - val_loss: 1.0935 - val_f1_score: 0.7366
Epoch 264/500
28/28 [=====] - 2s 74ms/step - loss: 0.5538 - f1_score: 0.8351 - val_loss: 1.0971 - val_f1_score: 0.7515
Epoch 265/500
28/28 [=====] - 2s 82ms/step - loss: 0.5347 - f1_score: 0.8394 - val_loss: 1.0931 - val_f1_score: 0.7409
Epoch 266/500
28/28 [=====] - 2s 77ms/step - loss: 0.5387 - f1_score: 0.8430 - val_loss: 1.1105 - val_f1_score: 0.7418
Epoch 267/500
28/28 [=====] - 2s 81ms/step - loss: 0.5413 - f1_score: 0.8338 - val_loss: 1.0432 - val_f1_score: 0.7457
Epoch 268/500
28/28 [=====] - 2s 75ms/step - loss: 0.5620 - f1_score: 0.8202 - val_loss: 1.1050 - val_f1_score: 0.7297
Epoch 269/500
28/28 [=====] - 2s 88ms/step - loss: 0.5354 - f1_score: 0.8402 - val_loss: 1.1462 - val_f1_score: 0.7266
Epoch 270/500
28/28 [=====] - 2s 71ms/step - loss: 0.5084 - f1_score: 0.8496 - val_loss: 1.1264 - val_f1_score: 0.7338
Epoch 271/500
28/28 [=====] - 2s 71ms/step - loss: 0.5459 - f1_score: 0.8408 - val_loss: 1.1971 - val_f1_score: 0.7183
Epoch 272/500
28/28 [=====] - 2s 70ms/step - loss: 0.5271 - f1_score: 0.8444 - val_loss: 1.0967 - val_f1_score: 0.7588
Epoch 273/500
28/28 [=====] - 2s 71ms/step - loss: 0.5074 - f1_score: 0.8444 - val_loss: 1.0833 - val_f1_score: 0.7406
Epoch 274/500
28/28 [=====] - 2s 73ms/step - loss: 0.5080 - f1_score: 0.8466 - val_loss: 1.1634 - val_f1_score: 0.7119
Epoch 275/500
28/28 [=====] - 2s 65ms/step - loss: 0.5257 - f1_score: 0.8392 - val_loss: 1.2946 - val_f1_score: 0.6914
Epoch 276/500
28/28 [=====] - 2s 65ms/step - loss: 0.5085 - f1_score: 0.8477 - val_loss: 1.1324 - val_f1_score: 0.7244
Epoch 277/500
28/28 [=====] - 2s 71ms/step - loss: 0.5089 - f1_score:
```

```
0.8394 - val_loss: 1.1543 - val_f1_score: 0.7133
Epoch 278/500
28/28 [=====] - 2s 66ms/step - loss: 0.5300 - f1_score:
0.8383 - val_loss: 1.1673 - val_f1_score: 0.7285
Epoch 279/500
28/28 [=====] - 2s 66ms/step - loss: 0.4933 - f1_score:
0.8491 - val_loss: 1.0629 - val_f1_score: 0.7560
Epoch 280/500
28/28 [=====] - 2s 72ms/step - loss: 0.5503 - f1_score:
0.8360 - val_loss: 1.1842 - val_f1_score: 0.7252
Epoch 281/500
28/28 [=====] - 2s 66ms/step - loss: 0.4982 - f1_score:
0.8469 - val_loss: 1.1537 - val_f1_score: 0.7357
Epoch 282/500
28/28 [=====] - 2s 71ms/step - loss: 0.4979 - f1_score:
0.8462 - val_loss: 1.2107 - val_f1_score: 0.7201
Epoch 283/500
28/28 [=====] - 2s 66ms/step - loss: 0.5131 - f1_score:
0.8444 - val_loss: 1.1756 - val_f1_score: 0.7436
Epoch 284/500
28/28 [=====] - 2s 66ms/step - loss: 0.5262 - f1_score:
0.8389 - val_loss: 1.1258 - val_f1_score: 0.7410
Epoch 285/500
28/28 [=====] - 2s 79ms/step - loss: 0.4932 - f1_score:
0.8521 - val_loss: 1.1128 - val_f1_score: 0.7296
Epoch 286/500
28/28 [=====] - 2s 66ms/step - loss: 0.4773 - f1_score:
0.8552 - val_loss: 1.0169 - val_f1_score: 0.7603
Epoch 287/500
28/28 [=====] - 2s 76ms/step - loss: 0.4738 - f1_score:
0.8553 - val_loss: 1.1475 - val_f1_score: 0.7357
Epoch 288/500
28/28 [=====] - 2s 66ms/step - loss: 0.4837 - f1_score:
0.8500 - val_loss: 1.1564 - val_f1_score: 0.7336
Epoch 289/500
28/28 [=====] - 2s 65ms/step - loss: 0.5077 - f1_score:
0.8475 - val_loss: 1.1914 - val_f1_score: 0.7199
Epoch 290/500
28/28 [=====] - 2s 78ms/step - loss: 0.4848 - f1_score:
0.8528 - val_loss: 1.2077 - val_f1_score: 0.7264
Epoch 291/500
28/28 [=====] - 2s 68ms/step - loss: 0.4931 - f1_score:
0.8414 - val_loss: 1.1511 - val_f1_score: 0.7263
Epoch 292/500
28/28 [=====] - 2s 74ms/step - loss: 0.5045 - f1_score:
0.8488 - val_loss: 1.1305 - val_f1_score: 0.7333
Epoch 293/500
28/28 [=====] - 2s 72ms/step - loss: 0.4969 - f1_score:
```

```
0.8508 - val_loss: 1.0835 - val_f1_score: 0.7454
Epoch 294/500
28/28 [=====] - 2s 70ms/step - loss: 0.4976 - f1_score:
0.8438 - val_loss: 1.1733 - val_f1_score: 0.7491
Epoch 295/500
28/28 [=====] - 2s 71ms/step - loss: 0.4673 - f1_score:
0.8499 - val_loss: 1.1828 - val_f1_score: 0.7505
Epoch 296/500
28/28 [=====] - 2s 70ms/step - loss: 0.4630 - f1_score:
0.8522 - val_loss: 1.2322 - val_f1_score: 0.7192
Epoch 297/500
28/28 [=====] - 2s 79ms/step - loss: 0.5014 - f1_score:
0.8430 - val_loss: 1.1915 - val_f1_score: 0.7425
Epoch 298/500
28/28 [=====] - 2s 64ms/step - loss: 0.4774 - f1_score:
0.8461 - val_loss: 1.1714 - val_f1_score: 0.7496
Epoch 299/500
28/28 [=====] - 2s 65ms/step - loss: 0.4777 - f1_score:
0.8531 - val_loss: 1.1457 - val_f1_score: 0.7247
Epoch 300/500
28/28 [=====] - 2s 71ms/step - loss: 0.4707 - f1_score:
0.8586 - val_loss: 1.2505 - val_f1_score: 0.7013
Epoch 301/500
28/28 [=====] - 2s 65ms/step - loss: 0.4326 - f1_score:
0.8735 - val_loss: 1.1439 - val_f1_score: 0.7408
Epoch 302/500
28/28 [=====] - 2s 65ms/step - loss: 0.4812 - f1_score:
0.8562 - val_loss: 1.1646 - val_f1_score: 0.7248
Epoch 303/500
28/28 [=====] - 2s 70ms/step - loss: 0.4685 - f1_score:
0.8555 - val_loss: 1.2087 - val_f1_score: 0.7092
Epoch 304/500
28/28 [=====] - 2s 64ms/step - loss: 0.4823 - f1_score:
0.8436 - val_loss: 1.2115 - val_f1_score: 0.7226
Epoch 305/500
28/28 [=====] - 2s 71ms/step - loss: 0.4754 - f1_score:
0.8480 - val_loss: 1.1653 - val_f1_score: 0.7212
Epoch 306/500
28/28 [=====] - 2s 65ms/step - loss: 0.4549 - f1_score:
0.8565 - val_loss: 1.1269 - val_f1_score: 0.7399
Epoch 307/500
28/28 [=====] - 2s 69ms/step - loss: 0.4519 - f1_score:
0.8647 - val_loss: 1.1572 - val_f1_score: 0.7359
Epoch 308/500
28/28 [=====] - 2s 74ms/step - loss: 0.4622 - f1_score:
0.8574 - val_loss: 1.1488 - val_f1_score: 0.7447
Epoch 309/500
28/28 [=====] - 2s 65ms/step - loss: 0.4508 - f1_score:
```

```
0.8640 - val_loss: 1.0582 - val_f1_score: 0.7402
Epoch 310/500
28/28 [=====] - 2s 65ms/step - loss: 0.4822 - f1_score: 0.8554 - val_loss: 1.1850 - val_f1_score: 0.7431
Epoch 311/500
28/28 [=====] - ETA: 0s - loss: 0.4694 - f1_score: 0.8568

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_4_layer_call_fn,
gru_cell_4_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 [=====] - 13s 462ms/step - loss: 0.4694 - f1_score: 0.8568 - val_loss: 1.0642 - val_f1_score: 0.7820
Epoch 312/500
28/28 [=====] - 2s 59ms/step - loss: 0.4322 - f1_score: 0.8723 - val_loss: 1.3283 - val_f1_score: 0.6924
Epoch 313/500
28/28 [=====] - 2s 66ms/step - loss: 0.4460 - f1_score: 0.8639 - val_loss: 1.2016 - val_f1_score: 0.7139
Epoch 314/500
28/28 [=====] - 2s 60ms/step - loss: 0.4812 - f1_score: 0.8486 - val_loss: 1.2074 - val_f1_score: 0.7007
Epoch 315/500
28/28 [=====] - 2s 60ms/step - loss: 0.4502 - f1_score: 0.8639 - val_loss: 1.2290 - val_f1_score: 0.6890
Epoch 316/500
28/28 [=====] - 2s 67ms/step - loss: 0.4430 - f1_score: 0.8592 - val_loss: 1.1120 - val_f1_score: 0.7581
Epoch 317/500
28/28 [=====] - 2s 61ms/step - loss: 0.4216 - f1_score: 0.8702 - val_loss: 1.1045 - val_f1_score: 0.7710
Epoch 318/500
28/28 [=====] - 2s 61ms/step - loss: 0.4593 - f1_score: 0.8586 - val_loss: 1.1562 - val_f1_score: 0.7301
Epoch 319/500
28/28 [=====] - 2s 67ms/step - loss: 0.4058 - f1_score: 0.8770 - val_loss: 1.2872 - val_f1_score: 0.6962
Epoch 320/500
28/28 [=====] - 2s 62ms/step - loss: 0.4425 - f1_score: 0.8643 - val_loss: 1.2477 - val_f1_score: 0.7303
Epoch 321/500
28/28 [=====] - 2s 62ms/step - loss: 0.4480 - f1_score: 0.8588 - val_loss: 1.3418 - val_f1_score: 0.6740
Epoch 322/500
```

```
28/28 [=====] - 2s 66ms/step - loss: 0.4348 - f1_score: 0.8687 - val_loss: 1.1512 - val_f1_score: 0.7179
Epoch 323/500
28/28 [=====] - 2s 63ms/step - loss: 0.4285 - f1_score: 0.8708 - val_loss: 1.1869 - val_f1_score: 0.7299
Epoch 324/500
28/28 [=====] - 2s 68ms/step - loss: 0.4121 - f1_score: 0.8736 - val_loss: 1.2092 - val_f1_score: 0.7306
Epoch 325/500
28/28 [=====] - 2s 64ms/step - loss: 0.4282 - f1_score: 0.8707 - val_loss: 1.1246 - val_f1_score: 0.7737
Epoch 326/500
28/28 [=====] - 2s 63ms/step - loss: 0.4404 - f1_score: 0.8650 - val_loss: 1.2352 - val_f1_score: 0.7394
Epoch 327/500
28/28 [=====] - 2s 73ms/step - loss: 0.4186 - f1_score: 0.8694 - val_loss: 1.1293 - val_f1_score: 0.7359
Epoch 328/500
28/28 [=====] - 2s 64ms/step - loss: 0.4289 - f1_score: 0.8826 - val_loss: 1.1840 - val_f1_score: 0.7450
Epoch 329/500
28/28 [=====] - 2s 63ms/step - loss: 0.4060 - f1_score: 0.8813 - val_loss: 1.1894 - val_f1_score: 0.7385
Epoch 330/500
28/28 [=====] - 2s 68ms/step - loss: 0.4010 - f1_score: 0.8897 - val_loss: 1.0672 - val_f1_score: 0.7635
Epoch 331/500
28/28 [=====] - 2s 63ms/step - loss: 0.4387 - f1_score: 0.8652 - val_loss: 1.1743 - val_f1_score: 0.7504
Epoch 332/500
28/28 [=====] - 2s 66ms/step - loss: 0.4436 - f1_score: 0.8620 - val_loss: 1.3547 - val_f1_score: 0.6973
Epoch 333/500
28/28 [=====] - 2s 65ms/step - loss: 0.4480 - f1_score: 0.8635 - val_loss: 1.3437 - val_f1_score: 0.7304
Epoch 334/500
28/28 [=====] - 2s 64ms/step - loss: 0.4326 - f1_score: 0.8766 - val_loss: 1.2463 - val_f1_score: 0.7154
Epoch 335/500
28/28 [=====] - 2s 72ms/step - loss: 0.4115 - f1_score: 0.8759 - val_loss: 1.2026 - val_f1_score: 0.7375
Epoch 336/500
28/28 [=====] - 2s 64ms/step - loss: 0.4345 - f1_score: 0.8676 - val_loss: 1.2053 - val_f1_score: 0.7242
Epoch 337/500
28/28 [=====] - 2s 65ms/step - loss: 0.3898 - f1_score: 0.8785 - val_loss: 1.2561 - val_f1_score: 0.7375
Epoch 338/500
```

```
28/28 [=====] - 2s 70ms/step - loss: 0.4255 - f1_score: 0.8761 - val_loss: 1.2341 - val_f1_score: 0.7408
Epoch 339/500
28/28 [=====] - 2s 64ms/step - loss: 0.4133 - f1_score: 0.8770 - val_loss: 1.2860 - val_f1_score: 0.7037
Epoch 340/500
28/28 [=====] - 2s 65ms/step - loss: 0.4144 - f1_score: 0.8741 - val_loss: 1.2779 - val_f1_score: 0.7307
Epoch 341/500
28/28 [=====] - 2s 70ms/step - loss: 0.4132 - f1_score: 0.8744 - val_loss: 1.2617 - val_f1_score: 0.7239
Epoch 342/500
28/28 [=====] - 2s 65ms/step - loss: 0.3863 - f1_score: 0.8811 - val_loss: 1.1568 - val_f1_score: 0.7389
Epoch 343/500
28/28 [=====] - 2s 79ms/step - loss: 0.3911 - f1_score: 0.8811 - val_loss: 1.1744 - val_f1_score: 0.7465
Epoch 344/500
28/28 [=====] - 2s 65ms/step - loss: 0.3989 - f1_score: 0.8766 - val_loss: 1.1644 - val_f1_score: 0.7389
Epoch 345/500
28/28 [=====] - 2s 71ms/step - loss: 0.4102 - f1_score: 0.8763 - val_loss: 1.1562 - val_f1_score: 0.7551
Epoch 346/500
28/28 [=====] - 2s 73ms/step - loss: 0.4255 - f1_score: 0.8733 - val_loss: 1.1672 - val_f1_score: 0.7534
Epoch 347/500
28/28 [=====] - 2s 66ms/step - loss: 0.3925 - f1_score: 0.8773 - val_loss: 1.3165 - val_f1_score: 0.7215
Epoch 348/500
28/28 [=====] - 2s 82ms/step - loss: 0.3840 - f1_score: 0.8856 - val_loss: 1.2434 - val_f1_score: 0.7490
Epoch 349/500
28/28 [=====] - 2s 70ms/step - loss: 0.4084 - f1_score: 0.8824 - val_loss: 1.1119 - val_f1_score: 0.7585
Epoch 350/500
28/28 [=====] - 2s 66ms/step - loss: 0.4036 - f1_score: 0.8804 - val_loss: 1.1878 - val_f1_score: 0.7527
Epoch 351/500
28/28 [=====] - 2s 76ms/step - loss: 0.4123 - f1_score: 0.8820 - val_loss: 1.1965 - val_f1_score: 0.7339
Epoch 352/500
28/28 [=====] - 2s 74ms/step - loss: 0.3964 - f1_score: 0.8782 - val_loss: 1.2092 - val_f1_score: 0.7668
Epoch 353/500
28/28 [=====] - 2s 78ms/step - loss: 0.3963 - f1_score: 0.8788 - val_loss: 1.2990 - val_f1_score: 0.7326
Epoch 354/500
```

```
28/28 [=====] - 2s 76ms/step - loss: 0.3971 - f1_score: 0.8800 - val_loss: 1.1708 - val_f1_score: 0.7263
Epoch 355/500
28/28 [=====] - 2s 82ms/step - loss: 0.3768 - f1_score: 0.8891 - val_loss: 1.3963 - val_f1_score: 0.7052
Epoch 356/500
28/28 [=====] - 2s 72ms/step - loss: 0.3715 - f1_score: 0.8890 - val_loss: 1.0964 - val_f1_score: 0.7547
Epoch 357/500
28/28 [=====] - 2s 73ms/step - loss: 0.3770 - f1_score: 0.8887 - val_loss: 1.2976 - val_f1_score: 0.7265
Epoch 358/500
28/28 [=====] - 2s 78ms/step - loss: 0.4275 - f1_score: 0.8683 - val_loss: 1.1928 - val_f1_score: 0.7583
Epoch 359/500
28/28 [=====] - 2s 64ms/step - loss: 0.3926 - f1_score: 0.8799 - val_loss: 1.1557 - val_f1_score: 0.7637
Epoch 360/500
28/28 [=====] - 2s 72ms/step - loss: 0.4120 - f1_score: 0.8733 - val_loss: 1.1749 - val_f1_score: 0.7597
Epoch 361/500
28/28 [=====] - 2s 65ms/step - loss: 0.3828 - f1_score: 0.8837 - val_loss: 1.1271 - val_f1_score: 0.7441
Epoch 362/500
28/28 [=====] - 2s 66ms/step - loss: 0.3880 - f1_score: 0.8763 - val_loss: 1.1577 - val_f1_score: 0.7330
Epoch 363/500
28/28 [=====] - 2s 71ms/step - loss: 0.3672 - f1_score: 0.8913 - val_loss: 1.2584 - val_f1_score: 0.7513
Epoch 364/500
28/28 [=====] - 2s 65ms/step - loss: 0.3953 - f1_score: 0.8804 - val_loss: 1.2406 - val_f1_score: 0.7532
Epoch 365/500
28/28 [=====] - 2s 66ms/step - loss: 0.3895 - f1_score: 0.8836 - val_loss: 1.1478 - val_f1_score: 0.7609
Epoch 366/500
28/28 [=====] - 2s 73ms/step - loss: 0.3696 - f1_score: 0.8929 - val_loss: 1.4320 - val_f1_score: 0.7054
Epoch 367/500
28/28 [=====] - 2s 66ms/step - loss: 0.3793 - f1_score: 0.8879 - val_loss: 1.1103 - val_f1_score: 0.7503
Epoch 368/500
28/28 [=====] - 2s 68ms/step - loss: 0.3665 - f1_score: 0.8884 - val_loss: 1.0920 - val_f1_score: 0.7385
Epoch 369/500
28/28 [=====] - 2s 64ms/step - loss: 0.3836 - f1_score: 0.8846 - val_loss: 1.2445 - val_f1_score: 0.7373
Epoch 370/500
```

```
28/28 [=====] - 2s 65ms/step - loss: 0.3522 - f1_score: 0.8950 - val_loss: 1.3243 - val_f1_score: 0.7185
Epoch 371/500
28/28 [=====] - 2s 70ms/step - loss: 0.3726 - f1_score: 0.8905 - val_loss: 1.2930 - val_f1_score: 0.7170
Epoch 372/500
28/28 [=====] - 2s 65ms/step - loss: 0.3655 - f1_score: 0.8971 - val_loss: 1.1829 - val_f1_score: 0.7592
Epoch 373/500
28/28 [=====] - 2s 71ms/step - loss: 0.3627 - f1_score: 0.8977 - val_loss: 1.2843 - val_f1_score: 0.7368
Epoch 374/500
28/28 [=====] - 2s 70ms/step - loss: 0.3568 - f1_score: 0.8896 - val_loss: 1.2712 - val_f1_score: 0.7287
Epoch 375/500
28/28 [=====] - 2s 67ms/step - loss: 0.3598 - f1_score: 0.8955 - val_loss: 1.1875 - val_f1_score: 0.7326
Epoch 376/500
28/28 [=====] - 2s 75ms/step - loss: 0.3928 - f1_score: 0.8818 - val_loss: 1.1181 - val_f1_score: 0.7613
Epoch 377/500
28/28 [=====] - 2s 69ms/step - loss: 0.3676 - f1_score: 0.8836 - val_loss: 1.0448 - val_f1_score: 0.7748
Epoch 378/500
28/28 [=====] - 2s 64ms/step - loss: 0.3400 - f1_score: 0.8972 - val_loss: 1.1807 - val_f1_score: 0.7330
Epoch 379/500
28/28 [=====] - 2s 79ms/step - loss: 0.3591 - f1_score: 0.8958 - val_loss: 1.2288 - val_f1_score: 0.7382
Epoch 380/500
28/28 [=====] - 2s 65ms/step - loss: 0.3454 - f1_score: 0.8996 - val_loss: 1.1319 - val_f1_score: 0.7560
Epoch 381/500
28/28 [=====] - 2s 74ms/step - loss: 0.3530 - f1_score: 0.8946 - val_loss: 1.1491 - val_f1_score: 0.7717
Epoch 382/500
28/28 [=====] - 2s 69ms/step - loss: 0.3420 - f1_score: 0.9062 - val_loss: 1.2145 - val_f1_score: 0.7546
Epoch 383/500
28/28 [=====] - 2s 66ms/step - loss: 0.3432 - f1_score: 0.9029 - val_loss: 1.1996 - val_f1_score: 0.7515
Epoch 384/500
28/28 [=====] - 2s 70ms/step - loss: 0.3737 - f1_score: 0.8865 - val_loss: 1.2100 - val_f1_score: 0.7571
Epoch 385/500
28/28 [=====] - 2s 65ms/step - loss: 0.3750 - f1_score: 0.8845 - val_loss: 1.2182 - val_f1_score: 0.7403
Epoch 386/500
```

```
28/28 [=====] - 2s 68ms/step - loss: 0.3606 - f1_score: 0.8913 - val_loss: 1.2223 - val_f1_score: 0.7269
Epoch 387/500
28/28 [=====] - 2s 66ms/step - loss: 0.3343 - f1_score: 0.9001 - val_loss: 1.1978 - val_f1_score: 0.7510
Epoch 388/500
28/28 [=====] - 2s 66ms/step - loss: 0.3632 - f1_score: 0.8893 - val_loss: 1.2545 - val_f1_score: 0.7351
Epoch 389/500
28/28 [=====] - 3s 104ms/step - loss: 0.3550 - f1_score: 0.8952 - val_loss: 1.3012 - val_f1_score: 0.7406
Epoch 390/500
28/28 [=====] - 3s 92ms/step - loss: 0.3633 - f1_score: 0.8991 - val_loss: 1.3286 - val_f1_score: 0.7182
Epoch 391/500
28/28 [=====] - 3s 104ms/step - loss: 0.3515 - f1_score: 0.8931 - val_loss: 1.2022 - val_f1_score: 0.7512
Epoch 392/500
28/28 [=====] - 2s 82ms/step - loss: 0.3764 - f1_score: 0.8904 - val_loss: 1.3320 - val_f1_score: 0.7261
Epoch 393/500
28/28 [=====] - 2s 79ms/step - loss: 0.3669 - f1_score: 0.8984 - val_loss: 1.1854 - val_f1_score: 0.7588
Epoch 394/500
28/28 [=====] - 2s 75ms/step - loss: 0.3544 - f1_score: 0.8948 - val_loss: 1.0468 - val_f1_score: 0.7728
Epoch 395/500
28/28 [=====] - 2s 76ms/step - loss: 0.3964 - f1_score: 0.8745 - val_loss: 1.1929 - val_f1_score: 0.7584
Epoch 396/500
28/28 [=====] - 2s 68ms/step - loss: 0.3223 - f1_score: 0.9071 - val_loss: 1.3460 - val_f1_score: 0.7098
Epoch 397/500
28/28 [=====] - 2s 68ms/step - loss: 0.3543 - f1_score: 0.8909 - val_loss: 1.2605 - val_f1_score: 0.7354
Epoch 398/500
28/28 [=====] - 2s 68ms/step - loss: 0.3724 - f1_score: 0.8900 - val_loss: 1.2289 - val_f1_score: 0.7282
Epoch 399/500
28/28 [=====] - 2s 64ms/step - loss: 0.3515 - f1_score: 0.8957 - val_loss: 1.1940 - val_f1_score: 0.7606
Epoch 400/500
28/28 [=====] - 2s 71ms/step - loss: 0.3439 - f1_score: 0.8950 - val_loss: 1.2863 - val_f1_score: 0.7228
Epoch 401/500
28/28 [=====] - 2s 64ms/step - loss: 0.3393 - f1_score: 0.9035 - val_loss: 1.3339 - val_f1_score: 0.7149
Epoch 402/500
```

```
28/28 [=====] - 2s 64ms/step - loss: 0.3522 - f1_score: 0.8975 - val_loss: 1.3577 - val_f1_score: 0.7120
Epoch 403/500
28/28 [=====] - 2s 76ms/step - loss: 0.3524 - f1_score: 0.8962 - val_loss: 1.1405 - val_f1_score: 0.7497
Epoch 404/500
28/28 [=====] - 2s 69ms/step - loss: 0.3409 - f1_score: 0.8999 - val_loss: 1.4277 - val_f1_score: 0.6905
Epoch 405/500
28/28 [=====] - 2s 81ms/step - loss: 0.3437 - f1_score: 0.8974 - val_loss: 1.1979 - val_f1_score: 0.7613
Epoch 406/500
28/28 [=====] - 2s 71ms/step - loss: 0.3168 - f1_score: 0.9060 - val_loss: 1.2407 - val_f1_score: 0.7363
Epoch 407/500
28/28 [=====] - 2s 67ms/step - loss: 0.3380 - f1_score: 0.8954 - val_loss: 1.2222 - val_f1_score: 0.7331
Epoch 408/500
28/28 [=====] - 2s 88ms/step - loss: 0.3174 - f1_score: 0.9061 - val_loss: 1.2129 - val_f1_score: 0.7494
Epoch 409/500
28/28 [=====] - 2s 69ms/step - loss: 0.3477 - f1_score: 0.8896 - val_loss: 1.2975 - val_f1_score: 0.7403
Epoch 410/500
28/28 [=====] - 2s 75ms/step - loss: 0.3416 - f1_score: 0.8984 - val_loss: 1.2744 - val_f1_score: 0.7320
Epoch 411/500
28/28 [=====] - 2s 66ms/step - loss: 0.3482 - f1_score: 0.9012 - val_loss: 1.3222 - val_f1_score: 0.7248
Epoch 412/500
28/28 [=====] - 2s 66ms/step - loss: 0.3288 - f1_score: 0.9045 - val_loss: 1.2054 - val_f1_score: 0.7449
Epoch 413/500
28/28 [=====] - 2s 78ms/step - loss: 0.3632 - f1_score: 0.8943 - val_loss: 1.3880 - val_f1_score: 0.7021
Epoch 414/500
28/28 [=====] - 2s 70ms/step - loss: 0.3627 - f1_score: 0.8938 - val_loss: 1.2011 - val_f1_score: 0.7500
Epoch 415/500
28/28 [=====] - 2s 74ms/step - loss: 0.3250 - f1_score: 0.9003 - val_loss: 1.2295 - val_f1_score: 0.7424
Epoch 416/500
28/28 [=====] - 2s 72ms/step - loss: 0.3188 - f1_score: 0.9056 - val_loss: 1.2498 - val_f1_score: 0.7533
Epoch 417/500
28/28 [=====] - 2s 66ms/step - loss: 0.3359 - f1_score: 0.9033 - val_loss: 1.2089 - val_f1_score: 0.7373
Epoch 418/500
```

```
28/28 [=====] - 2s 73ms/step - loss: 0.3208 - f1_score: 0.9046 - val_loss: 1.4732 - val_f1_score: 0.6972
Epoch 419/500
28/28 [=====] - 2s 66ms/step - loss: 0.3486 - f1_score: 0.8951 - val_loss: 1.2122 - val_f1_score: 0.7653
Epoch 420/500
28/28 [=====] - 2s 74ms/step - loss: 0.3343 - f1_score: 0.9030 - val_loss: 1.3313 - val_f1_score: 0.7291
Epoch 421/500
28/28 [=====] - 2s 65ms/step - loss: 0.3335 - f1_score: 0.9044 - val_loss: 1.2721 - val_f1_score: 0.7514
Epoch 422/500
28/28 [=====] - 2s 65ms/step - loss: 0.3692 - f1_score: 0.8813 - val_loss: 1.2575 - val_f1_score: 0.7265
Epoch 423/500
28/28 [=====] - 2s 70ms/step - loss: 0.3333 - f1_score: 0.9017 - val_loss: 1.1835 - val_f1_score: 0.7272
Epoch 424/500
28/28 [=====] - 2s 64ms/step - loss: 0.3004 - f1_score: 0.9159 - val_loss: 1.1740 - val_f1_score: 0.7481
Epoch 425/500
28/28 [=====] - 2s 65ms/step - loss: 0.3447 - f1_score: 0.9001 - val_loss: 1.8338 - val_f1_score: 0.6202
Epoch 426/500
28/28 [=====] - 2s 71ms/step - loss: 0.3321 - f1_score: 0.8953 - val_loss: 1.2358 - val_f1_score: 0.7545
Epoch 427/500
28/28 [=====] - 2s 66ms/step - loss: 0.3283 - f1_score: 0.9066 - val_loss: 1.2502 - val_f1_score: 0.7302
Epoch 428/500
28/28 [=====] - 2s 71ms/step - loss: 0.3253 - f1_score: 0.9047 - val_loss: 1.2704 - val_f1_score: 0.7726
Epoch 429/500
28/28 [=====] - 2s 66ms/step - loss: 0.3604 - f1_score: 0.8930 - val_loss: 1.2832 - val_f1_score: 0.7191
Epoch 430/500
28/28 [=====] - 2s 66ms/step - loss: 0.2900 - f1_score: 0.9192 - val_loss: 1.2139 - val_f1_score: 0.7573
Epoch 431/500
28/28 [=====] - 2s 76ms/step - loss: 0.3068 - f1_score: 0.9070 - val_loss: 1.0471 - val_f1_score: 0.7803
Epoch 432/500
28/28 [=====] - 2s 63ms/step - loss: 0.3139 - f1_score: 0.9029 - val_loss: 1.2652 - val_f1_score: 0.7569
Epoch 433/500
28/28 [=====] - 2s 65ms/step - loss: 0.3168 - f1_score: 0.9035 - val_loss: 1.2981 - val_f1_score: 0.6945
Epoch 434/500
```

```
28/28 [=====] - 3s 90ms/step - loss: 0.2975 - f1_score: 0.9160 - val_loss: 1.2791 - val_f1_score: 0.7501
Epoch 435/500
28/28 [=====] - 2s 64ms/step - loss: 0.3162 - f1_score: 0.9038 - val_loss: 1.3218 - val_f1_score: 0.7273
Epoch 436/500
28/28 [=====] - 2s 82ms/step - loss: 0.3017 - f1_score: 0.9175 - val_loss: 1.2901 - val_f1_score: 0.7374
Epoch 437/500
28/28 [=====] - 2s 82ms/step - loss: 0.3113 - f1_score: 0.9065 - val_loss: 1.2362 - val_f1_score: 0.7363
Epoch 438/500
28/28 [=====] - 3s 93ms/step - loss: 0.3400 - f1_score: 0.9028 - val_loss: 1.3658 - val_f1_score: 0.7170
Epoch 439/500
28/28 [=====] - 2s 80ms/step - loss: 0.3226 - f1_score: 0.9046 - val_loss: 1.3245 - val_f1_score: 0.7245
Epoch 440/500
28/28 [=====] - 3s 94ms/step - loss: 0.3223 - f1_score: 0.9096 - val_loss: 1.2818 - val_f1_score: 0.7278
Epoch 441/500
28/28 [=====] - 3s 92ms/step - loss: 0.3109 - f1_score: 0.9047 - val_loss: 1.3277 - val_f1_score: 0.7196
Epoch 442/500
28/28 [=====] - 3s 100ms/step - loss: 0.2990 - f1_score: 0.9151 - val_loss: 1.2265 - val_f1_score: 0.7581
Epoch 443/500
28/28 [=====] - 2s 87ms/step - loss: 0.3016 - f1_score: 0.9127 - val_loss: 1.4597 - val_f1_score: 0.6981
Epoch 444/500
28/28 [=====] - 3s 93ms/step - loss: 0.3212 - f1_score: 0.9004 - val_loss: 1.3375 - val_f1_score: 0.7405
Epoch 445/500
28/28 [=====] - 3s 95ms/step - loss: 0.3074 - f1_score: 0.9078 - val_loss: 1.2175 - val_f1_score: 0.7529
Epoch 446/500
28/28 [=====] - 2s 85ms/step - loss: 0.3064 - f1_score: 0.9092 - val_loss: 1.3517 - val_f1_score: 0.7182
Epoch 447/500
28/28 [=====] - 2s 87ms/step - loss: 0.3069 - f1_score: 0.9077 - val_loss: 1.3293 - val_f1_score: 0.7317
Epoch 448/500
28/28 [=====] - 3s 90ms/step - loss: 0.3292 - f1_score: 0.8963 - val_loss: 1.3575 - val_f1_score: 0.7173
Epoch 449/500
28/28 [=====] - 2s 69ms/step - loss: 0.2929 - f1_score: 0.9168 - val_loss: 1.2310 - val_f1_score: 0.7286
Epoch 450/500
```

```
28/28 [=====] - 2s 74ms/step - loss: 0.3217 - f1_score: 0.9036 - val_loss: 1.1837 - val_f1_score: 0.7368
Epoch 451/500
28/28 [=====] - 2s 67ms/step - loss: 0.2776 - f1_score: 0.9275 - val_loss: 1.2289 - val_f1_score: 0.7484
Epoch 452/500
28/28 [=====] - 2s 65ms/step - loss: 0.3116 - f1_score: 0.9061 - val_loss: 1.2596 - val_f1_score: 0.7399
Epoch 453/500
28/28 [=====] - 2s 75ms/step - loss: 0.3210 - f1_score: 0.9026 - val_loss: 1.3785 - val_f1_score: 0.7349
Epoch 454/500
28/28 [=====] - 2s 72ms/step - loss: 0.3261 - f1_score: 0.9057 - val_loss: 1.3075 - val_f1_score: 0.7292
Epoch 455/500
28/28 [=====] - 2s 74ms/step - loss: 0.3309 - f1_score: 0.8975 - val_loss: 1.3580 - val_f1_score: 0.7520
Epoch 456/500
28/28 [=====] - 2s 68ms/step - loss: 0.3215 - f1_score: 0.9031 - val_loss: 1.2642 - val_f1_score: 0.7254
Epoch 457/500
28/28 [=====] - 2s 66ms/step - loss: 0.3039 - f1_score: 0.9091 - val_loss: 1.3743 - val_f1_score: 0.7107
Epoch 458/500
28/28 [=====] - 2s 76ms/step - loss: 0.2863 - f1_score: 0.9152 - val_loss: 1.4568 - val_f1_score: 0.7083
Epoch 459/500
28/28 [=====] - 2s 67ms/step - loss: 0.2698 - f1_score: 0.9254 - val_loss: 1.3394 - val_f1_score: 0.7191
Epoch 460/500
28/28 [=====] - 2s 81ms/step - loss: 0.2804 - f1_score: 0.9144 - val_loss: 1.2920 - val_f1_score: 0.7270
Epoch 461/500
28/28 [=====] - 2s 73ms/step - loss: 0.2950 - f1_score: 0.9079 - val_loss: 1.3451 - val_f1_score: 0.7578
Epoch 462/500
28/28 [=====] - 2s 60ms/step - loss: 0.3059 - f1_score: 0.9125 - val_loss: 1.3365 - val_f1_score: 0.7439
Epoch 463/500
28/28 [=====] - 2s 72ms/step - loss: 0.2845 - f1_score: 0.9127 - val_loss: 1.1198 - val_f1_score: 0.7747
Epoch 464/500
28/28 [=====] - 2s 70ms/step - loss: 0.3028 - f1_score: 0.9139 - val_loss: 1.2649 - val_f1_score: 0.7597
Epoch 465/500
28/28 [=====] - 2s 85ms/step - loss: 0.2755 - f1_score: 0.9240 - val_loss: 1.2928 - val_f1_score: 0.7446
Epoch 466/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 0.2520 - f1_score: 0.9311 - val_loss: 1.3884 - val_f1_score: 0.7289
Epoch 467/500
28/28 [=====] - 2s 70ms/step - loss: 0.3208 - f1_score: 0.9020 - val_loss: 1.3953 - val_f1_score: 0.6992
Epoch 468/500
28/28 [=====] - 2s 74ms/step - loss: 0.3166 - f1_score: 0.9097 - val_loss: 1.3324 - val_f1_score: 0.7450
Epoch 469/500
28/28 [=====] - 2s 67ms/step - loss: 0.2967 - f1_score: 0.9161 - val_loss: 1.3276 - val_f1_score: 0.7273
Epoch 470/500
28/28 [=====] - 2s 73ms/step - loss: 0.2779 - f1_score: 0.9211 - val_loss: 1.3729 - val_f1_score: 0.7231
Epoch 471/500
28/28 [=====] - 2s 69ms/step - loss: 0.2818 - f1_score: 0.9136 - val_loss: 1.4388 - val_f1_score: 0.7165
Epoch 472/500
28/28 [=====] - 2s 71ms/step - loss: 0.2593 - f1_score: 0.9283 - val_loss: 1.2781 - val_f1_score: 0.7554
Epoch 473/500
28/28 [=====] - 2s 79ms/step - loss: 0.3041 - f1_score: 0.9118 - val_loss: 1.5496 - val_f1_score: 0.7352
Epoch 475/500
28/28 [=====] - 3s 110ms/step - loss: 0.3018 - f1_score: 0.9117 - val_loss: 1.3117 - val_f1_score: 0.7322
Epoch 476/500
28/28 [=====] - 2s 75ms/step - loss: 0.2706 - f1_score: 0.9178 - val_loss: 1.2664 - val_f1_score: 0.7410
Epoch 477/500
28/28 [=====] - 2s 68ms/step - loss: 0.2788 - f1_score: 0.9224 - val_loss: 1.2975 - val_f1_score: 0.7320
Epoch 478/500
28/28 [=====] - 2s 60ms/step - loss: 0.2534 - f1_score: 0.9284 - val_loss: 1.4518 - val_f1_score: 0.7119
Epoch 479/500
28/28 [=====] - 2s 62ms/step - loss: 0.3104 - f1_score: 0.9045 - val_loss: 1.2992 - val_f1_score: 0.7433
Epoch 480/500
28/28 [=====] - 2s 83ms/step - loss: 0.2575 - f1_score: 0.9241 - val_loss: 1.3374 - val_f1_score: 0.7388
Epoch 481/500
28/28 [=====] - 2s 76ms/step - loss: 0.2957 - f1_score: 0.9145 - val_loss: 1.2407 - val_f1_score: 0.7484
Epoch 482/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 0.3082 - f1_score: 0.9116 - val_loss: 1.2563 - val_f1_score: 0.7422
Epoch 483/500
28/28 [=====] - 2s 63ms/step - loss: 0.2747 - f1_score: 0.9200 - val_loss: 1.2359 - val_f1_score: 0.7437
Epoch 484/500
28/28 [=====] - 2s 63ms/step - loss: 0.2439 - f1_score: 0.9353 - val_loss: 1.3536 - val_f1_score: 0.7290
Epoch 485/500
28/28 [=====] - 2s 74ms/step - loss: 0.3307 - f1_score: 0.9022 - val_loss: 1.2720 - val_f1_score: 0.7240
Epoch 486/500

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)
```

```
28/28 [=====] - 2s 84ms/step - loss: 0.2771 - f1_score: 0.9210 - val_loss: 1.2898 - val_f1_score: 0.7470
Epoch 488/500
28/28 [=====] - 2s 83ms/step - loss: 0.2776 - f1_score: 0.9195 - val_loss: 1.2921 - val_f1_score: 0.7454
Epoch 489/500
28/28 [=====] - 2s 88ms/step - loss: 0.2780 - f1_score: 0.9162 - val_loss: 1.2752 - val_f1_score: 0.7360
Epoch 490/500
28/28 [=====] - 2s 84ms/step - loss: 0.2813 - f1_score: 0.9189 - val_loss: 1.2732 - val_f1_score: 0.7284
Epoch 491/500
28/28 [=====] - 2s 75ms/step - loss: 0.2419 - f1_score: 0.9293 - val_loss: 1.2519 - val_f1_score: 0.7454
Epoch 492/500
28/28 [=====] - 2s 68ms/step - loss: 0.2602 - f1_score: 0.9254 - val_loss: 1.2657 - val_f1_score: 0.7093
Epoch 493/500
28/28 [=====] - 2s 69ms/step - loss: 0.2693 - f1_score: 0.9224 - val_loss: 1.2619 - val_f1_score: 0.7353
Epoch 494/500
28/28 [=====] - 2s 78ms/step - loss: 0.2774 - f1_score: 0.9204 - val_loss: 1.3453 - val_f1_score: 0.7146
Epoch 495/500
28/28 [=====] - 3s 92ms/step - loss: 0.2409 - f1_score:
```

```

0.9353 - val_loss: 1.3423 - val_f1_score: 0.7361
Epoch 496/500
28/28 [=====] - 2s 84ms/step - loss: 0.2505 - f1_score:
0.9262 - val_loss: 1.2212 - val_f1_score: 0.7311
Epoch 497/500
28/28 [=====] - 2s 77ms/step - loss: 0.3005 - f1_score:
0.9082 - val_loss: 1.3234 - val_f1_score: 0.7159
Epoch 498/500
28/28 [=====] - 2s 87ms/step - loss: 0.2771 - f1_score:
0.9214 - val_loss: 1.2346 - val_f1_score: 0.7627
Epoch 499/500
28/28 [=====] - 2s 89ms/step - loss: 0.2602 - f1_score:
0.9233 - val_loss: 1.2470 - val_f1_score: 0.7472
Epoch 500/500
28/28 [=====] - 2s 86ms/step - loss: 0.3001 - f1_score:
0.9096 - val_loss: 1.3708 - val_f1_score: 0.7389

```

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

	precision	recall	f1-score	support
AXE	0.875	0.875	0.875	8
BACKPACK	0.625	0.833	0.714	6
BASKETBALL	0.833	1.000	0.909	10
BEE	1.000	0.700	0.824	10
BELT	0.800	1.000	0.889	4
BITE	1.000	0.750	0.857	8
BREAKFAST	1.000	1.000	1.000	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	1.000	0.333	0.500	6
DECIDE	1.000	0.667	0.800	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	0.750	0.500	0.600	6
DINNER	1.000	0.750	0.857	8
DOG	0.667	0.667	0.667	6
DOWNSIZE	0.778	0.875	0.824	8
DRAG	1.000	0.250	0.400	4
EAT	0.833	0.833	0.833	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.636	0.875	0.737	8

FINE	1.000	0.500	0.667	4
FLOAT	0.400	0.500	0.444	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	0.000	0.000	0.000	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.750	0.750	0.750	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.667	0.500	0.571	4
MEAT	0.333	0.500	0.400	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.500	1.000	0.667	8
NOON	0.800	1.000	0.889	8
PARTY	0.714	0.625	0.667	8
PATIENT	0.500	0.667	0.571	6
RAZOR	0.500	0.750	0.600	4
RIVER	0.750	1.000	0.857	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.636	0.700	0.667	10
SINK	1.000	0.500	0.667	6
SQUEEZE	1.000	0.250	0.400	4
THEY	1.000	1.000	1.000	4
TWINS	0.583	0.875	0.700	8
WHATFOR	0.700	0.700	0.700	10
accuracy			0.765	324
macro avg	0.797	0.742	0.739	324
weighted avg	0.806	0.765	0.759	324

```
[150]: # 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)
```

```
[151]: hist_df.tail()
```

	loss	f1_score	val_loss	val_f1_score
495	0.250501	0.926209	1.221245	0.731050
496	0.300468	0.908172	1.323396	0.715862
497	0.277054	0.921428	1.234635	0.762694

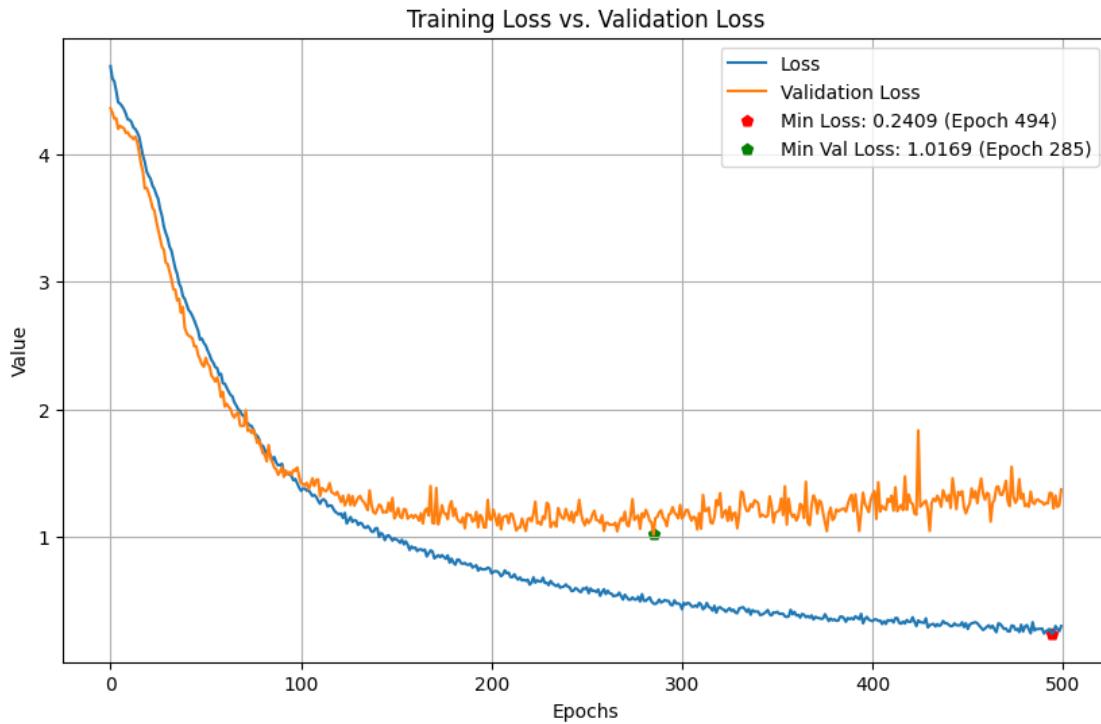
```
498  0.260211  0.923331  1.247010      0.747196
499  0.300107  0.909601  1.370833      0.738937
```

```
[152]: # 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()
```



```
[153]: # 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()

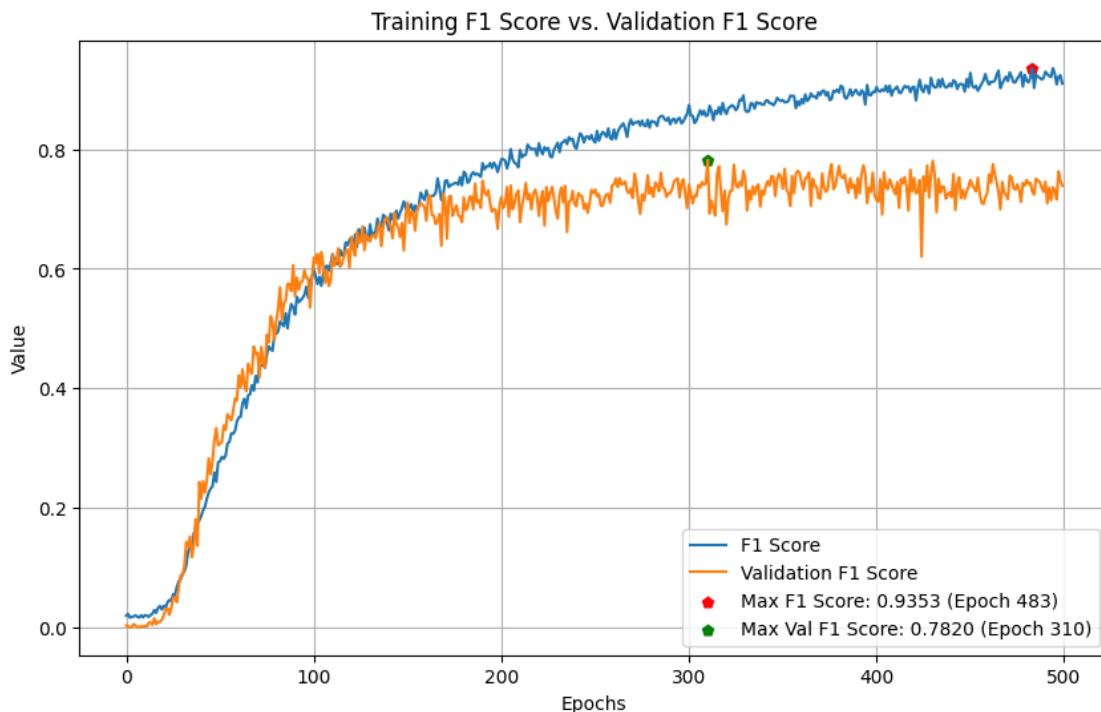
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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")

```

2023-09-11 08:08:36.168100: 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 08:08:37.343243: 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

```

[120]: reconstructed\_model.summary()

```
Model: "sequential_3"
-----
```

Layer (type)	Output Shape	Param #
conv1d_6 (Conv1D)	(None, 122, 100)	359200
max_pooling1d_6 (MaxPooling 1D)	(None, 13, 100)	0
conv1d_7 (Conv1D)	(None, 13, 125)	12625
max_pooling1d_7 (MaxPooling 1D)	(None, 13, 125)	0
dropout_6 (Dropout)	(None, 13, 125)	0
gru_3 (GRU)	(None, 75)	45450
dropout_7 (Dropout)	(None, 75)	0
dense_6 (Dense)	(None, 100)	7600
dense_7 (Dense)	(None, 50)	5050

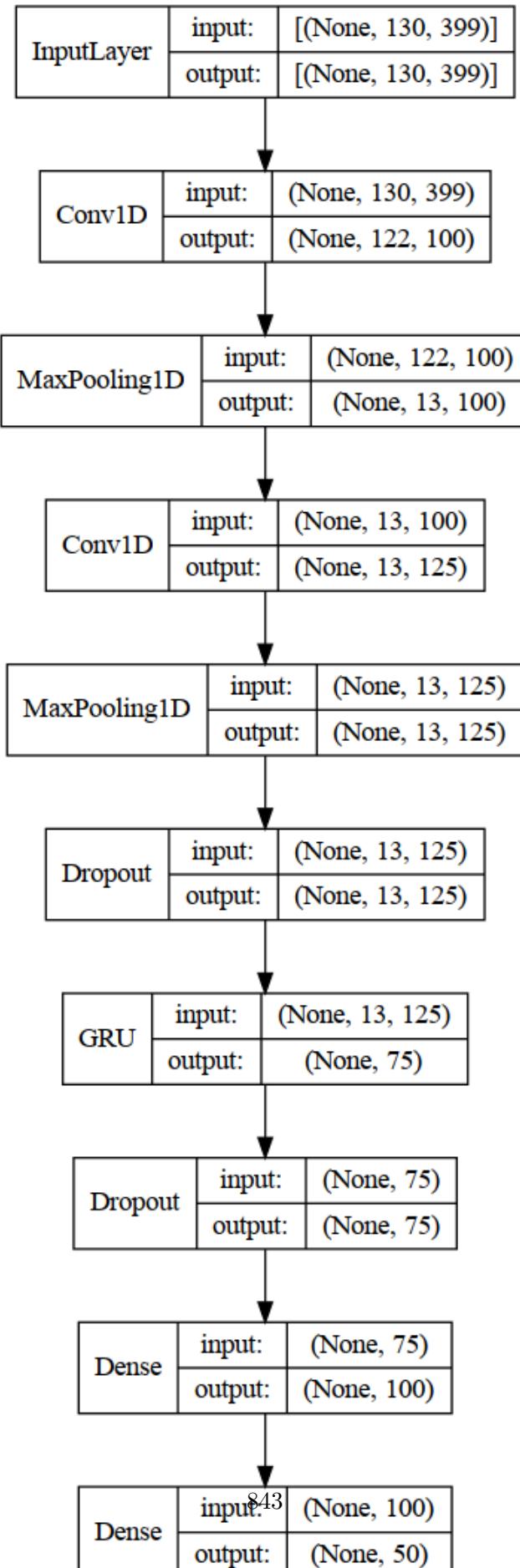
=====

Total params: 429,925  
Trainable params: 429,925  
Non-trainable params: 0

-----

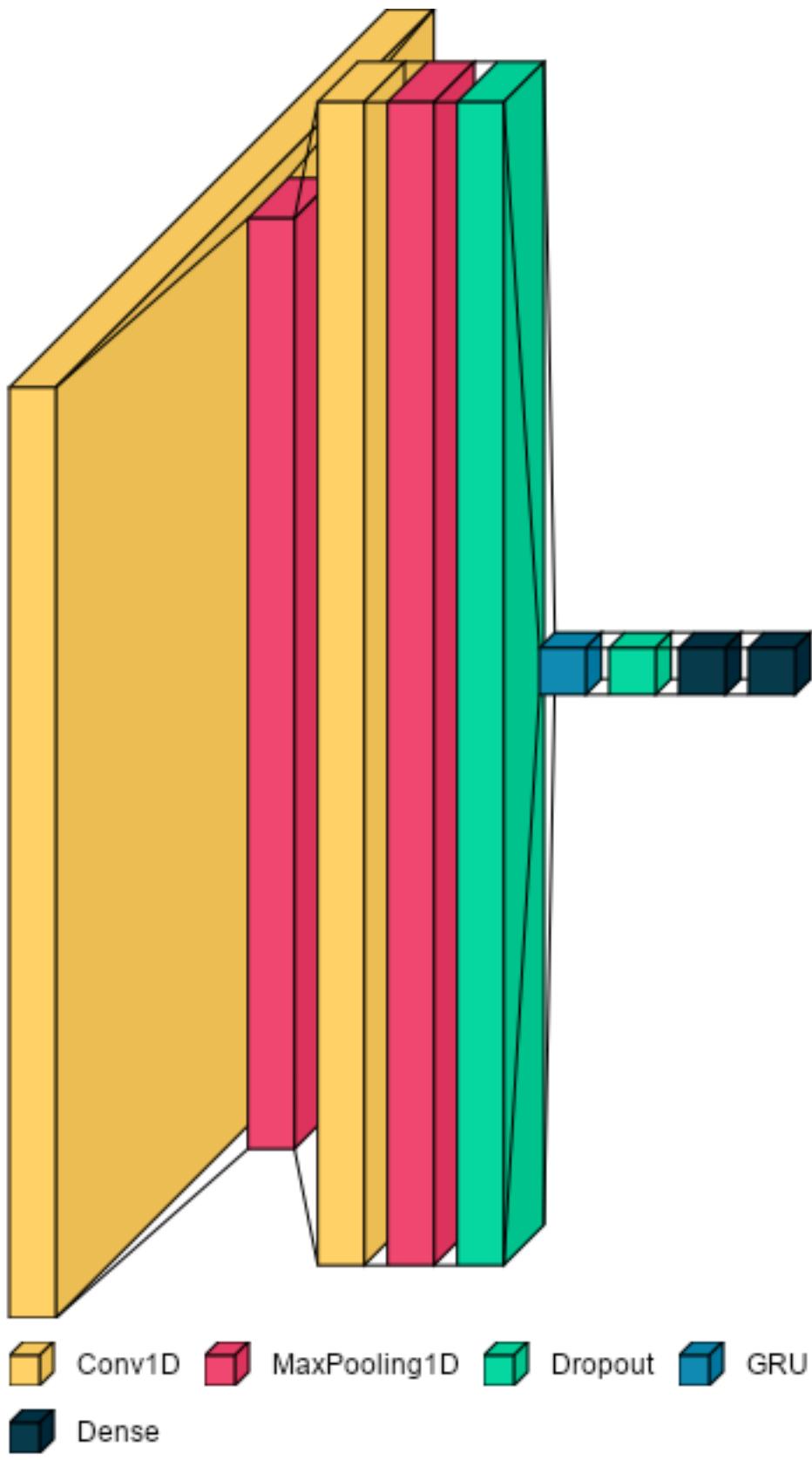
```
[121]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

```
[121]:
```



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

```
[122]:
```



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

2023-09-11 08:08:52.883001: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
11/11 [=====] - 10s 19ms/step - loss: 1.0642 -
f1_score: 0.7820
```

[123]: [1.0641664266586304, 0.7819815278053284]

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

84/84 [=====] - 1s 12ms/step - loss: 0.1385 - f1_score:
0.9771
```

[124]: [0.1384536623954773, 0.9770539999008179]

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

	precision	recall	f1-score	support
AXE	0.800	1.000	0.889	8
BACKPACK	0.500	0.667	0.571	6
BASKETBALL	0.833	1.000	0.909	10
BEE	0.889	0.800	0.842	10
BELT	0.667	1.000	0.800	4
BITE	1.000	0.875	0.933	8
BREAKFAST	1.000	0.833	0.909	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	0.667	0.333	0.444	6
DECIDE	1.000	0.667	0.800	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	0.800	0.667	0.727	6
DINNER	1.000	0.750	0.857	8
DOG	0.667	0.667	0.667	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	1.000	0.500	0.667	4
EAT	0.857	1.000	0.923	6
EDIT	0.857	1.000	0.923	6

ELEVATOR	0.571	1.000	0.727	8
FINE	1.000	0.500	0.667	4
FLOAT	0.500	0.500	0.500	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	1.000	1.000	1.000	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	1.000	1.000	1.000	6
HURDLE/TRIP	0.333	0.250	0.286	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	0.667	0.500	0.571	4
MEAT	0.500	0.667	0.571	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.615	1.000	0.762	8
NOON	1.000	1.000	1.000	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.600	0.500	0.545	6
RAZOR	0.571	1.000	0.727	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.875	0.700	0.778	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	0.571	1.000	0.727	8
WHATFOR	0.727	0.800	0.762	10
accuracy			0.802	324
macro avg	0.831	0.782	0.782	324
weighted avg	0.835	0.802	0.798	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)
```

```
[120]: 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=1265, 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])

```

2023-09-17 10:57:32.962856: 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.

2023-09-17 10:57:33.031991: 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, 122, 100)	359200
max_pooling1d (MaxPooling1D )	(None, 13, 100)	0
conv1d_1 (Conv1D)	(None, 13, 1265)	127765
max_pooling1d_1 (MaxPooling )	(None, 13, 1265)	0

1D)

dropout (Dropout)	(None, 13, 1265)	0
gru (GRU)	(None, 75)	301950
dropout_1 (Dropout)	(None, 75)	0
dense (Dense)	(None, 100)	7600
dense_1 (Dense)	(None, 50)	5050

=====

Total params: 801,565  
Trainable params: 801,565  
Non-trainable params: 0

-----  
Epoch 1/500

2023-09-17 10:57:38.399877: I tensorflow/stream\_executor/cuda/cuda\_dnn.cc:384] Loaded cuDNN version 8700  
2023-09-17 10:57:39.036955: I tensorflow/compiler/xla/service/service.cc:173] XLA service 0x7f341d5890c0 initialized for platform CUDA (this does not guarantee that XLA will be used). Devices:  
2023-09-17 10:57:39.036988: I tensorflow/compiler/xla/service/service.cc:181] StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1  
2023-09-17 10:57:39.047191: I tensorflow/compiler/mlir/tensorflow/utils/dump\_mlir\_util.cc:268] disabling MLIR crash reproducer, set env var `MLIR\_CRASH\_REPRODUCER\_DIRECTORY` to enable.  
2023-09-17 10:57:39.225458: 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: 4.7370 - f1\_score: 0.0160  
  
WARNING:absl:Found untraced functions such as \_jit\_compiled\_convolution\_op, \_jit\_compiled\_convolution\_op, gru\_cell\_layer\_call\_fn, gru\_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 18s 443ms/step - loss: 4.7370 - f1\_score: 0.0160 - val\_loss: 4.6173 - val\_f1\_score: 4.9383e-04  
Epoch 2/500  
28/28 [=====] - ETA: 0s - loss: 4.5286 - f1\_score: 0.0124

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 332ms/step - loss: 4.5286 -
f1_score: 0.0124 - val_loss: 4.4371 - val_f1_score: 7.2727e-04
Epoch 3/500
28/28 [=====] - ETA: 0s - loss: 4.3691 - f1_score:
0.0146

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 355ms/step - loss: 4.3691 -
f1_score: 0.0146 - val_loss: 4.3035 - val_f1_score: 9.6677e-04
Epoch 4/500
28/28 [=====] - ETA: 0s - loss: 4.2554 - f1_score:
0.0153

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 361ms/step - loss: 4.2554 -
f1_score: 0.0153 - val_loss: 4.2101 - val_f1_score: 0.0013
Epoch 5/500
28/28 [=====] - ETA: 0s - loss: 4.1665 - f1_score:
0.0163

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
```

```
28/28 [=====] - 10s 384ms/step - loss: 4.1665 -  
f1_score: 0.0163 - val_loss: 4.1255 - val_f1_score: 0.0048  
Epoch 6/500  
28/28 [=====] - 2s 80ms/step - loss: 4.0701 - f1_score:  
0.0128 - val_loss: 3.9964 - val_f1_score: 0.0038  
Epoch 7/500  
28/28 [=====] - 2s 80ms/step - loss: 3.9012 - f1_score:  
0.0209 - val_loss: 3.8284 - val_f1_score: 0.0039  
Epoch 8/500  
28/28 [=====] - 2s 81ms/step - loss: 3.7809 - f1_score:  
0.0231 - val_loss: 3.6863 - val_f1_score: 0.0040  
Epoch 9/500  
28/28 [=====] - ETA: 0s - loss: 3.6893 - f1_score:  
0.0303  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 369ms/step - loss: 3.6893 -  
f1_score: 0.0303 - val_loss: 3.6269 - val_f1_score: 0.0132  
Epoch 10/500  
28/28 [=====] - 2s 81ms/step - loss: 3.6175 - f1_score:  
0.0326 - val_loss: 3.5051 - val_f1_score: 0.0096  
Epoch 11/500  
28/28 [=====] - ETA: 0s - loss: 3.5367 - f1_score:  
0.0457  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 360ms/step - loss: 3.5367 -  
f1_score: 0.0457 - val_loss: 3.4997 - val_f1_score: 0.0136  
Epoch 12/500  
28/28 [=====] - ETA: 0s - loss: 3.4526 - f1_score:  
0.0444  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 353ms/step - loss: 3.4526 -
f1_score: 0.0444 - val_loss: 3.3835 - val_f1_score: 0.0273
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 3.3893 - f1_score:
0.0575

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 384ms/step - loss: 3.3893 -
f1_score: 0.0575 - val_loss: 3.3209 - val_f1_score: 0.0435
Epoch 14/500
28/28 [=====] - ETA: 0s - loss: 3.3238 - f1_score:
0.0678

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 395ms/step - loss: 3.3238 -
f1_score: 0.0678 - val_loss: 3.2943 - val_f1_score: 0.0704
Epoch 15/500
28/28 [=====] - ETA: 0s - loss: 3.2718 - f1_score:
0.0769

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 343ms/step - loss: 3.2718 -
f1_score: 0.0769 - val_loss: 3.1532 - val_f1_score: 0.0784
Epoch 16/500
28/28 [=====] - ETA: 0s - loss: 3.2098 - f1_score:
0.0718
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 9s 330ms/step - loss: 3.2098 -
f1_score: 0.0718 - val_loss: 3.1071 - val_f1_score: 0.1000
Epoch 17/500

28/28 [=====] - 2s 81ms/step - loss: 3.1328 - f1_score:
0.0952 - val_loss: 3.0329 - val_f1_score: 0.0776
Epoch 18/500

28/28 [=====] - 2s 80ms/step - loss: 3.0845 - f1_score:
0.1126 - val_loss: 3.0100 - val_f1_score: 0.0855
Epoch 19/500

28/28 [=====] - 2s 81ms/step - loss: 3.0143 - f1_score:
0.1169 - val_loss: 2.9954 - val_f1_score: 0.0787
Epoch 20/500

28/28 [=====] - ETA: 0s - loss: 2.9701 - f1_score:
0.1244

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 10s 369ms/step - loss: 2.9701 -
f1_score: 0.1244 - val_loss: 2.8706 - val_f1_score: 0.1086
Epoch 21/500

28/28 [=====] - ETA: 0s - loss: 2.9288 - f1_score:
0.1245

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 11s 396ms/step - loss: 2.9288 -
f1_score: 0.1245 - val_loss: 2.8084 - val_f1_score: 0.1418
Epoch 22/500

28/28 [=====] - ETA: 0s - loss: 2.8691 - f1_score:
0.1510
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 29s 1s/step - loss: 2.8691 - f1_score: 0.1510 - val_loss: 2.7675 - val_f1_score: 0.1526
Epoch 23/500

28/28 [=====] - 2s 80ms/step - loss: 2.8429 - f1_score: 0.1630 - val_loss: 2.7729 - val_f1_score: 0.1295
Epoch 24/500

28/28 [=====] - ETA: 0s - loss: 2.8108 - f1_score: 0.1619

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 10s 350ms/step - loss: 2.8108 - f1_score: 0.1619 - val_loss: 2.7188 - val_f1_score: 0.1636
Epoch 25/500

28/28 [=====] - ETA: 0s - loss: 2.7418 - f1_score: 0.1788

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 9s 335ms/step - loss: 2.7418 - f1_score: 0.1788 - val_loss: 2.6834 - val_f1_score: 0.1985
Epoch 26/500

28/28 [=====] - 2s 80ms/step - loss: 2.7145 - f1_score: 0.1807 - val_loss: 2.6042 - val_f1_score: 0.1938
Epoch 27/500

28/28 [=====] - 2s 81ms/step - loss: 2.6665 - f1_score: 0.1941 - val_loss: 2.7275 - val_f1_score: 0.1544
Epoch 28/500

28/28 [=====] - 2s 80ms/step - loss: 2.6462 - f1_score: 0.2076 - val_loss: 2.6000 - val_f1_score: 0.1885
```

```
Epoch 29/500
28/28 [=====] - ETA: 0s - loss: 2.6195 - f1_score: 0.2082

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 45s 2s/step - loss: 2.6195 - f1_score: 0.2082 - val_loss: 2.5583 - val_f1_score: 0.2152
Epoch 30/500
28/28 [=====] - ETA: 0s - loss: 2.5583 - f1_score: 0.2301

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 9s 334ms/step - loss: 2.5583 - f1_score: 0.2301 - val_loss: 2.4994 - val_f1_score: 0.2363
Epoch 31/500
28/28 [=====] - 2s 80ms/step - loss: 2.5259 - f1_score: 0.2378 - val_loss: 2.5686 - val_f1_score: 0.1964
Epoch 32/500
28/28 [=====] - ETA: 0s - loss: 2.4932 - f1_score: 0.2366

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 11s 420ms/step - loss: 2.4932 - f1_score: 0.2366 - val_loss: 2.4139 - val_f1_score: 0.2613
Epoch 33/500
28/28 [=====] - 2s 80ms/step - loss: 2.4570 - f1_score: 0.2506 - val_loss: 2.5075 - val_f1_score: 0.2164
Epoch 34/500
28/28 [=====] - 2s 80ms/step - loss: 2.4074 - f1_score: 0.2657 - val_loss: 2.4780 - val_f1_score: 0.2314
```

```
Epoch 35/500
28/28 [=====] - ETA: 0s - loss: 2.4075 - f1_score: 0.2719

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 35s 1s/step - loss: 2.4075 - f1_score: 0.2719 - val_loss: 2.4191 - val_f1_score: 0.2652
Epoch 36/500
28/28 [=====] - ETA: 0s - loss: 2.3652 - f1_score: 0.2702

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 8s 307ms/step - loss: 2.3652 - f1_score: 0.2702 - val_loss: 2.3671 - val_f1_score: 0.2688
Epoch 37/500
28/28 [=====] - ETA: 0s - loss: 2.3279 - f1_score: 0.2825

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 10s 354ms/step - loss: 2.3279 - f1_score: 0.2825 - val_loss: 2.3311 - val_f1_score: 0.2823
Epoch 38/500
28/28 [=====] - 2s 80ms/step - loss: 2.3610 - f1_score: 0.2852 - val_loss: 2.3262 - val_f1_score: 0.2710
Epoch 39/500
28/28 [=====] - ETA: 0s - loss: 2.2955 - f1_score: 0.2986

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
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gru_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 GRU Mish/assets  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 358ms/step - loss: 2.2955 -  
f1_score: 0.2986 - val_loss: 2.2789 - val_f1_score: 0.3274  
Epoch 40/500  
28/28 [=====] - 2s 80ms/step - loss: 2.2628 - f1_score:  
0.2973 - val_loss: 2.2557 - val_f1_score: 0.3266  
Epoch 41/500  
28/28 [=====] - 2s 80ms/step - loss: 2.2465 - f1_score:  
0.3027 - val_loss: 2.2419 - val_f1_score: 0.3024  
Epoch 42/500  
28/28 [=====] - 2s 80ms/step - loss: 2.2204 - f1_score:  
0.3122 - val_loss: 2.2596 - val_f1_score: 0.3198  
Epoch 43/500  
28/28 [=====] - 2s 81ms/step - loss: 2.1861 - f1_score:  
0.3215 - val_loss: 2.2349 - val_f1_score: 0.2941  
Epoch 44/500  
28/28 [=====] - ETA: 0s - loss: 2.1697 - f1_score:  
0.3400  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
28/28 [=====] - 10s 370ms/step - loss: 2.1697 -  
f1_score: 0.3400 - val_loss: 2.2495 - val_f1_score: 0.3344  
Epoch 45/500  
28/28 [=====] - 2s 80ms/step - loss: 2.1554 - f1_score:  
0.3392 - val_loss: 2.1676 - val_f1_score: 0.3253  
Epoch 46/500  
28/28 [=====] - 2s 81ms/step - loss: 2.1331 - f1_score:  
0.3444 - val_loss: 2.2197 - val_f1_score: 0.3268  
Epoch 47/500  
28/28 [=====] - 2s 82ms/step - loss: 2.1126 - f1_score:  
0.3539 - val_loss: 2.1526 - val_f1_score: 0.3332  
Epoch 48/500  
28/28 [=====] - ETA: 0s - loss: 2.1021 - f1_score:  
0.3414  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
```

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gru_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 360ms/step - loss: 2.1021 -  
f1_score: 0.3414 - val_loss: 2.1678 - val_f1_score: 0.3448  
Epoch 49/500  
28/28 [=====] - 2s 80ms/step - loss: 2.0807 - f1_score:  
0.3673 - val_loss: 2.1922 - val_f1_score: 0.3306  
Epoch 50/500  
28/28 [=====] - 2s 81ms/step - loss: 2.1259 - f1_score:  
0.3454 - val_loss: 2.2226 - val_f1_score: 0.3228  
Epoch 51/500  
28/28 [=====] - ETA: 0s - loss: 2.0651 - f1_score:  
0.3522  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 10s 350ms/step - loss: 2.0651 -  
f1_score: 0.3522 - val_loss: 2.1923 - val_f1_score: 0.3574  
Epoch 52/500  
28/28 [=====] - ETA: 0s - loss: 2.0379 - f1_score:  
0.3626  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets  
  
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets  
  
28/28 [=====] - 25s 923ms/step - loss: 2.0379 -  
f1_score: 0.3626 - val_loss: 2.1768 - val_f1_score: 0.3663  
Epoch 53/500  
28/28 [=====] - ETA: 0s - loss: 2.0300 - f1_score:  
0.3640  
  
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,  
_jit_compiled_convolution_op, gru_cell_layer_call_fn,  
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 9s 315ms/step - loss: 2.0300 -
f1_score: 0.3640 - val_loss: 2.1415 - val_f1_score: 0.3695
Epoch 54/500
28/28 [=====] - 2s 80ms/step - loss: 1.9992 - f1_score:
0.3818 - val_loss: 2.1922 - val_f1_score: 0.3479
Epoch 55/500
28/28 [=====] - 2s 80ms/step - loss: 1.9860 - f1_score:
0.3847 - val_loss: 2.1035 - val_f1_score: 0.3673
Epoch 56/500
28/28 [=====] - ETA: 0s - loss: 1.9741 - f1_score:
0.3840

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 358ms/step - loss: 1.9741 -
f1_score: 0.3840 - val_loss: 2.0701 - val_f1_score: 0.3819
Epoch 57/500
28/28 [=====] - 2s 80ms/step - loss: 1.9532 - f1_score:
0.3929 - val_loss: 2.1120 - val_f1_score: 0.3674
Epoch 58/500
28/28 [=====] - 2s 82ms/step - loss: 1.9262 - f1_score:
0.4092 - val_loss: 2.2125 - val_f1_score: 0.3781
Epoch 59/500
28/28 [=====] - 2s 82ms/step - loss: 1.9226 - f1_score:
0.4156 - val_loss: 2.0873 - val_f1_score: 0.3733
Epoch 60/500
28/28 [=====] - ETA: 0s - loss: 1.9143 - f1_score:
0.4065

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 11s 403ms/step - loss: 1.9143 -
f1_score: 0.4065 - val_loss: 2.1051 - val_f1_score: 0.4028
Epoch 61/500
28/28 [=====] - 2s 81ms/step - loss: 1.8875 - f1_score:
```

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0.4148 - val_loss: 2.1251 - val_f1_score: 0.3658
Epoch 62/500
28/28 [=====] - 2s 80ms/step - loss: 1.8943 - f1_score: 0.4144 - val_loss: 2.1837 - val_f1_score: 0.3881
Epoch 63/500
28/28 [=====] - 2s 81ms/step - loss: 1.8785 - f1_score: 0.4256 - val_loss: 2.0870 - val_f1_score: 0.3645
Epoch 64/500
28/28 [=====] - 2s 81ms/step - loss: 1.8589 - f1_score: 0.4150 - val_loss: 2.1380 - val_f1_score: 0.3643
Epoch 65/500
28/28 [=====] - 2s 81ms/step - loss: 1.8500 - f1_score: 0.4248 - val_loss: 2.1708 - val_f1_score: 0.3813
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 1.8625 - f1_score: 0.4181

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 10s 379ms/step - loss: 1.8625 - f1_score: 0.4181 - val_loss: 2.0488 - val_f1_score: 0.4292
Epoch 67/500
28/28 [=====] - 2s 81ms/step - loss: 1.8233 - f1_score: 0.4338 - val_loss: 2.1245 - val_f1_score: 0.3738
Epoch 68/500
28/28 [=====] - 2s 81ms/step - loss: 1.8239 - f1_score: 0.4286 - val_loss: 2.2117 - val_f1_score: 0.3633
Epoch 69/500
28/28 [=====] - 2s 81ms/step - loss: 1.8096 - f1_score: 0.4365 - val_loss: 2.3795 - val_f1_score: 0.3505
Epoch 70/500
28/28 [=====] - 2s 81ms/step - loss: 1.8217 - f1_score: 0.4337 - val_loss: 2.1578 - val_f1_score: 0.4086
Epoch 71/500
28/28 [=====] - 2s 81ms/step - loss: 1.7845 - f1_score: 0.4422 - val_loss: 2.0371 - val_f1_score: 0.3978
Epoch 72/500
28/28 [=====] - 2s 81ms/step - loss: 1.7871 - f1_score: 0.4497 - val_loss: 2.1286 - val_f1_score: 0.3978
Epoch 73/500
28/28 [=====] - 2s 81ms/step - loss: 1.7872 - f1_score: 0.4462 - val_loss: 2.1170 - val_f1_score: 0.3782
Epoch 74/500
```

```
28/28 [=====] - 2s 83ms/step - loss: 1.7625 - f1_score: 0.4430 - val_loss: 2.0820 - val_f1_score: 0.4065
Epoch 75/500
28/28 [=====] - 2s 81ms/step - loss: 1.7439 - f1_score: 0.4571 - val_loss: 2.0410 - val_f1_score: 0.4235
Epoch 76/500
28/28 [=====] - 2s 82ms/step - loss: 1.7388 - f1_score: 0.4515 - val_loss: 2.1648 - val_f1_score: 0.4046
Epoch 77/500
28/28 [=====] - 2s 81ms/step - loss: 1.7127 - f1_score: 0.4626 - val_loss: 2.1609 - val_f1_score: 0.3794
Epoch 78/500
28/28 [=====] - 2s 82ms/step - loss: 1.6937 - f1_score: 0.4729 - val_loss: 2.0791 - val_f1_score: 0.4094
Epoch 79/500
28/28 [=====] - 2s 81ms/step - loss: 1.6976 - f1_score: 0.4752 - val_loss: 2.0602 - val_f1_score: 0.4148
Epoch 80/500
28/28 [=====] - 2s 82ms/step - loss: 1.6839 - f1_score: 0.4814 - val_loss: 2.1954 - val_f1_score: 0.3783
Epoch 81/500
28/28 [=====] - 2s 82ms/step - loss: 1.6872 - f1_score: 0.4748 - val_loss: 2.1065 - val_f1_score: 0.4259
Epoch 82/500
28/28 [=====] - 2s 82ms/step - loss: 1.6728 - f1_score: 0.4711 - val_loss: 2.0973 - val_f1_score: 0.3991
Epoch 83/500
28/28 [=====] - 2s 82ms/step - loss: 1.6521 - f1_score: 0.4918 - val_loss: 2.1196 - val_f1_score: 0.4112
Epoch 84/500
28/28 [=====] - 2s 82ms/step - loss: 1.6556 - f1_score: 0.4779 - val_loss: 2.0638 - val_f1_score: 0.4242
Epoch 85/500
28/28 [=====] - 2s 82ms/step - loss: 1.6307 - f1_score: 0.4898 - val_loss: 2.1138 - val_f1_score: 0.4050
Epoch 86/500
28/28 [=====] - 2s 82ms/step - loss: 1.6415 - f1_score: 0.4734 - val_loss: 2.1489 - val_f1_score: 0.4084
Epoch 87/500
28/28 [=====] - 2s 83ms/step - loss: 1.6418 - f1_score: 0.4916 - val_loss: 2.1818 - val_f1_score: 0.3907
Epoch 88/500
28/28 [=====] - 2s 83ms/step - loss: 1.5885 - f1_score: 0.5168 - val_loss: 2.1998 - val_f1_score: 0.3928
Epoch 89/500
28/28 [=====] - 2s 82ms/step - loss: 1.5798 - f1_score: 0.5133 - val_loss: 2.0799 - val_f1_score: 0.4243
Epoch 90/500
```

```
28/28 [=====] - 2s 82ms/step - loss: 1.6110 - f1_score: 0.5031 - val_loss: 2.0788 - val_f1_score: 0.4118
Epoch 91/500
28/28 [=====] - 2s 83ms/step - loss: 1.5937 - f1_score: 0.5130 - val_loss: 2.1087 - val_f1_score: 0.4195
Epoch 92/500
28/28 [=====] - 2s 83ms/step - loss: 1.6242 - f1_score: 0.4866 - val_loss: 2.0722 - val_f1_score: 0.4228
Epoch 93/500
28/28 [=====] - 2s 82ms/step - loss: 1.5712 - f1_score: 0.5106 - val_loss: 2.1207 - val_f1_score: 0.4266
Epoch 94/500
28/28 [=====] - 2s 83ms/step - loss: 1.5999 - f1_score: 0.5031 - val_loss: 2.0866 - val_f1_score: 0.4283
Epoch 95/500
28/28 [=====] - 2s 83ms/step - loss: 1.5536 - f1_score: 0.5074 - val_loss: 2.1979 - val_f1_score: 0.4019
Epoch 96/500
28/28 [=====] - 2s 83ms/step - loss: 1.5437 - f1_score: 0.5212 - val_loss: 2.1656 - val_f1_score: 0.3994
Epoch 97/500
28/28 [=====] - 2s 83ms/step - loss: 1.5517 - f1_score: 0.5208 - val_loss: 2.1180 - val_f1_score: 0.4178
Epoch 98/500
28/28 [=====] - 2s 83ms/step - loss: 1.5464 - f1_score: 0.5249 - val_loss: 2.2041 - val_f1_score: 0.4031
Epoch 99/500
28/28 [=====] - ETA: 0s - loss: 1.5272 - f1_score: 0.5163
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op, _jit_compiled_convolution_op, gru_cell_layer_call_fn, gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 425ms/step - loss: 1.5272 - f1_score: 0.5163 - val_loss: 2.1296 - val_f1_score: 0.4296
Epoch 100/500
28/28 [=====] - 2s 81ms/step - loss: 1.5000 - f1_score: 0.5282 - val_loss: 2.2345 - val_f1_score: 0.3878
Epoch 101/500
28/28 [=====] - 2s 81ms/step - loss: 1.5115 - f1_score: 0.5203 - val_loss: 2.2230 - val_f1_score: 0.3955
Epoch 102/500
28/28 [=====] - 2s 82ms/step - loss: 1.5083 - f1_score: 0.5308 - val_loss: 2.2008 - val_f1_score: 0.4066
```

```
Epoch 103/500
28/28 [=====] - 2s 82ms/step - loss: 1.4896 - f1_score: 0.5428 - val_loss: 2.0937 - val_f1_score: 0.4208
Epoch 104/500
28/28 [=====] - 2s 82ms/step - loss: 1.4922 - f1_score: 0.5320 - val_loss: 2.2077 - val_f1_score: 0.4094
Epoch 105/500
28/28 [=====] - 2s 82ms/step - loss: 1.5163 - f1_score: 0.5261 - val_loss: 2.1362 - val_f1_score: 0.4194
Epoch 106/500
28/28 [=====] - 2s 82ms/step - loss: 1.4739 - f1_score: 0.5400 - val_loss: 2.2373 - val_f1_score: 0.4082
Epoch 107/500
28/28 [=====] - 2s 82ms/step - loss: 1.4662 - f1_score: 0.5528 - val_loss: 2.1684 - val_f1_score: 0.4274
Epoch 108/500
28/28 [=====] - 2s 83ms/step - loss: 1.4403 - f1_score: 0.5442 - val_loss: 2.1521 - val_f1_score: 0.4226
Epoch 109/500
28/28 [=====] - 2s 83ms/step - loss: 1.4672 - f1_score: 0.5399 - val_loss: 2.1642 - val_f1_score: 0.4247
Epoch 110/500
28/28 [=====] - 2s 83ms/step - loss: 1.4523 - f1_score: 0.5361 - val_loss: 2.1934 - val_f1_score: 0.4137
Epoch 111/500
28/28 [=====] - 2s 82ms/step - loss: 1.4460 - f1_score: 0.5563 - val_loss: 2.1574 - val_f1_score: 0.4168
Epoch 112/500
28/28 [=====] - 2s 83ms/step - loss: 1.4396 - f1_score: 0.5432 - val_loss: 2.2721 - val_f1_score: 0.4166
Epoch 113/500
28/28 [=====] - 2s 83ms/step - loss: 1.4286 - f1_score: 0.5618 - val_loss: 2.1576 - val_f1_score: 0.4137
Epoch 114/500
28/28 [=====] - 2s 83ms/step - loss: 1.4191 - f1_score: 0.5531 - val_loss: 2.1407 - val_f1_score: 0.4149
Epoch 115/500
28/28 [=====] - 2s 83ms/step - loss: 1.4341 - f1_score: 0.5533 - val_loss: 2.2004 - val_f1_score: 0.4011
Epoch 116/500
28/28 [=====] - ETA: 0s - loss: 1.4045 - f1_score: 0.5619

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
```

INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets

28/28 [=====] - 12s 439ms/step - loss: 1.4045 -  
f1\_score: 0.5619 - val\_loss: 2.2104 - val\_f1\_score: 0.4427  
Epoch 117/500

28/28 [=====] - 2s 82ms/step - loss: 1.3964 - f1\_score:  
0.5601 - val\_loss: 2.2329 - val\_f1\_score: 0.4269  
Epoch 118/500

28/28 [=====] - 2s 82ms/step - loss: 1.3869 - f1\_score:  
0.5711 - val\_loss: 2.1664 - val\_f1\_score: 0.4342  
Epoch 119/500

28/28 [=====] - 2s 82ms/step - loss: 1.3950 - f1\_score:  
0.5616 - val\_loss: 2.1658 - val\_f1\_score: 0.4368  
Epoch 120/500

28/28 [=====] - 2s 82ms/step - loss: 1.3628 - f1\_score:  
0.5783 - val\_loss: 2.4075 - val\_f1\_score: 0.3981  
Epoch 121/500

28/28 [=====] - 2s 84ms/step - loss: 1.3778 - f1\_score:  
0.5759 - val\_loss: 2.1535 - val\_f1\_score: 0.4214  
Epoch 122/500

28/28 [=====] - 2s 84ms/step - loss: 1.3722 - f1\_score:  
0.5665 - val\_loss: 2.2420 - val\_f1\_score: 0.4032  
Epoch 123/500

28/28 [=====] - 2s 85ms/step - loss: 1.3261 - f1\_score:  
0.5836 - val\_loss: 2.2253 - val\_f1\_score: 0.4103  
Epoch 124/500

28/28 [=====] - 2s 82ms/step - loss: 1.3473 - f1\_score:  
0.5769 - val\_loss: 2.1106 - val\_f1\_score: 0.4083  
Epoch 125/500

28/28 [=====] - 2s 83ms/step - loss: 1.3459 - f1\_score:  
0.5763 - val\_loss: 2.1997 - val\_f1\_score: 0.4022  
Epoch 126/500

28/28 [=====] - 2s 83ms/step - loss: 1.3255 - f1\_score:  
0.5894 - val\_loss: 2.2691 - val\_f1\_score: 0.4306  
Epoch 127/500

28/28 [=====] - 2s 85ms/step - loss: 1.3348 - f1\_score:  
0.5776 - val\_loss: 2.2681 - val\_f1\_score: 0.4194  
Epoch 128/500

28/28 [=====] - 2s 83ms/step - loss: 1.3258 - f1\_score:  
0.5777 - val\_loss: 2.3397 - val\_f1\_score: 0.4160  
Epoch 129/500

28/28 [=====] - 2s 83ms/step - loss: 1.3269 - f1\_score:  
0.5980 - val\_loss: 2.3214 - val\_f1\_score: 0.4228  
Epoch 130/500

28/28 [=====] - 2s 84ms/step - loss: 1.3278 - f1\_score:  
0.5901 - val\_loss: 2.3270 - val\_f1\_score: 0.4150  
Epoch 131/500

28/28 [=====] - 2s 84ms/step - loss: 1.3140 - f1\_score:

```
0.5871 - val_loss: 2.4431 - val_f1_score: 0.4069
Epoch 132/500
28/28 [=====] - 2s 84ms/step - loss: 1.3096 - f1_score: 0.5901 - val_loss: 2.2830 - val_f1_score: 0.4221
Epoch 133/500
28/28 [=====] - 2s 83ms/step - loss: 1.2741 - f1_score: 0.5988 - val_loss: 2.2668 - val_f1_score: 0.4381
Epoch 134/500
28/28 [=====] - 2s 86ms/step - loss: 1.2832 - f1_score: 0.6015 - val_loss: 2.1862 - val_f1_score: 0.4063
Epoch 135/500
28/28 [=====] - 2s 83ms/step - loss: 1.2831 - f1_score: 0.6053 - val_loss: 2.2202 - val_f1_score: 0.4090
Epoch 136/500
28/28 [=====] - 2s 83ms/step - loss: 1.2500 - f1_score: 0.6185 - val_loss: 2.2326 - val_f1_score: 0.4134
Epoch 137/500
28/28 [=====] - 2s 83ms/step - loss: 1.2538 - f1_score: 0.6074 - val_loss: 2.3589 - val_f1_score: 0.4020
Epoch 138/500
28/28 [=====] - 2s 83ms/step - loss: 1.2692 - f1_score: 0.6020 - val_loss: 2.2674 - val_f1_score: 0.4198
Epoch 139/500
28/28 [=====] - 2s 84ms/step - loss: 1.2631 - f1_score: 0.6116 - val_loss: 2.2680 - val_f1_score: 0.4249
Epoch 140/500
28/28 [=====] - 2s 84ms/step - loss: 1.2627 - f1_score: 0.6065 - val_loss: 2.2561 - val_f1_score: 0.4178
Epoch 141/500
28/28 [=====] - 2s 84ms/step - loss: 1.2516 - f1_score: 0.6103 - val_loss: 2.1835 - val_f1_score: 0.4314
Epoch 142/500
28/28 [=====] - 2s 83ms/step - loss: 1.2318 - f1_score: 0.6130 - val_loss: 2.2855 - val_f1_score: 0.4178
Epoch 143/500
28/28 [=====] - 2s 83ms/step - loss: 1.2213 - f1_score: 0.6173 - val_loss: 2.2542 - val_f1_score: 0.4161
Epoch 144/500
28/28 [=====] - 2s 84ms/step - loss: 1.2513 - f1_score: 0.6033 - val_loss: 2.2760 - val_f1_score: 0.4297
Epoch 145/500
28/28 [=====] - 2s 84ms/step - loss: 1.2392 - f1_score: 0.6089 - val_loss: 2.2695 - val_f1_score: 0.4285
Epoch 146/500
28/28 [=====] - 2s 83ms/step - loss: 1.2207 - f1_score: 0.6126 - val_loss: 2.4595 - val_f1_score: 0.4246
Epoch 147/500
28/28 [=====] - 2s 83ms/step - loss: 1.2401 - f1_score:
```

```
0.6149 - val_loss: 2.4913 - val_f1_score: 0.4021
Epoch 148/500
28/28 [=====] - 2s 84ms/step - loss: 1.2224 - f1_score:
0.6239 - val_loss: 2.4192 - val_f1_score: 0.4012
Epoch 149/500
28/28 [=====] - 2s 84ms/step - loss: 1.2195 - f1_score:
0.6250 - val_loss: 2.3941 - val_f1_score: 0.4249
Epoch 150/500
28/28 [=====] - 2s 83ms/step - loss: 1.1845 - f1_score:
0.6234 - val_loss: 2.2908 - val_f1_score: 0.4258
Epoch 151/500
28/28 [=====] - 2s 83ms/step - loss: 1.1931 - f1_score:
0.6211 - val_loss: 2.3159 - val_f1_score: 0.4165
Epoch 152/500
28/28 [=====] - 2s 84ms/step - loss: 1.1856 - f1_score:
0.6327 - val_loss: 2.2635 - val_f1_score: 0.4037
Epoch 153/500
28/28 [=====] - 2s 83ms/step - loss: 1.1733 - f1_score:
0.6335 - val_loss: 2.2729 - val_f1_score: 0.4299
Epoch 154/500
28/28 [=====] - 2s 84ms/step - loss: 1.1734 - f1_score:
0.6426 - val_loss: 2.4306 - val_f1_score: 0.4064
Epoch 155/500
28/28 [=====] - 2s 83ms/step - loss: 1.1772 - f1_score:
0.6452 - val_loss: 2.2570 - val_f1_score: 0.4135
Epoch 156/500
28/28 [=====] - 2s 83ms/step - loss: 1.1562 - f1_score:
0.6415 - val_loss: 2.5131 - val_f1_score: 0.4243
Epoch 157/500
28/28 [=====] - 2s 83ms/step - loss: 1.1669 - f1_score:
0.6319 - val_loss: 2.2907 - val_f1_score: 0.4104
Epoch 158/500
28/28 [=====] - 2s 83ms/step - loss: 1.1583 - f1_score:
0.6482 - val_loss: 2.3357 - val_f1_score: 0.4199
Epoch 159/500
28/28 [=====] - 2s 83ms/step - loss: 1.1825 - f1_score:
0.6254 - val_loss: 2.3433 - val_f1_score: 0.3938
Epoch 160/500
28/28 [=====] - 2s 84ms/step - loss: 1.1472 - f1_score:
0.6428 - val_loss: 2.2922 - val_f1_score: 0.4279
Epoch 161/500
28/28 [=====] - 2s 84ms/step - loss: 1.1349 - f1_score:
0.6453 - val_loss: 2.4255 - val_f1_score: 0.4025
Epoch 162/500
28/28 [=====] - 2s 83ms/step - loss: 1.1493 - f1_score:
0.6453 - val_loss: 2.3209 - val_f1_score: 0.4247
Epoch 163/500
28/28 [=====] - 2s 83ms/step - loss: 1.1549 - f1_score:
```

```
0.6365 - val_loss: 2.3203 - val_f1_score: 0.4100
Epoch 164/500
28/28 [=====] - 2s 84ms/step - loss: 1.1344 - f1_score: 0.6456 - val_loss: 2.3331 - val_f1_score: 0.4227
Epoch 165/500
28/28 [=====] - 2s 85ms/step - loss: 1.1305 - f1_score: 0.6500 - val_loss: 2.4027 - val_f1_score: 0.4115
Epoch 166/500
28/28 [=====] - 2s 84ms/step - loss: 1.1114 - f1_score: 0.6545 - val_loss: 2.3878 - val_f1_score: 0.4009
Epoch 167/500
28/28 [=====] - 2s 84ms/step - loss: 1.1409 - f1_score: 0.6398 - val_loss: 2.3811 - val_f1_score: 0.3934
Epoch 168/500
28/28 [=====] - 2s 84ms/step - loss: 1.1024 - f1_score: 0.6637 - val_loss: 2.3389 - val_f1_score: 0.4013
Epoch 169/500
28/28 [=====] - 2s 84ms/step - loss: 1.1227 - f1_score: 0.6571 - val_loss: 2.3371 - val_f1_score: 0.4217
Epoch 170/500
28/28 [=====] - 2s 83ms/step - loss: 1.1210 - f1_score: 0.6495 - val_loss: 2.4186 - val_f1_score: 0.4102
Epoch 171/500
28/28 [=====] - 2s 84ms/step - loss: 1.1148 - f1_score: 0.6659 - val_loss: 2.3682 - val_f1_score: 0.4204
Epoch 172/500
28/28 [=====] - 2s 84ms/step - loss: 1.1027 - f1_score: 0.6488 - val_loss: 2.5310 - val_f1_score: 0.4023
Epoch 173/500
28/28 [=====] - 2s 85ms/step - loss: 1.0900 - f1_score: 0.6767 - val_loss: 2.4186 - val_f1_score: 0.4156
Epoch 174/500
28/28 [=====] - 2s 89ms/step - loss: 1.0824 - f1_score: 0.6578 - val_loss: 2.6096 - val_f1_score: 0.4016
Epoch 175/500
28/28 [=====] - 2s 86ms/step - loss: 1.0737 - f1_score: 0.6623 - val_loss: 2.5501 - val_f1_score: 0.3945
Epoch 176/500
28/28 [=====] - 2s 87ms/step - loss: 1.0703 - f1_score: 0.6641 - val_loss: 2.4874 - val_f1_score: 0.4117
Epoch 177/500
28/28 [=====] - 2s 87ms/step - loss: 1.0754 - f1_score: 0.6750 - val_loss: 2.4185 - val_f1_score: 0.4137
Epoch 178/500
28/28 [=====] - 2s 84ms/step - loss: 1.0905 - f1_score: 0.6644 - val_loss: 2.4174 - val_f1_score: 0.3956
Epoch 179/500
28/28 [=====] - 2s 84ms/step - loss: 1.0422 - f1_score:
```

```
0.6727 - val_loss: 2.4261 - val_f1_score: 0.3945
Epoch 180/500
28/28 [=====] - 2s 84ms/step - loss: 1.0599 - f1_score: 0.6727 - val_loss: 2.4277 - val_f1_score: 0.4116
Epoch 181/500
28/28 [=====] - 3s 92ms/step - loss: 1.0609 - f1_score: 0.6610 - val_loss: 2.4528 - val_f1_score: 0.4027
Epoch 182/500
28/28 [=====] - 2s 85ms/step - loss: 1.0502 - f1_score: 0.6745 - val_loss: 2.4906 - val_f1_score: 0.3985
Epoch 183/500
28/28 [=====] - 2s 84ms/step - loss: 1.0256 - f1_score: 0.6854 - val_loss: 2.5051 - val_f1_score: 0.4017
Epoch 184/500
28/28 [=====] - ETA: 0s - loss: 1.0463 - f1_score: 0.6825
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 12s 447ms/step - loss: 1.0463 - f1_score: 0.6825 - val_loss: 2.4169 - val_f1_score: 0.4499
Epoch 185/500
28/28 [=====] - 2s 82ms/step - loss: 1.0234 - f1_score: 0.6815 - val_loss: 2.6884 - val_f1_score: 0.3855
Epoch 186/500
28/28 [=====] - 2s 82ms/step - loss: 1.0246 - f1_score: 0.6850 - val_loss: 2.3413 - val_f1_score: 0.4067
Epoch 187/500
28/28 [=====] - 2s 82ms/step - loss: 1.0271 - f1_score: 0.6897 - val_loss: 2.4802 - val_f1_score: 0.4033
Epoch 188/500
28/28 [=====] - 2s 83ms/step - loss: 1.0297 - f1_score: 0.6792 - val_loss: 2.4705 - val_f1_score: 0.4164
Epoch 189/500
28/28 [=====] - 2s 83ms/step - loss: 1.0166 - f1_score: 0.6893 - val_loss: 2.5708 - val_f1_score: 0.3865
Epoch 190/500
28/28 [=====] - 2s 83ms/step - loss: 1.0110 - f1_score: 0.6809 - val_loss: 2.5061 - val_f1_score: 0.4119
Epoch 191/500
28/28 [=====] - 2s 85ms/step - loss: 1.0085 - f1_score: 0.6842 - val_loss: 2.4218 - val_f1_score: 0.4280
Epoch 192/500
```

```
28/28 [=====] - 2s 86ms/step - loss: 0.9983 - f1_score: 0.6922 - val_loss: 2.4216 - val_f1_score: 0.4387
Epoch 193/500
28/28 [=====] - 2s 90ms/step - loss: 0.9726 - f1_score: 0.7046 - val_loss: 2.5037 - val_f1_score: 0.4208
Epoch 194/500
28/28 [=====] - 2s 88ms/step - loss: 1.0220 - f1_score: 0.6872 - val_loss: 2.5664 - val_f1_score: 0.4003
Epoch 195/500
28/28 [=====] - 3s 94ms/step - loss: 0.9989 - f1_score: 0.6962 - val_loss: 2.5128 - val_f1_score: 0.4071
Epoch 196/500
28/28 [=====] - 2s 87ms/step - loss: 0.9964 - f1_score: 0.6924 - val_loss: 2.5358 - val_f1_score: 0.4101
Epoch 197/500
28/28 [=====] - 2s 85ms/step - loss: 0.9779 - f1_score: 0.6993 - val_loss: 2.5657 - val_f1_score: 0.4033
Epoch 198/500
28/28 [=====] - 2s 85ms/step - loss: 0.9941 - f1_score: 0.6973 - val_loss: 2.5075 - val_f1_score: 0.4145
Epoch 199/500
28/28 [=====] - 3s 94ms/step - loss: 0.9656 - f1_score: 0.7029 - val_loss: 2.6412 - val_f1_score: 0.4107
Epoch 200/500
28/28 [=====] - 3s 90ms/step - loss: 0.9516 - f1_score: 0.7092 - val_loss: 2.4382 - val_f1_score: 0.3950
Epoch 201/500
28/28 [=====] - 2s 84ms/step - loss: 0.9513 - f1_score: 0.7070 - val_loss: 2.4311 - val_f1_score: 0.4262
Epoch 202/500
28/28 [=====] - 2s 84ms/step - loss: 0.9723 - f1_score: 0.7074 - val_loss: 2.4825 - val_f1_score: 0.4242
Epoch 203/500
28/28 [=====] - 2s 83ms/step - loss: 0.9601 - f1_score: 0.6950 - val_loss: 2.5737 - val_f1_score: 0.4066
Epoch 204/500
28/28 [=====] - 2s 84ms/step - loss: 0.9501 - f1_score: 0.7115 - val_loss: 2.5011 - val_f1_score: 0.4314
Epoch 205/500
28/28 [=====] - 2s 83ms/step - loss: 0.9471 - f1_score: 0.7095 - val_loss: 2.4110 - val_f1_score: 0.4259
Epoch 206/500
28/28 [=====] - 2s 84ms/step - loss: 0.9506 - f1_score: 0.7064 - val_loss: 2.5486 - val_f1_score: 0.4255
Epoch 207/500
28/28 [=====] - 2s 85ms/step - loss: 0.9490 - f1_score: 0.7192 - val_loss: 2.5699 - val_f1_score: 0.4048
Epoch 208/500
```

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28/28 [=====] - 2s 85ms/step - loss: 0.9365 - f1_score: 0.7153 - val_loss: 2.4708 - val_f1_score: 0.4224
Epoch 209/500
28/28 [=====] - 2s 83ms/step - loss: 0.9150 - f1_score: 0.7270 - val_loss: 2.7437 - val_f1_score: 0.4117
Epoch 210/500
28/28 [=====] - 2s 83ms/step - loss: 0.8971 - f1_score: 0.7306 - val_loss: 2.7016 - val_f1_score: 0.3826
Epoch 211/500
28/28 [=====] - 2s 84ms/step - loss: 0.9563 - f1_score: 0.7159 - val_loss: 2.7141 - val_f1_score: 0.3857
Epoch 212/500
28/28 [=====] - 3s 91ms/step - loss: 0.9096 - f1_score: 0.7333 - val_loss: 2.6535 - val_f1_score: 0.4114
Epoch 213/500
28/28 [=====] - 3s 94ms/step - loss: 0.9013 - f1_score: 0.7282 - val_loss: 2.5180 - val_f1_score: 0.4149
Epoch 214/500
28/28 [=====] - 3s 93ms/step - loss: 0.9435 - f1_score: 0.7050 - val_loss: 2.5838 - val_f1_score: 0.4121
Epoch 215/500
28/28 [=====] - 2s 88ms/step - loss: 0.9361 - f1_score: 0.7172 - val_loss: 2.6994 - val_f1_score: 0.3976
Epoch 216/500
28/28 [=====] - 2s 84ms/step - loss: 0.9101 - f1_score: 0.7218 - val_loss: 2.5258 - val_f1_score: 0.4061
Epoch 217/500
28/28 [=====] - 2s 87ms/step - loss: 0.9041 - f1_score: 0.7309 - val_loss: 2.6352 - val_f1_score: 0.4074
Epoch 218/500
28/28 [=====] - 2s 87ms/step - loss: 0.8901 - f1_score: 0.7311 - val_loss: 2.6219 - val_f1_score: 0.4086
Epoch 219/500
28/28 [=====] - 2s 84ms/step - loss: 0.9248 - f1_score: 0.7175 - val_loss: 2.5181 - val_f1_score: 0.4254
Epoch 220/500
28/28 [=====] - 2s 84ms/step - loss: 0.8882 - f1_score: 0.7275 - val_loss: 2.6155 - val_f1_score: 0.4014
Epoch 221/500
28/28 [=====] - 2s 84ms/step - loss: 0.8823 - f1_score: 0.7309 - val_loss: 2.4934 - val_f1_score: 0.4300
Epoch 222/500
28/28 [=====] - 2s 83ms/step - loss: 0.8532 - f1_score: 0.7448 - val_loss: 2.5739 - val_f1_score: 0.4333
Epoch 223/500
28/28 [=====] - 2s 84ms/step - loss: 0.8955 - f1_score: 0.7313 - val_loss: 2.6959 - val_f1_score: 0.4210
Epoch 224/500
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28/28 [=====] - 2s 84ms/step - loss: 0.8808 - f1_score: 0.7325 - val_loss: 2.6805 - val_f1_score: 0.4048
Epoch 225/500
28/28 [=====] - 2s 89ms/step - loss: 0.9483 - f1_score: 0.7229 - val_loss: 2.5960 - val_f1_score: 0.4470
Epoch 226/500
28/28 [=====] - 2s 86ms/step - loss: 0.8998 - f1_score: 0.7311 - val_loss: 2.7321 - val_f1_score: 0.3902
Epoch 227/500
28/28 [=====] - 2s 84ms/step - loss: 0.8580 - f1_score: 0.7375 - val_loss: 2.6763 - val_f1_score: 0.4000
Epoch 228/500
28/28 [=====] - 2s 88ms/step - loss: 0.8617 - f1_score: 0.7321 - val_loss: 2.7837 - val_f1_score: 0.4216
Epoch 229/500
28/28 [=====] - 2s 83ms/step - loss: 0.8594 - f1_score: 0.7390 - val_loss: 2.7159 - val_f1_score: 0.4012
Epoch 230/500
28/28 [=====] - 2s 85ms/step - loss: 0.9037 - f1_score: 0.7174 - val_loss: 2.6296 - val_f1_score: 0.4105
Epoch 231/500
28/28 [=====] - 2s 84ms/step - loss: 0.8263 - f1_score: 0.7648 - val_loss: 2.7801 - val_f1_score: 0.4103
Epoch 232/500
28/28 [=====] - 2s 85ms/step - loss: 0.8687 - f1_score: 0.7475 - val_loss: 2.6123 - val_f1_score: 0.4466
Epoch 233/500
28/28 [=====] - 2s 87ms/step - loss: 0.8566 - f1_score: 0.7488 - val_loss: 2.7614 - val_f1_score: 0.4074
Epoch 234/500
28/28 [=====] - 2s 83ms/step - loss: 0.8790 - f1_score: 0.7409 - val_loss: 2.8338 - val_f1_score: 0.4191
Epoch 235/500
28/28 [=====] - 2s 84ms/step - loss: 0.8268 - f1_score: 0.7585 - val_loss: 2.6288 - val_f1_score: 0.4166
Epoch 236/500
28/28 [=====] - 2s 83ms/step - loss: 0.8605 - f1_score: 0.7330 - val_loss: 2.7750 - val_f1_score: 0.4180
Epoch 237/500
28/28 [=====] - 2s 88ms/step - loss: 0.8609 - f1_score: 0.7370 - val_loss: 2.7041 - val_f1_score: 0.4233
Epoch 238/500
28/28 [=====] - 2s 84ms/step - loss: 0.8297 - f1_score: 0.7575 - val_loss: 2.8126 - val_f1_score: 0.4112
Epoch 239/500
28/28 [=====] - 2s 85ms/step - loss: 0.8417 - f1_score: 0.7566 - val_loss: 2.5675 - val_f1_score: 0.4457
Epoch 240/500
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28/28 [=====] - 3s 91ms/step - loss: 0.8323 - f1_score: 0.7478 - val_loss: 2.7445 - val_f1_score: 0.3976
Epoch 241/500
28/28 [=====] - 2s 89ms/step - loss: 0.8047 - f1_score: 0.7620 - val_loss: 2.7459 - val_f1_score: 0.4092
Epoch 242/500
28/28 [=====] - 2s 86ms/step - loss: 0.7946 - f1_score: 0.7573 - val_loss: 2.7932 - val_f1_score: 0.4127
Epoch 243/500
28/28 [=====] - 2s 87ms/step - loss: 0.8091 - f1_score: 0.7492 - val_loss: 2.7812 - val_f1_score: 0.3919
Epoch 244/500
28/28 [=====] - 3s 92ms/step - loss: 0.8235 - f1_score: 0.7539 - val_loss: 2.7906 - val_f1_score: 0.4097
Epoch 245/500
28/28 [=====] - 3s 94ms/step - loss: 0.7747 - f1_score: 0.7657 - val_loss: 2.7319 - val_f1_score: 0.4128
Epoch 246/500
28/28 [=====] - 3s 90ms/step - loss: 0.8149 - f1_score: 0.7566 - val_loss: 2.7466 - val_f1_score: 0.4008
Epoch 247/500
28/28 [=====] - 2s 87ms/step - loss: 0.8041 - f1_score: 0.7650 - val_loss: 2.6283 - val_f1_score: 0.3970
Epoch 248/500
28/28 [=====] - 2s 85ms/step - loss: 0.7745 - f1_score: 0.7706 - val_loss: 2.8752 - val_f1_score: 0.3949
Epoch 249/500
28/28 [=====] - 3s 94ms/step - loss: 0.7814 - f1_score: 0.7713 - val_loss: 2.7561 - val_f1_score: 0.4020
Epoch 250/500
28/28 [=====] - 3s 91ms/step - loss: 0.8017 - f1_score: 0.7640 - val_loss: 2.7761 - val_f1_score: 0.4246
Epoch 251/500
28/28 [=====] - 2s 88ms/step - loss: 0.7686 - f1_score: 0.7794 - val_loss: 2.7318 - val_f1_score: 0.4232
Epoch 252/500
28/28 [=====] - 2s 89ms/step - loss: 0.7620 - f1_score: 0.7725 - val_loss: 2.9905 - val_f1_score: 0.4266
Epoch 253/500
28/28 [=====] - 3s 91ms/step - loss: 0.7756 - f1_score: 0.7716 - val_loss: 2.8449 - val_f1_score: 0.4145
Epoch 254/500
28/28 [=====] - 2s 86ms/step - loss: 0.7897 - f1_score: 0.7573 - val_loss: 2.7996 - val_f1_score: 0.4179
Epoch 255/500
28/28 [=====] - 2s 85ms/step - loss: 0.7851 - f1_score: 0.7544 - val_loss: 2.7338 - val_f1_score: 0.4121
Epoch 256/500
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28/28 [=====] - 2s 88ms/step - loss: 0.7667 - f1_score: 0.7791 - val_loss: 2.9832 - val_f1_score: 0.4162
Epoch 257/500
28/28 [=====] - 3s 100ms/step - loss: 0.7472 - f1_score: 0.7778 - val_loss: 2.6805 - val_f1_score: 0.4346
Epoch 258/500
28/28 [=====] - 2s 87ms/step - loss: 0.7678 - f1_score: 0.7641 - val_loss: 2.8594 - val_f1_score: 0.4144
Epoch 259/500
28/28 [=====] - 2s 86ms/step - loss: 0.7567 - f1_score: 0.7861 - val_loss: 2.9644 - val_f1_score: 0.4161
Epoch 260/500
28/28 [=====] - 2s 84ms/step - loss: 0.7631 - f1_score: 0.7777 - val_loss: 2.8321 - val_f1_score: 0.4067
Epoch 261/500
28/28 [=====] - 2s 85ms/step - loss: 0.7519 - f1_score: 0.7753 - val_loss: 2.8725 - val_f1_score: 0.4379
Epoch 262/500
28/28 [=====] - 2s 83ms/step - loss: 0.7695 - f1_score: 0.7776 - val_loss: 2.8799 - val_f1_score: 0.3956
Epoch 263/500
28/28 [=====] - 2s 84ms/step - loss: 0.7631 - f1_score: 0.7775 - val_loss: 2.8242 - val_f1_score: 0.4123
Epoch 264/500
28/28 [=====] - 2s 83ms/step - loss: 0.7570 - f1_score: 0.7739 - val_loss: 2.8336 - val_f1_score: 0.4208
Epoch 265/500
28/28 [=====] - 2s 84ms/step - loss: 0.7418 - f1_score: 0.7858 - val_loss: 2.8724 - val_f1_score: 0.4000
Epoch 266/500
28/28 [=====] - 2s 83ms/step - loss: 0.7293 - f1_score: 0.7908 - val_loss: 2.9508 - val_f1_score: 0.3973
Epoch 267/500
28/28 [=====] - 2s 86ms/step - loss: 0.7423 - f1_score: 0.7751 - val_loss: 2.8462 - val_f1_score: 0.3905
Epoch 268/500
28/28 [=====] - 2s 88ms/step - loss: 0.7705 - f1_score: 0.7757 - val_loss: 3.0011 - val_f1_score: 0.4230
Epoch 269/500
28/28 [=====] - 2s 89ms/step - loss: 0.7533 - f1_score: 0.7738 - val_loss: 2.7264 - val_f1_score: 0.4115
Epoch 270/500
28/28 [=====] - 2s 89ms/step - loss: 0.7135 - f1_score: 0.7936 - val_loss: 2.8834 - val_f1_score: 0.4111
Epoch 271/500
28/28 [=====] - 2s 84ms/step - loss: 0.6836 - f1_score: 0.8015 - val_loss: 2.8192 - val_f1_score: 0.4311
Epoch 272/500
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28/28 [=====] - 3s 91ms/step - loss: 0.7153 - f1_score: 0.7990 - val_loss: 2.8725 - val_f1_score: 0.4217
Epoch 273/500
28/28 [=====] - 3s 92ms/step - loss: 0.7569 - f1_score: 0.7667 - val_loss: 2.8433 - val_f1_score: 0.4136
Epoch 274/500
28/28 [=====] - 2s 86ms/step - loss: 0.7021 - f1_score: 0.7919 - val_loss: 2.8499 - val_f1_score: 0.4131
Epoch 275/500
28/28 [=====] - 2s 86ms/step - loss: 0.7293 - f1_score: 0.7864 - val_loss: 3.0185 - val_f1_score: 0.4186
Epoch 276/500
28/28 [=====] - 2s 84ms/step - loss: 0.7299 - f1_score: 0.7841 - val_loss: 2.9572 - val_f1_score: 0.4260
Epoch 277/500
28/28 [=====] - 2s 84ms/step - loss: 0.7206 - f1_score: 0.7897 - val_loss: 2.9909 - val_f1_score: 0.4164
Epoch 278/500
28/28 [=====] - 2s 84ms/step - loss: 0.7075 - f1_score: 0.7885 - val_loss: 2.8764 - val_f1_score: 0.4425
Epoch 279/500
28/28 [=====] - 2s 83ms/step - loss: 0.6810 - f1_score: 0.8034 - val_loss: 2.9360 - val_f1_score: 0.4176
Epoch 280/500
28/28 [=====] - 2s 83ms/step - loss: 0.7170 - f1_score: 0.7847 - val_loss: 3.1333 - val_f1_score: 0.4170
Epoch 281/500
28/28 [=====] - 2s 84ms/step - loss: 0.7146 - f1_score: 0.7967 - val_loss: 2.8300 - val_f1_score: 0.4264
Epoch 282/500
28/28 [=====] - 2s 84ms/step - loss: 0.6923 - f1_score: 0.7925 - val_loss: 2.8420 - val_f1_score: 0.4130
Epoch 283/500
28/28 [=====] - 2s 84ms/step - loss: 0.7202 - f1_score: 0.7868 - val_loss: 3.0480 - val_f1_score: 0.3822
Epoch 284/500
28/28 [=====] - 2s 85ms/step - loss: 0.7096 - f1_score: 0.7897 - val_loss: 2.9467 - val_f1_score: 0.4291
Epoch 285/500
28/28 [=====] - 2s 84ms/step - loss: 0.7200 - f1_score: 0.7919 - val_loss: 3.0813 - val_f1_score: 0.4030
Epoch 286/500
28/28 [=====] - 2s 84ms/step - loss: 0.6783 - f1_score: 0.8002 - val_loss: 2.8942 - val_f1_score: 0.4111
Epoch 287/500
28/28 [=====] - 2s 83ms/step - loss: 0.7157 - f1_score: 0.7824 - val_loss: 3.1050 - val_f1_score: 0.4196
Epoch 288/500
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28/28 [=====] - 2s 83ms/step - loss: 0.6990 - f1_score: 0.8084 - val_loss: 3.0622 - val_f1_score: 0.3842
Epoch 289/500
28/28 [=====] - 2s 83ms/step - loss: 0.6762 - f1_score: 0.8028 - val_loss: 2.9843 - val_f1_score: 0.3923
Epoch 290/500
28/28 [=====] - 2s 86ms/step - loss: 0.6947 - f1_score: 0.7988 - val_loss: 3.0014 - val_f1_score: 0.4081
Epoch 291/500
28/28 [=====] - 2s 84ms/step - loss: 0.6857 - f1_score: 0.8012 - val_loss: 3.0908 - val_f1_score: 0.3834
Epoch 292/500
28/28 [=====] - 2s 84ms/step - loss: 0.7638 - f1_score: 0.7777 - val_loss: 2.9564 - val_f1_score: 0.4098
Epoch 293/500
28/28 [=====] - 2s 84ms/step - loss: 0.6782 - f1_score: 0.8090 - val_loss: 3.0573 - val_f1_score: 0.4112
Epoch 294/500
28/28 [=====] - 2s 84ms/step - loss: 0.6632 - f1_score: 0.8038 - val_loss: 3.0873 - val_f1_score: 0.4213
Epoch 295/500
28/28 [=====] - 2s 85ms/step - loss: 0.6640 - f1_score: 0.8020 - val_loss: 3.1774 - val_f1_score: 0.4078
Epoch 296/500
28/28 [=====] - 3s 91ms/step - loss: 0.6856 - f1_score: 0.7980 - val_loss: 3.0304 - val_f1_score: 0.4056
Epoch 297/500
28/28 [=====] - 2s 85ms/step - loss: 0.6621 - f1_score: 0.8059 - val_loss: 3.0510 - val_f1_score: 0.4122
Epoch 298/500
28/28 [=====] - 2s 84ms/step - loss: 0.6525 - f1_score: 0.8097 - val_loss: 3.0292 - val_f1_score: 0.4326
Epoch 299/500
28/28 [=====] - 2s 85ms/step - loss: 0.6944 - f1_score: 0.7938 - val_loss: 3.0275 - val_f1_score: 0.4233
Epoch 300/500
28/28 [=====] - 2s 87ms/step - loss: 0.6542 - f1_score: 0.8178 - val_loss: 3.0562 - val_f1_score: 0.4305
Epoch 301/500
28/28 [=====] - 2s 86ms/step - loss: 0.6422 - f1_score: 0.8167 - val_loss: 3.0471 - val_f1_score: 0.4307
Epoch 302/500
28/28 [=====] - 2s 85ms/step - loss: 0.6758 - f1_score: 0.7986 - val_loss: 3.1666 - val_f1_score: 0.4122
Epoch 303/500
28/28 [=====] - 2s 87ms/step - loss: 0.6540 - f1_score: 0.8126 - val_loss: 3.0733 - val_f1_score: 0.4190
Epoch 304/500
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28/28 [=====] - 2s 89ms/step - loss: 0.6617 - f1_score: 0.8125 - val_loss: 3.0346 - val_f1_score: 0.4089
Epoch 305/500
28/28 [=====] - 2s 85ms/step - loss: 0.6658 - f1_score: 0.8055 - val_loss: 2.9613 - val_f1_score: 0.4227
Epoch 306/500
28/28 [=====] - 2s 84ms/step - loss: 0.6729 - f1_score: 0.8002 - val_loss: 3.0600 - val_f1_score: 0.4194
Epoch 307/500
28/28 [=====] - 2s 85ms/step - loss: 0.6455 - f1_score: 0.8122 - val_loss: 3.1165 - val_f1_score: 0.4001
Epoch 308/500
28/28 [=====] - 2s 84ms/step - loss: 0.6393 - f1_score: 0.8274 - val_loss: 3.1351 - val_f1_score: 0.4193
Epoch 309/500
28/28 [=====] - 2s 85ms/step - loss: 0.6366 - f1_score: 0.8189 - val_loss: 3.2826 - val_f1_score: 0.4212
Epoch 310/500
28/28 [=====] - 2s 86ms/step - loss: 0.6209 - f1_score: 0.8204 - val_loss: 3.2062 - val_f1_score: 0.4134
Epoch 311/500
28/28 [=====] - 2s 85ms/step - loss: 0.6144 - f1_score: 0.8275 - val_loss: 3.4169 - val_f1_score: 0.4143
Epoch 312/500
28/28 [=====] - 2s 86ms/step - loss: 0.6592 - f1_score: 0.8132 - val_loss: 3.1118 - val_f1_score: 0.4210
Epoch 313/500
28/28 [=====] - 2s 87ms/step - loss: 0.6195 - f1_score: 0.8279 - val_loss: 3.1243 - val_f1_score: 0.4266
Epoch 314/500
28/28 [=====] - 3s 92ms/step - loss: 0.6388 - f1_score: 0.8164 - val_loss: 3.1155 - val_f1_score: 0.3930
Epoch 315/500
28/28 [=====] - 3s 90ms/step - loss: 0.6320 - f1_score: 0.8096 - val_loss: 3.0743 - val_f1_score: 0.4198
Epoch 316/500
28/28 [=====] - 2s 87ms/step - loss: 0.6231 - f1_score: 0.8250 - val_loss: 2.9908 - val_f1_score: 0.4377
Epoch 317/500
28/28 [=====] - 3s 90ms/step - loss: 0.5990 - f1_score: 0.8301 - val_loss: 3.2842 - val_f1_score: 0.4197
Epoch 318/500
28/28 [=====] - 2s 88ms/step - loss: 0.6224 - f1_score: 0.8251 - val_loss: 3.2975 - val_f1_score: 0.3943
Epoch 319/500
28/28 [=====] - 3s 91ms/step - loss: 0.6143 - f1_score: 0.8227 - val_loss: 3.0527 - val_f1_score: 0.4380
Epoch 320/500
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28/28 [=====] - 2s 86ms/step - loss: 0.6054 - f1_score: 0.8294 - val_loss: 3.1268 - val_f1_score: 0.3955
Epoch 321/500
28/28 [=====] - 2s 85ms/step - loss: 0.6154 - f1_score: 0.8293 - val_loss: 3.1494 - val_f1_score: 0.4272
Epoch 322/500
28/28 [=====] - 2s 85ms/step - loss: 0.6467 - f1_score: 0.8142 - val_loss: 3.0877 - val_f1_score: 0.4220
Epoch 323/500
28/28 [=====] - 2s 85ms/step - loss: 0.6368 - f1_score: 0.8190 - val_loss: 3.0417 - val_f1_score: 0.4184
Epoch 324/500
28/28 [=====] - 2s 85ms/step - loss: 0.6396 - f1_score: 0.8170 - val_loss: 3.1921 - val_f1_score: 0.4037
Epoch 325/500
28/28 [=====] - 2s 85ms/step - loss: 0.6384 - f1_score: 0.8123 - val_loss: 3.1325 - val_f1_score: 0.3990
Epoch 326/500
28/28 [=====] - 2s 85ms/step - loss: 0.6064 - f1_score: 0.8298 - val_loss: 3.2827 - val_f1_score: 0.4224
Epoch 327/500
28/28 [=====] - 2s 85ms/step - loss: 0.6090 - f1_score: 0.8181 - val_loss: 3.1612 - val_f1_score: 0.4155
Epoch 328/500
28/28 [=====] - 2s 84ms/step - loss: 0.5973 - f1_score: 0.8353 - val_loss: 3.2499 - val_f1_score: 0.4076
Epoch 329/500
28/28 [=====] - 2s 88ms/step - loss: 0.5870 - f1_score: 0.8373 - val_loss: 3.2749 - val_f1_score: 0.3974
Epoch 330/500
28/28 [=====] - 2s 89ms/step - loss: 0.6099 - f1_score: 0.8223 - val_loss: 3.2481 - val_f1_score: 0.4261
Epoch 331/500
28/28 [=====] - 2s 85ms/step - loss: 0.5857 - f1_score: 0.8416 - val_loss: 3.1709 - val_f1_score: 0.3947
Epoch 332/500
28/28 [=====] - 2s 87ms/step - loss: 0.5998 - f1_score: 0.8272 - val_loss: 3.3494 - val_f1_score: 0.4224
Epoch 333/500
28/28 [=====] - 2s 85ms/step - loss: 0.6037 - f1_score: 0.8239 - val_loss: 3.3135 - val_f1_score: 0.4097
Epoch 334/500
28/28 [=====] - 2s 86ms/step - loss: 0.5861 - f1_score: 0.8387 - val_loss: 3.3619 - val_f1_score: 0.4107
Epoch 335/500
28/28 [=====] - 2s 84ms/step - loss: 0.5892 - f1_score: 0.8376 - val_loss: 3.3531 - val_f1_score: 0.4220
Epoch 336/500
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28/28 [=====] - 2s 86ms/step - loss: 0.5847 - f1_score: 0.8355 - val_loss: 3.2627 - val_f1_score: 0.3904
Epoch 337/500
28/28 [=====] - 2s 86ms/step - loss: 0.5822 - f1_score: 0.8405 - val_loss: 3.3436 - val_f1_score: 0.4151
Epoch 338/500
28/28 [=====] - 2s 85ms/step - loss: 0.5889 - f1_score: 0.8340 - val_loss: 3.4260 - val_f1_score: 0.4022
Epoch 339/500
28/28 [=====] - 2s 87ms/step - loss: 0.6333 - f1_score: 0.8287 - val_loss: 3.3368 - val_f1_score: 0.4287
Epoch 340/500
28/28 [=====] - 2s 86ms/step - loss: 0.6004 - f1_score: 0.8334 - val_loss: 3.2326 - val_f1_score: 0.4391
Epoch 341/500
28/28 [=====] - 2s 86ms/step - loss: 0.6014 - f1_score: 0.8290 - val_loss: 3.3149 - val_f1_score: 0.4150
Epoch 342/500
28/28 [=====] - 3s 91ms/step - loss: 0.5787 - f1_score: 0.8340 - val_loss: 3.2695 - val_f1_score: 0.4233
Epoch 343/500
28/28 [=====] - 3s 91ms/step - loss: 0.5929 - f1_score: 0.8321 - val_loss: 3.2806 - val_f1_score: 0.4051
Epoch 344/500
28/28 [=====] - 3s 90ms/step - loss: 0.5670 - f1_score: 0.8391 - val_loss: 3.3420 - val_f1_score: 0.4114
Epoch 345/500
28/28 [=====] - 3s 91ms/step - loss: 0.5603 - f1_score: 0.8558 - val_loss: 3.6122 - val_f1_score: 0.3912
Epoch 346/500
28/28 [=====] - 2s 88ms/step - loss: 0.5709 - f1_score: 0.8401 - val_loss: 3.3365 - val_f1_score: 0.4310
Epoch 347/500
28/28 [=====] - 2s 86ms/step - loss: 0.5926 - f1_score: 0.8357 - val_loss: 3.2280 - val_f1_score: 0.4345
Epoch 348/500
28/28 [=====] - 2s 86ms/step - loss: 0.5717 - f1_score: 0.8331 - val_loss: 3.1749 - val_f1_score: 0.4476
Epoch 349/500
28/28 [=====] - 2s 85ms/step - loss: 0.6139 - f1_score: 0.8287 - val_loss: 3.4460 - val_f1_score: 0.4405
Epoch 350/500
28/28 [=====] - 2s 86ms/step - loss: 0.5819 - f1_score: 0.8340 - val_loss: 3.3785 - val_f1_score: 0.4267
Epoch 351/500
28/28 [=====] - 2s 86ms/step - loss: 0.5647 - f1_score: 0.8417 - val_loss: 3.3319 - val_f1_score: 0.4288
Epoch 352/500
```

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28/28 [=====] - 2s 85ms/step - loss: 0.5819 - f1_score: 0.8366 - val_loss: 3.3828 - val_f1_score: 0.4117
Epoch 353/500
28/28 [=====] - 2s 87ms/step - loss: 0.5669 - f1_score: 0.8426 - val_loss: 3.3544 - val_f1_score: 0.4165
Epoch 354/500
28/28 [=====] - 2s 86ms/step - loss: 0.5473 - f1_score: 0.8502 - val_loss: 3.3337 - val_f1_score: 0.4297
Epoch 355/500
28/28 [=====] - 2s 85ms/step - loss: 0.5586 - f1_score: 0.8464 - val_loss: 3.3534 - val_f1_score: 0.4139
Epoch 356/500
28/28 [=====] - 2s 87ms/step - loss: 0.5461 - f1_score: 0.8449 - val_loss: 3.2167 - val_f1_score: 0.4346
Epoch 357/500
28/28 [=====] - 2s 85ms/step - loss: 0.5565 - f1_score: 0.8439 - val_loss: 3.3182 - val_f1_score: 0.4349
Epoch 358/500
28/28 [=====] - 2s 85ms/step - loss: 0.5409 - f1_score: 0.8498 - val_loss: 3.3991 - val_f1_score: 0.4380
Epoch 359/500
28/28 [=====] - 2s 87ms/step - loss: 0.5635 - f1_score: 0.8448 - val_loss: 3.2095 - val_f1_score: 0.4344
Epoch 360/500
28/28 [=====] - 2s 86ms/step - loss: 0.5776 - f1_score: 0.8366 - val_loss: 3.3203 - val_f1_score: 0.4290
Epoch 361/500
28/28 [=====] - 2s 85ms/step - loss: 0.5474 - f1_score: 0.8429 - val_loss: 3.4664 - val_f1_score: 0.4207
Epoch 362/500
28/28 [=====] - 2s 86ms/step - loss: 0.5258 - f1_score: 0.8544 - val_loss: 3.2189 - val_f1_score: 0.4226
Epoch 363/500
28/28 [=====] - 2s 87ms/step - loss: 0.5441 - f1_score: 0.8480 - val_loss: 3.4088 - val_f1_score: 0.4262
Epoch 364/500
28/28 [=====] - 2s 87ms/step - loss: 0.5668 - f1_score: 0.8426 - val_loss: 3.3664 - val_f1_score: 0.4142
Epoch 365/500
28/28 [=====] - 2s 86ms/step - loss: 0.5017 - f1_score: 0.8611 - val_loss: 3.4288 - val_f1_score: 0.4164
Epoch 366/500
28/28 [=====] - 2s 86ms/step - loss: 0.5308 - f1_score: 0.8464 - val_loss: 3.3395 - val_f1_score: 0.4230
Epoch 367/500
28/28 [=====] - 2s 87ms/step - loss: 0.5205 - f1_score: 0.8551 - val_loss: 3.4389 - val_f1_score: 0.4358
Epoch 368/500
```

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28/28 [=====] - 2s 86ms/step - loss: 0.5459 - f1_score: 0.8453 - val_loss: 3.4342 - val_f1_score: 0.4286
Epoch 369/500
28/28 [=====] - 2s 86ms/step - loss: 0.5597 - f1_score: 0.8426 - val_loss: 3.5328 - val_f1_score: 0.4140
Epoch 370/500
28/28 [=====] - 2s 86ms/step - loss: 0.5366 - f1_score: 0.8520 - val_loss: 3.6434 - val_f1_score: 0.4036
Epoch 371/500
28/28 [=====] - 2s 86ms/step - loss: 0.5660 - f1_score: 0.8411 - val_loss: 3.3684 - val_f1_score: 0.4167
Epoch 372/500
28/28 [=====] - 2s 85ms/step - loss: 0.5516 - f1_score: 0.8460 - val_loss: 3.6047 - val_f1_score: 0.4134
Epoch 373/500
28/28 [=====] - 2s 88ms/step - loss: 0.5414 - f1_score: 0.8456 - val_loss: 3.5477 - val_f1_score: 0.4236
Epoch 374/500
28/28 [=====] - 2s 87ms/step - loss: 0.5296 - f1_score: 0.8574 - val_loss: 3.4284 - val_f1_score: 0.4034
Epoch 375/500
28/28 [=====] - 2s 87ms/step - loss: 0.5277 - f1_score: 0.8513 - val_loss: 3.5048 - val_f1_score: 0.4252
Epoch 376/500
28/28 [=====] - 2s 88ms/step - loss: 0.5359 - f1_score: 0.8533 - val_loss: 3.4197 - val_f1_score: 0.4200
Epoch 377/500
28/28 [=====] - 2s 86ms/step - loss: 0.5543 - f1_score: 0.8413 - val_loss: 3.8409 - val_f1_score: 0.3819
Epoch 378/500
28/28 [=====] - 2s 88ms/step - loss: 0.5248 - f1_score: 0.8610 - val_loss: 3.3885 - val_f1_score: 0.4164
Epoch 379/500
28/28 [=====] - 2s 89ms/step - loss: 0.5123 - f1_score: 0.8520 - val_loss: 3.4618 - val_f1_score: 0.3931
Epoch 380/500
28/28 [=====] - 2s 87ms/step - loss: 0.5210 - f1_score: 0.8676 - val_loss: 3.3666 - val_f1_score: 0.4093
Epoch 381/500
28/28 [=====] - 2s 87ms/step - loss: 0.5457 - f1_score: 0.8504 - val_loss: 3.3591 - val_f1_score: 0.4189
Epoch 382/500
28/28 [=====] - 3s 90ms/step - loss: 0.5348 - f1_score: 0.8589 - val_loss: 3.3162 - val_f1_score: 0.4202
Epoch 383/500
28/28 [=====] - ETA: 0s - loss: 0.5085 - f1_score: 0.8619
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 13s 490ms/step - loss: 0.5085 - f1_score: 0.8619 - val_loss: 3.3786 - val_f1_score: 0.4514
Epoch 384/500
28/28 [=====] - 2s 87ms/step - loss: 0.4808 - f1_score: 0.8729 - val_loss: 3.4980 - val_f1_score: 0.4140
Epoch 385/500
28/28 [=====] - 2s 84ms/step - loss: 0.4892 - f1_score: 0.8685 - val_loss: 3.4666 - val_f1_score: 0.4155
Epoch 386/500
28/28 [=====] - 2s 85ms/step - loss: 0.5284 - f1_score: 0.8491 - val_loss: 3.4880 - val_f1_score: 0.4206
Epoch 387/500
28/28 [=====] - 2s 86ms/step - loss: 0.5207 - f1_score: 0.8559 - val_loss: 3.4374 - val_f1_score: 0.4332
Epoch 388/500
28/28 [=====] - 2s 85ms/step - loss: 0.5000 - f1_score: 0.8665 - val_loss: 3.3558 - val_f1_score: 0.4220
Epoch 389/500
28/28 [=====] - 2s 87ms/step - loss: 0.4881 - f1_score: 0.8641 - val_loss: 3.4617 - val_f1_score: 0.4117
Epoch 390/500
28/28 [=====] - 2s 86ms/step - loss: 0.5070 - f1_score: 0.8602 - val_loss: 3.3594 - val_f1_score: 0.4081
Epoch 391/500
28/28 [=====] - 2s 86ms/step - loss: 0.4836 - f1_score: 0.8769 - val_loss: 3.3728 - val_f1_score: 0.4045
Epoch 392/500
28/28 [=====] - 2s 88ms/step - loss: 0.5060 - f1_score: 0.8578 - val_loss: 3.5159 - val_f1_score: 0.3940
Epoch 393/500
28/28 [=====] - 2s 86ms/step - loss: 0.5005 - f1_score: 0.8644 - val_loss: 3.6487 - val_f1_score: 0.3955
Epoch 394/500
28/28 [=====] - 2s 85ms/step - loss: 0.5579 - f1_score: 0.8456 - val_loss: 3.4688 - val_f1_score: 0.4222
Epoch 395/500
28/28 [=====] - 2s 89ms/step - loss: 0.5385 - f1_score: 0.8407 - val_loss: 3.4891 - val_f1_score: 0.4446
Epoch 396/500
28/28 [=====] - 3s 92ms/step - loss: 0.5302 - f1_score:
```

```
0.8525 - val_loss: 3.9456 - val_f1_score: 0.3988
Epoch 397/500
28/28 [=====] - 3s 90ms/step - loss: 0.5391 - f1_score:
0.8526 - val_loss: 3.5364 - val_f1_score: 0.4374
Epoch 398/500
28/28 [=====] - 2s 87ms/step - loss: 0.5225 - f1_score:
0.8545 - val_loss: 3.5167 - val_f1_score: 0.4270
Epoch 399/500
28/28 [=====] - 2s 86ms/step - loss: 0.4865 - f1_score:
0.8713 - val_loss: 3.7697 - val_f1_score: 0.4155
Epoch 400/500
28/28 [=====] - 2s 88ms/step - loss: 0.5060 - f1_score:
0.8644 - val_loss: 3.4500 - val_f1_score: 0.4303
Epoch 401/500
28/28 [=====] - 2s 87ms/step - loss: 0.4773 - f1_score:
0.8756 - val_loss: 3.7048 - val_f1_score: 0.4167
Epoch 402/500
28/28 [=====] - 2s 86ms/step - loss: 0.4756 - f1_score:
0.8754 - val_loss: 3.8554 - val_f1_score: 0.4060
Epoch 403/500
28/28 [=====] - 2s 88ms/step - loss: 0.5025 - f1_score:
0.8637 - val_loss: 3.5182 - val_f1_score: 0.4103
Epoch 404/500
28/28 [=====] - 2s 87ms/step - loss: 0.4687 - f1_score:
0.8728 - val_loss: 3.4697 - val_f1_score: 0.4225
Epoch 405/500
28/28 [=====] - 2s 87ms/step - loss: 0.4615 - f1_score:
0.8736 - val_loss: 3.5145 - val_f1_score: 0.4142
Epoch 406/500
28/28 [=====] - 2s 87ms/step - loss: 0.4901 - f1_score:
0.8736 - val_loss: 3.4136 - val_f1_score: 0.4412
Epoch 407/500
28/28 [=====] - 2s 89ms/step - loss: 0.4949 - f1_score:
0.8609 - val_loss: 3.6345 - val_f1_score: 0.4350
Epoch 408/500
28/28 [=====] - 2s 87ms/step - loss: 0.4511 - f1_score:
0.8850 - val_loss: 3.7054 - val_f1_score: 0.4261
Epoch 409/500
28/28 [=====] - 2s 88ms/step - loss: 0.4887 - f1_score:
0.8674 - val_loss: 3.4449 - val_f1_score: 0.4391
Epoch 410/500
28/28 [=====] - 2s 88ms/step - loss: 0.4634 - f1_score:
0.8736 - val_loss: 3.6299 - val_f1_score: 0.4357
Epoch 411/500
28/28 [=====] - 2s 88ms/step - loss: 0.4708 - f1_score:
0.8837 - val_loss: 3.5781 - val_f1_score: 0.4155
Epoch 412/500
28/28 [=====] - 3s 90ms/step - loss: 0.4601 - f1_score:
```

```
0.8750 - val_loss: 3.4460 - val_f1_score: 0.4235
Epoch 413/500
28/28 [=====] - 3s 91ms/step - loss: 0.4760 - f1_score:
0.8755 - val_loss: 3.5552 - val_f1_score: 0.4234
Epoch 414/500
28/28 [=====] - 3s 92ms/step - loss: 0.4648 - f1_score:
0.8685 - val_loss: 3.6294 - val_f1_score: 0.4286
Epoch 415/500
28/28 [=====] - 3s 92ms/step - loss: 0.4857 - f1_score:
0.8715 - val_loss: 3.6001 - val_f1_score: 0.4041
Epoch 416/500
28/28 [=====] - 3s 93ms/step - loss: 0.4627 - f1_score:
0.8768 - val_loss: 3.5561 - val_f1_score: 0.4368
Epoch 417/500
28/28 [=====] - 2s 87ms/step - loss: 0.4595 - f1_score:
0.8783 - val_loss: 3.6821 - val_f1_score: 0.4225
Epoch 418/500
28/28 [=====] - 2s 88ms/step - loss: 0.4731 - f1_score:
0.8749 - val_loss: 3.6834 - val_f1_score: 0.4174
Epoch 419/500
28/28 [=====] - 2s 89ms/step - loss: 0.4911 - f1_score:
0.8661 - val_loss: 3.5356 - val_f1_score: 0.4414
Epoch 420/500
28/28 [=====] - 2s 88ms/step - loss: 0.4926 - f1_score:
0.8676 - val_loss: 3.6681 - val_f1_score: 0.4203
Epoch 421/500
28/28 [=====] - 2s 87ms/step - loss: 0.4552 - f1_score:
0.8893 - val_loss: 3.4548 - val_f1_score: 0.4505
Epoch 422/500
28/28 [=====] - 2s 87ms/step - loss: 0.4952 - f1_score:
0.8560 - val_loss: 3.6373 - val_f1_score: 0.4368
Epoch 423/500
28/28 [=====] - 2s 89ms/step - loss: 0.5938 - f1_score:
0.8297 - val_loss: 3.5201 - val_f1_score: 0.4389
Epoch 424/500
28/28 [=====] - 2s 87ms/step - loss: 0.5004 - f1_score:
0.8597 - val_loss: 3.7565 - val_f1_score: 0.4154
Epoch 425/500
28/28 [=====] - 2s 88ms/step - loss: 0.4662 - f1_score:
0.8781 - val_loss: 3.6933 - val_f1_score: 0.4317
Epoch 426/500
28/28 [=====] - 2s 88ms/step - loss: 0.4548 - f1_score:
0.8833 - val_loss: 3.6365 - val_f1_score: 0.4270
Epoch 427/500
28/28 [=====] - 2s 89ms/step - loss: 0.4350 - f1_score:
0.8847 - val_loss: 3.7591 - val_f1_score: 0.4313
Epoch 428/500
28/28 [=====] - 2s 87ms/step - loss: 0.4580 - f1_score:
```

```
0.8776 - val_loss: 3.7714 - val_f1_score: 0.4021
Epoch 429/500
28/28 [=====] - 2s 87ms/step - loss: 0.4706 - f1_score:
0.8746 - val_loss: 3.7248 - val_f1_score: 0.4456
Epoch 430/500
28/28 [=====] - 2s 87ms/step - loss: 0.4425 - f1_score:
0.8846 - val_loss: 3.5953 - val_f1_score: 0.4353
Epoch 431/500
28/28 [=====] - 2s 89ms/step - loss: 0.4802 - f1_score:
0.8676 - val_loss: 3.6383 - val_f1_score: 0.4240
Epoch 432/500
28/28 [=====] - 2s 88ms/step - loss: 0.4817 - f1_score:
0.8714 - val_loss: 3.5292 - val_f1_score: 0.4296
Epoch 433/500
28/28 [=====] - 2s 87ms/step - loss: 0.4481 - f1_score:
0.8803 - val_loss: 3.7221 - val_f1_score: 0.4255
Epoch 434/500
28/28 [=====] - 2s 88ms/step - loss: 0.4586 - f1_score:
0.8764 - val_loss: 3.8732 - val_f1_score: 0.4122
Epoch 435/500
28/28 [=====] - 2s 86ms/step - loss: 0.4538 - f1_score:
0.8784 - val_loss: 3.6008 - val_f1_score: 0.4176
Epoch 436/500
28/28 [=====] - 2s 88ms/step - loss: 0.4544 - f1_score:
0.8813 - val_loss: 3.7009 - val_f1_score: 0.4326
Epoch 437/500
28/28 [=====] - 3s 92ms/step - loss: 0.4722 - f1_score:
0.8764 - val_loss: 3.8196 - val_f1_score: 0.3997
Epoch 438/500
28/28 [=====] - 3s 91ms/step - loss: 0.4428 - f1_score:
0.8810 - val_loss: 3.8128 - val_f1_score: 0.4140
Epoch 439/500
28/28 [=====] - 2s 88ms/step - loss: 0.4454 - f1_score:
0.8829 - val_loss: 3.5991 - val_f1_score: 0.4302
Epoch 440/500
28/28 [=====] - 2s 87ms/step - loss: 0.4994 - f1_score:
0.8632 - val_loss: 3.4836 - val_f1_score: 0.4353
Epoch 441/500
28/28 [=====] - 2s 89ms/step - loss: 0.4265 - f1_score:
0.8890 - val_loss: 3.4703 - val_f1_score: 0.4412
Epoch 442/500
28/28 [=====] - 2s 88ms/step - loss: 0.4489 - f1_score:
0.8879 - val_loss: 3.9817 - val_f1_score: 0.3998
Epoch 443/500
28/28 [=====] - 2s 87ms/step - loss: 0.4917 - f1_score:
0.8736 - val_loss: 3.7699 - val_f1_score: 0.3956
Epoch 444/500
28/28 [=====] - 2s 88ms/step - loss: 0.4477 - f1_score:
```

```
0.8783 - val_loss: 3.5979 - val_f1_score: 0.4147
Epoch 445/500
28/28 [=====] - 2s 88ms/step - loss: 0.4586 - f1_score: 0.8772 - val_loss: 3.6685 - val_f1_score: 0.4107
Epoch 446/500
28/28 [=====] - 2s 86ms/step - loss: 0.4525 - f1_score: 0.8778 - val_loss: 3.7366 - val_f1_score: 0.4133
Epoch 447/500
28/28 [=====] - 2s 87ms/step - loss: 0.4714 - f1_score: 0.8743 - val_loss: 3.7219 - val_f1_score: 0.4112
Epoch 448/500
28/28 [=====] - 2s 87ms/step - loss: 0.4538 - f1_score: 0.8763 - val_loss: 3.6280 - val_f1_score: 0.4473
Epoch 449/500
28/28 [=====] - 2s 88ms/step - loss: 0.4359 - f1_score: 0.8882 - val_loss: 3.7681 - val_f1_score: 0.4203
Epoch 450/500
28/28 [=====] - 2s 88ms/step - loss: 0.3985 - f1_score: 0.8978 - val_loss: 3.6734 - val_f1_score: 0.4488
Epoch 451/500
28/28 [=====] - ETA: 0s - loss: 0.4231 - f1_score: 0.8945

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
_jit_compiled_convolution_op, gru_cell_layer_call_fn,
gru_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 GRU Mish/assets
INFO:tensorflow:Assets written to: 2 1DCNN + 1 GRU Mish/assets
28/28 [=====] - 16s 572ms/step - loss: 0.4231 - f1_score: 0.8945 - val_loss: 3.6099 - val_f1_score: 0.4629
Epoch 452/500
28/28 [=====] - 2s 83ms/step - loss: 0.4305 - f1_score: 0.8879 - val_loss: 3.6634 - val_f1_score: 0.4338
Epoch 453/500
28/28 [=====] - 2s 83ms/step - loss: 0.4946 - f1_score: 0.8698 - val_loss: 3.9984 - val_f1_score: 0.4271
Epoch 454/500
28/28 [=====] - 2s 87ms/step - loss: 0.4798 - f1_score: 0.8657 - val_loss: 3.5677 - val_f1_score: 0.4416
Epoch 455/500
28/28 [=====] - 2s 88ms/step - loss: 0.4643 - f1_score: 0.8751 - val_loss: 3.6248 - val_f1_score: 0.4457
Epoch 456/500
28/28 [=====] - 2s 85ms/step - loss: 0.5325 - f1_score: 0.8511 - val_loss: 3.6608 - val_f1_score: 0.4177
Epoch 457/500
```

```
28/28 [=====] - 2s 85ms/step - loss: 0.4539 - f1_score: 0.8828 - val_loss: 3.7489 - val_f1_score: 0.4441
Epoch 458/500
28/28 [=====] - 2s 88ms/step - loss: 0.4827 - f1_score: 0.8701 - val_loss: 3.8050 - val_f1_score: 0.4092
Epoch 459/500
28/28 [=====] - 2s 88ms/step - loss: 0.4378 - f1_score: 0.8823 - val_loss: 3.8796 - val_f1_score: 0.4175
Epoch 460/500
28/28 [=====] - 2s 87ms/step - loss: 0.4383 - f1_score: 0.8897 - val_loss: 3.8291 - val_f1_score: 0.4277
Epoch 461/500
28/28 [=====] - 2s 88ms/step - loss: 0.4784 - f1_score: 0.8728 - val_loss: 3.6782 - val_f1_score: 0.4308
Epoch 462/500
28/28 [=====] - 2s 88ms/step - loss: 0.4293 - f1_score: 0.8916 - val_loss: 3.9091 - val_f1_score: 0.4360
Epoch 463/500
28/28 [=====] - 2s 87ms/step - loss: 0.4326 - f1_score: 0.8941 - val_loss: 3.7629 - val_f1_score: 0.4337
Epoch 464/500
28/28 [=====] - 2s 88ms/step - loss: 0.4407 - f1_score: 0.8891 - val_loss: 3.7926 - val_f1_score: 0.4176
Epoch 465/500
28/28 [=====] - 2s 88ms/step - loss: 0.4581 - f1_score: 0.8723 - val_loss: 4.1535 - val_f1_score: 0.3957
Epoch 466/500
28/28 [=====] - 2s 87ms/step - loss: 0.4701 - f1_score: 0.8706 - val_loss: 3.6845 - val_f1_score: 0.4319
Epoch 467/500
28/28 [=====] - 2s 88ms/step - loss: 0.4158 - f1_score: 0.8900 - val_loss: 3.7975 - val_f1_score: 0.4282
Epoch 468/500
28/28 [=====] - 2s 86ms/step - loss: 0.4047 - f1_score: 0.8973 - val_loss: 3.9193 - val_f1_score: 0.4139
Epoch 469/500
28/28 [=====] - 2s 85ms/step - loss: 0.4406 - f1_score: 0.8822 - val_loss: 3.8319 - val_f1_score: 0.4218
Epoch 470/500
28/28 [=====] - 2s 88ms/step - loss: 0.4072 - f1_score: 0.9024 - val_loss: 3.7202 - val_f1_score: 0.4117
Epoch 471/500
28/28 [=====] - 2s 87ms/step - loss: 0.4122 - f1_score: 0.8985 - val_loss: 3.6896 - val_f1_score: 0.4414
Epoch 472/500
28/28 [=====] - 2s 85ms/step - loss: 0.5549 - f1_score: 0.8533 - val_loss: 4.0464 - val_f1_score: 0.4105
Epoch 473/500
```

```
28/28 [=====] - 2s 86ms/step - loss: 0.4496 - f1_score: 0.8870 - val_loss: 3.8944 - val_f1_score: 0.4273
Epoch 474/500
28/28 [=====] - 2s 86ms/step - loss: 0.4395 - f1_score: 0.8871 - val_loss: 3.9058 - val_f1_score: 0.4039
Epoch 475/500
28/28 [=====] - 3s 91ms/step - loss: 0.4352 - f1_score: 0.8848 - val_loss: 3.8365 - val_f1_score: 0.4211
Epoch 476/500
28/28 [=====] - 3s 92ms/step - loss: 0.4142 - f1_score: 0.8904 - val_loss: 3.8862 - val_f1_score: 0.4146
Epoch 477/500
28/28 [=====] - 2s 89ms/step - loss: 0.4545 - f1_score: 0.8751 - val_loss: 3.7676 - val_f1_score: 0.4250
Epoch 478/500
28/28 [=====] - 2s 87ms/step - loss: 0.4376 - f1_score: 0.8836 - val_loss: 4.0223 - val_f1_score: 0.4172
Epoch 479/500
28/28 [=====] - 3s 90ms/step - loss: 0.4352 - f1_score: 0.8921 - val_loss: 3.8196 - val_f1_score: 0.4277
Epoch 480/500
28/28 [=====] - 3s 93ms/step - loss: 0.4580 - f1_score: 0.8831 - val_loss: 3.8762 - val_f1_score: 0.4275
Epoch 481/500
28/28 [=====] - 3s 93ms/step - loss: 0.3980 - f1_score: 0.9042 - val_loss: 4.0334 - val_f1_score: 0.4231
Epoch 482/500
28/28 [=====] - 3s 95ms/step - loss: 0.4336 - f1_score: 0.8842 - val_loss: 4.0213 - val_f1_score: 0.4116
Epoch 483/500
28/28 [=====] - 3s 93ms/step - loss: 0.4458 - f1_score: 0.8865 - val_loss: 3.8236 - val_f1_score: 0.4068
Epoch 484/500
28/28 [=====] - 2s 88ms/step - loss: 0.4315 - f1_score: 0.8945 - val_loss: 3.5189 - val_f1_score: 0.4265
Epoch 485/500
28/28 [=====] - 3s 90ms/step - loss: 0.4178 - f1_score: 0.8926 - val_loss: 3.8583 - val_f1_score: 0.4342
Epoch 486/500
28/28 [=====] - 2s 89ms/step - loss: 0.3968 - f1_score: 0.8992 - val_loss: 3.8986 - val_f1_score: 0.4165
Epoch 487/500
28/28 [=====] - 2s 87ms/step - loss: 0.4134 - f1_score: 0.8917 - val_loss: 3.9018 - val_f1_score: 0.4275
Epoch 488/500
28/28 [=====] - 2s 88ms/step - loss: 0.3953 - f1_score: 0.9031 - val_loss: 3.9121 - val_f1_score: 0.4259
Epoch 489/500
```

```

28/28 [=====] - 3s 90ms/step - loss: 0.3924 - f1_score: 0.9009 - val_loss: 3.9322 - val_f1_score: 0.4308
Epoch 490/500
28/28 [=====] - 2s 88ms/step - loss: 0.4208 - f1_score: 0.8927 - val_loss: 3.9264 - val_f1_score: 0.4052
Epoch 491/500
28/28 [=====] - 2s 88ms/step - loss: 0.4190 - f1_score: 0.8975 - val_loss: 3.9444 - val_f1_score: 0.4100
Epoch 492/500
28/28 [=====] - 2s 88ms/step - loss: 0.4194 - f1_score: 0.8924 - val_loss: 3.8144 - val_f1_score: 0.4457
Epoch 493/500
28/28 [=====] - 2s 89ms/step - loss: 0.4264 - f1_score: 0.8868 - val_loss: 3.7737 - val_f1_score: 0.4411
Epoch 494/500
28/28 [=====] - 3s 91ms/step - loss: 0.4194 - f1_score: 0.8957 - val_loss: 3.9854 - val_f1_score: 0.4007
Epoch 495/500
28/28 [=====] - 2s 89ms/step - loss: 0.4357 - f1_score: 0.8821 - val_loss: 3.9422 - val_f1_score: 0.4188
Epoch 496/500
28/28 [=====] - 2s 88ms/step - loss: 0.4198 - f1_score: 0.8918 - val_loss: 3.8982 - val_f1_score: 0.4315
Epoch 497/500
28/28 [=====] - 3s 90ms/step - loss: 0.3863 - f1_score: 0.9050 - val_loss: 3.8757 - val_f1_score: 0.4196
Epoch 498/500
28/28 [=====] - 3s 92ms/step - loss: 0.3911 - f1_score: 0.9015 - val_loss: 3.9526 - val_f1_score: 0.4121
Epoch 499/500
28/28 [=====] - 3s 91ms/step - loss: 0.3955 - f1_score: 0.9056 - val_loss: 3.7390 - val_f1_score: 0.4340
Epoch 500/500
28/28 [=====] - 2s 88ms/step - loss: 0.3864 - f1_score: 0.8995 - val_loss: 3.8720 - val_f1_score: 0.4381

```

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

	precision	recall	f1-score	support
AXE	0.833	0.625	0.714	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.875	0.700	0.778	10

BEE	0.000	0.000	0.000	10
BELT	1.000	1.000	1.000	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.000	0.000	0.000	6
CANCER	0.333	0.500	0.400	8
CHRISTMAS	0.500	0.667	0.571	6
CONFUSED	0.222	0.333	0.267	6
DARK	1.000	0.750	0.857	4
DEAF	0.000	0.000	0.000	6
DECIDE	0.750	0.500	0.600	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.286	0.333	0.308	6
DINNER	0.000	0.000	0.000	8
DOG	0.286	0.333	0.308	6
DOWNSIZE	0.750	0.750	0.750	8
DRAG	1.000	0.500	0.667	4
EAT	0.600	0.500	0.545	6
EDIT	0.800	0.667	0.727	6
ELEVATOR	0.400	0.250	0.308	8
FINE	0.286	0.500	0.364	4
FLOAT	0.400	0.500	0.444	4
FOREIGNER	0.500	0.333	0.400	6
GUESS	0.571	0.500	0.533	8
HALLOWEEN	0.667	1.000	0.800	8
HOSPITAL	0.133	0.333	0.190	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	0.333	0.250	0.286	8
LUNCH	0.500	0.250	0.333	8
MAPLE	0.000	0.000	0.000	4
MEAT	0.600	1.000	0.750	6
MECHANIC	0.571	1.000	0.727	4
MICROSCOPE	0.600	0.375	0.462	8
MOVIE	0.267	0.500	0.348	8
NOON	0.714	0.625	0.667	8
PARTY	0.545	0.750	0.632	8
PATIENT	0.286	0.333	0.308	6
RAZOR	0.222	0.500	0.308	4
RIVER	0.625	0.833	0.714	6
ROCKINGCHAIR	0.727	1.000	0.842	8
SHAVE	0.250	0.300	0.273	10
SINK	0.286	0.333	0.308	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.400	0.500	0.444	4
TWINS	0.100	0.125	0.111	8
WHATFOR	0.500	0.400	0.444	10

accuracy			0.454	324
macro avg	0.456	0.458	0.438	324
weighted avg	0.455	0.454	0.437	324

```
[122]: # 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)
```

```
[124]: hist_df = pd.read_csv('2 1DCNN + 1 GRU Mish/history.csv', index_col=0)
hist_df.tail()
```

```
[124]:      loss  f1_score  val_loss  val_f1_score
495  0.419776  0.891804  3.898187  0.431453
496  0.386257  0.905040  3.875715  0.419560
497  0.391138  0.901491  3.952640  0.412126
498  0.395500  0.905607  3.739040  0.433954
499  0.386382  0.899518  3.872027  0.438089
```

```
[125]: # 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]

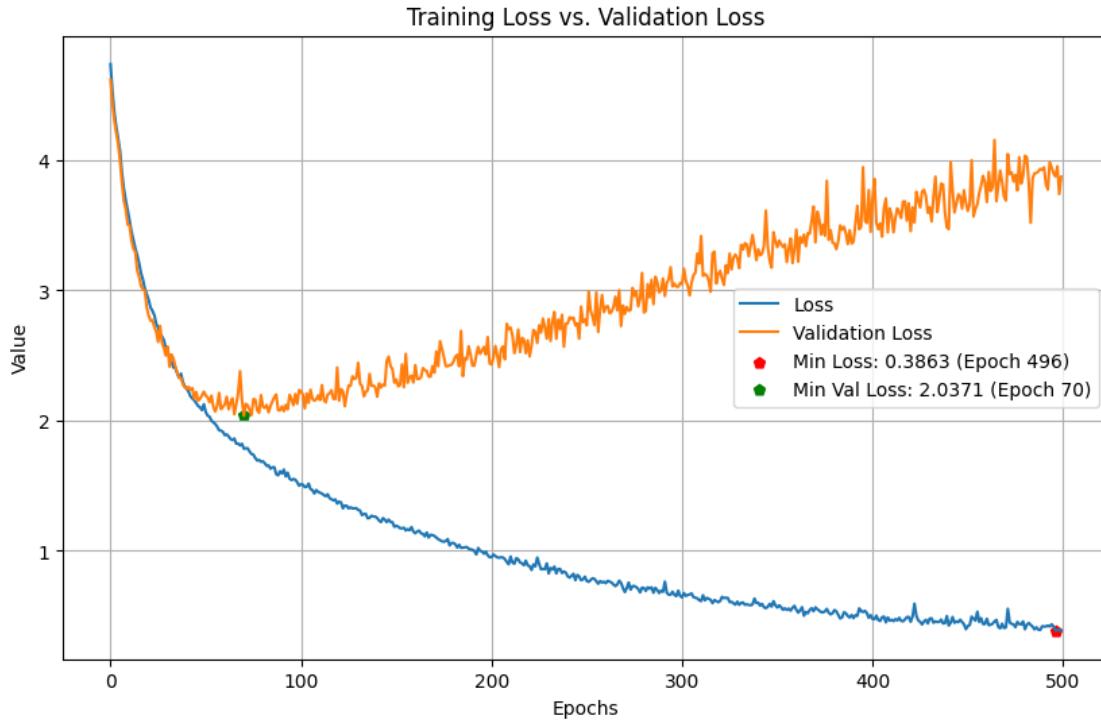
# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (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()

```



```

[126]: # 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(

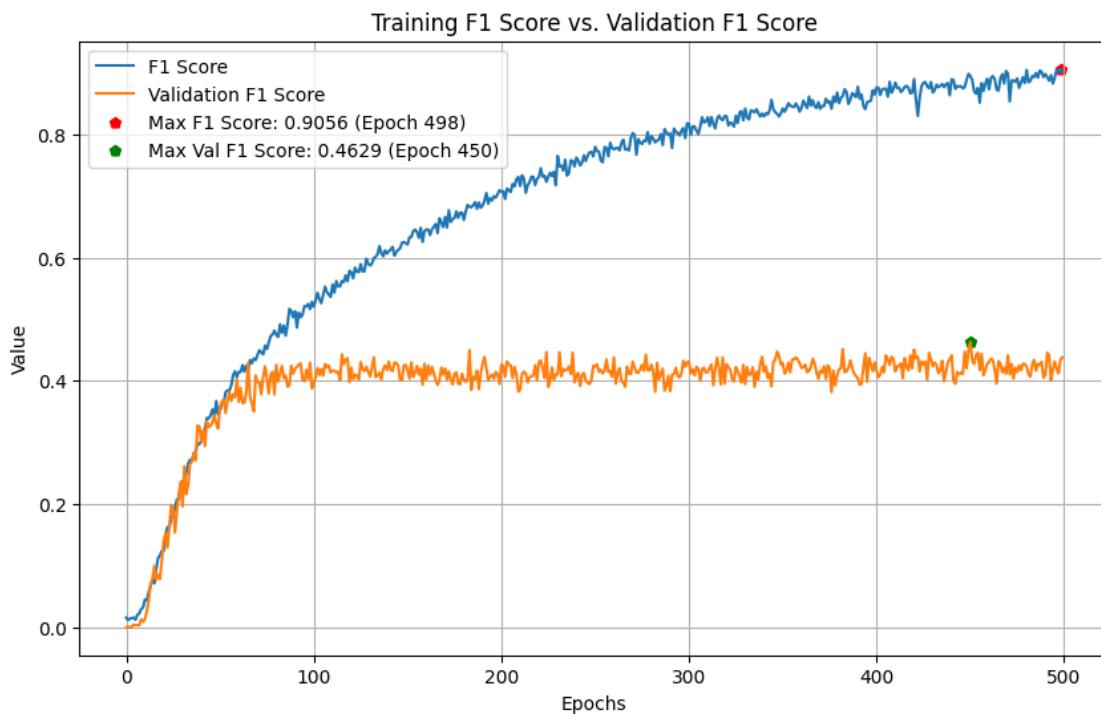
```

```

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]: reconstructed\_model = tf.keras.models.load\_model("2 1DCNN + 1 GRU Mish")

2023-09-23 17:38:53.578964: 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 17:38:53.640026: 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
```

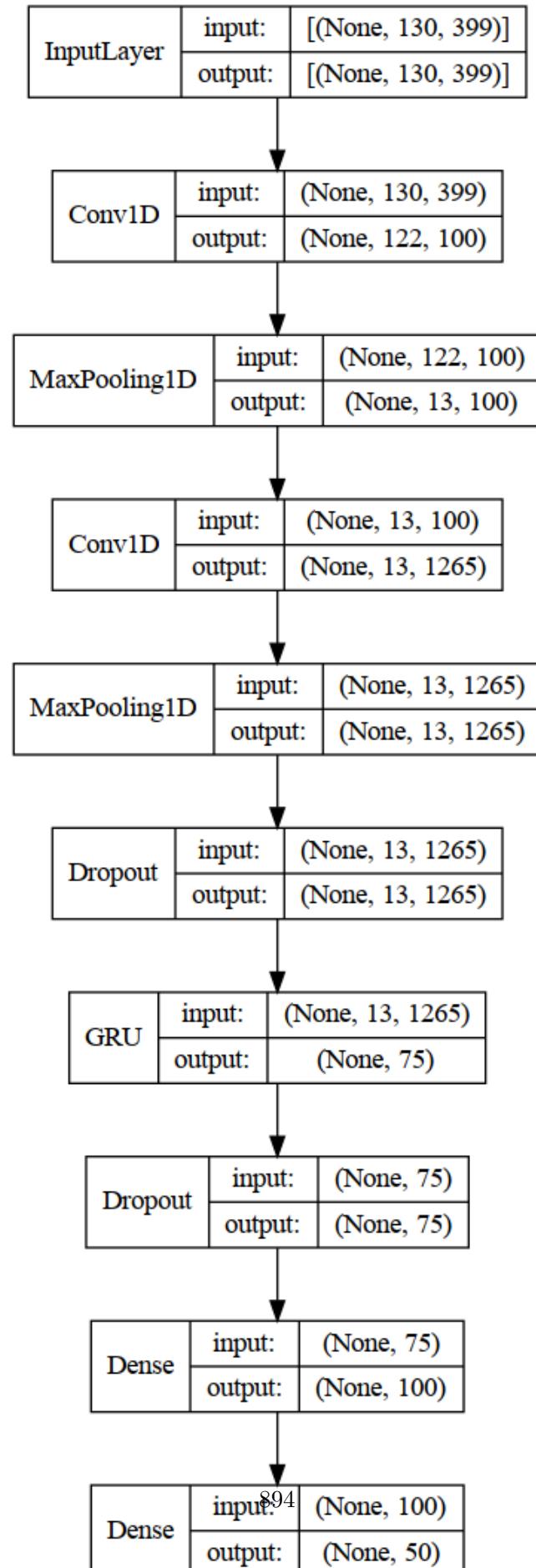
```
[126]: reconstructed_model.summary()
```

```
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, 1265)	127765
max_pooling1d_1 (MaxPooling 1D)	(None, 13, 1265)	0
dropout (Dropout)	(None, 13, 1265)	0
gru (GRU)	(None, 75)	301950
dropout_1 (Dropout)	(None, 75)	0
dense (Dense)	(None, 100)	7600
dense_1 (Dense)	(None, 50)	5050
<hr/>		
Total params:	801,565	
Trainable params:	801,565	
Non-trainable params:	0	

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

```
[127]:
```



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

```
2023-09-23 17:39:31.101680: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384]
Loaded cuDNN version 8700
11/11 [=====] - 1s 16ms/step - loss: 3.6099 - f1_score: 0.4629
```

```
[128]: [3.6098763942718506, 0.4629427194595337]
```

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

```
2023-09-23 17:39:33.483345: W tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.
2023-09-23 17:39:33.961509: W tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.
```

```
84/84 [=====] - 1s 13ms/step - loss: 0.2054 - f1_score: 0.9752
```

```
[129]: [0.2054452747106552, 0.9751793146133423]
```

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

	precision	recall	f1-score	support
AXE	0.833	0.625	0.714	8
BACKPACK	0.667	1.000	0.800	6
BASKETBALL	1.000	1.000	1.000	10
BEE	0.000	0.000	0.000	10
BELT	1.000	1.000	1.000	4
BITE	0.000	0.000	0.000	8
BREAKFAST	0.000	0.000	0.000	6
CANCER	0.462	0.750	0.571	8
CHRISTMAS	0.500	0.333	0.400	6
CONFUSED	0.250	0.333	0.286	6
DARK	1.000	0.750	0.857	4
DEAF	0.000	0.000	0.000	6
DECIDE	0.800	0.667	0.727	6
DEMAND	1.000	0.750	0.857	8

DEVELOP	0.333	0.500	0.400	6
DINNER	0.000	0.000	0.000	8
DOG	0.400	0.333	0.364	6
DOWNSIZE	0.778	0.875	0.824	8
DRAG	1.000	0.250	0.400	4
EAT	0.600	0.500	0.545	6
EDIT	1.000	0.500	0.667	6
ELEVATOR	0.400	0.250	0.308	8
FINE	0.286	0.500	0.364	4
FLOAT	0.400	0.500	0.444	4
FOREIGNER	0.500	0.500	0.500	6
GUESS	0.800	0.500	0.615	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	0.125	0.167	0.143	6
HURDLE/TRIP	0.000	0.000	0.000	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.200	0.250	0.222	4
LOCK	0.375	0.375	0.375	8
LUNCH	0.500	0.250	0.333	8
MAPLE	0.000	0.000	0.000	4
MEAT	0.857	1.000	0.923	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.214	0.375	0.273	8
NOON	0.556	0.625	0.588	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.125	0.167	0.143	6
RAZOR	0.182	0.500	0.267	4
RIVER	0.714	0.833	0.769	6
ROCKINGCHAIR	1.000	0.875	0.933	8
SHAVE	0.250	0.300	0.273	10
SINK	0.222	0.333	0.267	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.600	0.750	0.667	4
TWINS	0.083	0.125	0.100	8
WHATFOR	0.500	0.500	0.500	10
accuracy			0.475	324
macro avg	0.493	0.472	0.463	324
weighted avg	0.497	0.475	0.469	324

#### 4.8.1 2 1D-CNN + 1 GRU Trial 698

```
[122]: best_model = tuner.get_best_models(num_models=8)[7]
```

2023-09-17 15:05:03.641424: 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.

2023-09-17 15:05:03.711362: 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](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
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
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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.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.evaluate(Xtrain, Ytrain)

```
2023-09-17 15:02:08.433261: I tensorflow/stream_executor/cuda/cuda_dnn.cc:384] Loaded cuDNN version 8700
84/84 [=====] - 2s 14ms/step - loss: 0.6389 - f1_score: 0.8507
```

[123]: [0.6388570070266724, 0.8506678938865662]

[124]: best\_model.evaluate(Xval, Yval)

```
11/11 [=====] - 0s 18ms/step - loss: 1.2167 - f1_score: 0.7151
```

```

[124]: [1.2167245149612427, 0.7151216268539429]

[123]: bestHP = tuner.get_best_hyperparameters(num_trials=8)[7]

[124]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='2 1D-CNN + 1 GRU Trial 698/',
    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

2023-09-17 15:05:23.392967: I tensorflow/stream\_executor/cuda/cuda\_dnn.cc:384] Loaded cuDNN version 8700

2023-09-17 15:05:23.886487: I tensorflow/compiler/xla/service/service.cc:173] XLA service 0x33d5a490 initialized for platform CUDA (this does not guarantee that XLA will be used). Devices:

2023-09-17 15:05:23.886515: I tensorflow/compiler/xla/service/service.cc:181] StreamExecutor device (0): NVIDIA GeForce MX250, Compute Capability 6.1

2023-09-17 15:05:23.894201: I tensorflow/compiler/mlir/tensorflow/utils/dump\_mlir\_util.cc:268] disabling MLIR crash reproducer, set env var `MLIR\_CRASH\_REPRODUCER\_DIRECTORY` to enable.

2023-09-17 15:05:24.030220: 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: 4.3060 - f1\_score: 0.0155

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 1D-CNN + 1 GRU Trial 698/assets

INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 23s 708ms/step - loss: 4.3060 - f1\_score: 0.0155 - val\_loss: 4.2643 - val\_f1\_score: 0.0023

```
Epoch 2/500
28/28 [=====] - ETA: 0s - loss: 4.2598 - 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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 9s 324ms/step - loss: 4.2598 -
f1_score: 0.0168 - val_loss: 4.2376 - val_f1_score: 0.0044
Epoch 3/500
28/28 [=====] - 2s 69ms/step - loss: 4.2194 - f1_score: 0.0195 -
val_loss: 4.2021 - val_f1_score: 0.0031
Epoch 4/500
28/28 [=====] - ETA: 0s - loss: 4.1897 - f1_score: 0.0172

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 9s 313ms/step - loss: 4.1897 -
f1_score: 0.0172 - val_loss: 4.1743 - val_f1_score: 0.0078
Epoch 5/500
28/28 [=====] - 2s 68ms/step - loss: 4.1626 - f1_score: 0.0164 -
val_loss: 4.1438 - val_f1_score: 0.0032
Epoch 6/500
28/28 [=====] - 2s 68ms/step - loss: 4.1241 - f1_score: 0.0206 -
val_loss: 4.0999 - val_f1_score: 0.0078
Epoch 7/500
28/28 [=====] - ETA: 0s - loss: 4.0746 - f1_score: 0.0253

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 9s 318ms/step - loss: 4.0746 -
f1_score: 0.0253 - val_loss: 4.0348 - val_f1_score: 0.0147
```

```
Epoch 8/500
28/28 [=====] - ETA: 0s - loss: 3.9914 - f1_score: 0.0268

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 10s 358ms/step - loss: 3.9914 -
f1_score: 0.0268 - val_loss: 3.9240 - val_f1_score: 0.0205
Epoch 9/500
28/28 [=====] - 2s 69ms/step - loss: 3.9017 - f1_score: 0.0300 -
val_loss: 3.8117 - val_f1_score: 0.0111
Epoch 10/500
28/28 [=====] - ETA: 0s - loss: 3.8208 - f1_score: 0.0385

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 9s 317ms/step - loss: 3.8208 -
f1_score: 0.0385 - val_loss: 3.7274 - val_f1_score: 0.0259
Epoch 11/500
28/28 [=====] - 2s 69ms/step - loss: 3.7375 - f1_score: 0.0477 -
val_loss: 3.6419 - val_f1_score: 0.0227
Epoch 12/500
28/28 [=====] - ETA: 0s - loss: 3.6616 - f1_score: 0.0527

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets

28/28 [=====] - 9s 348ms/step - loss: 3.6616 -
f1_score: 0.0527 - val_loss: 3.5457 - val_f1_score: 0.0367
Epoch 13/500
28/28 [=====] - ETA: 0s - loss: 3.5684 - f1_score: 0.0579
```

```
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 8s 307ms/step - loss: 3.5684 -
f1_score: 0.0579 - val_loss: 3.3881 - val_f1_score: 0.0478
Epoch 14/500
28/28 [=====] - ETA: 0s - loss: 3.4560 - f1_score:
0.0707

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 326ms/step - loss: 3.4560 -
f1_score: 0.0707 - val_loss: 3.3013 - val_f1_score: 0.0543
Epoch 15/500
28/28 [=====] - ETA: 0s - loss: 3.3763 - f1_score:
0.0787

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 334ms/step - loss: 3.3763 -
f1_score: 0.0787 - val_loss: 3.1803 - val_f1_score: 0.0816
Epoch 16/500
28/28 [=====] - ETA: 0s - loss: 3.2794 - f1_score:
0.0985

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
```

```
28/28 [=====] - 9s 347ms/step - loss: 3.2794 -
f1_score: 0.0985 - val_loss: 3.0867 - val_f1_score: 0.1030
Epoch 17/500
28/28 [=====] - ETA: 0s - loss: 3.1814 - f1_score:
0.1180

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 19s 711ms/step - loss: 3.1814 -
f1_score: 0.1180 - val_loss: 3.0297 - val_f1_score: 0.1158
Epoch 18/500
28/28 [=====] - ETA: 0s - loss: 3.0862 - f1_score:
0.1265

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 8s 312ms/step - loss: 3.0862 -
f1_score: 0.1265 - val_loss: 2.8815 - val_f1_score: 0.1253
Epoch 19/500
28/28 [=====] - 2s 69ms/step - loss: 3.0152 - f1_score:
0.1512 - val_loss: 2.8935 - val_f1_score: 0.1196
Epoch 20/500
28/28 [=====] - ETA: 0s - loss: 2.9304 - f1_score:
0.1577

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 360ms/step - loss: 2.9304 -
f1_score: 0.1577 - val_loss: 2.8125 - val_f1_score: 0.1810
Epoch 21/500
28/28 [=====] - 2s 69ms/step - loss: 2.8819 - f1_score:
0.1693 - val_loss: 2.7164 - val_f1_score: 0.1792
Epoch 22/500
```

```
28/28 [=====] - 2s 69ms/step - loss: 2.8137 - f1_score: 0.1857 - val_loss: 2.6735 - val_f1_score: 0.1803
Epoch 23/500
28/28 [=====] - ETA: 0s - loss: 2.7653 - f1_score: 0.1948

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 361ms/step - loss: 2.7653 - f1_score: 0.1948 - val_loss: 2.6496 - val_f1_score: 0.1993
Epoch 24/500
28/28 [=====] - ETA: 0s - loss: 2.7068 - f1_score: 0.2180

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 355ms/step - loss: 2.7068 - f1_score: 0.2180 - val_loss: 2.6054 - val_f1_score: 0.2401
Epoch 25/500
28/28 [=====] - 2s 70ms/step - loss: 2.6651 - f1_score: 0.2282 - val_loss: 2.5432 - val_f1_score: 0.2330
Epoch 26/500
28/28 [=====] - ETA: 0s - loss: 2.5998 - f1_score: 0.2398

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 346ms/step - loss: 2.5998 - f1_score: 0.2398 - val_loss: 2.5381 - val_f1_score: 0.2441
Epoch 27/500
28/28 [=====] - ETA: 0s - loss: 2.5781 - f1_score: 0.2476
```

```
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 328ms/step - loss: 2.5781 -
f1_score: 0.2476 - val_loss: 2.4789 - val_f1_score: 0.2546
Epoch 28/500
28/28 [=====] - 2s 69ms/step - loss: 2.5115 - f1_score:
0.2565 - val_loss: 2.5387 - val_f1_score: 0.2371
Epoch 29/500
28/28 [=====] - ETA: 0s - loss: 2.4906 - f1_score:
0.2655

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 333ms/step - loss: 2.4906 -
f1_score: 0.2655 - val_loss: 2.3785 - val_f1_score: 0.2982
Epoch 30/500
28/28 [=====] - 2s 69ms/step - loss: 2.4536 - f1_score:
0.2873 - val_loss: 2.4348 - val_f1_score: 0.2781
Epoch 31/500
28/28 [=====] - ETA: 0s - loss: 2.4077 - f1_score:
0.2761

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 366ms/step - loss: 2.4077 -
f1_score: 0.2761 - val_loss: 2.3107 - val_f1_score: 0.3459
Epoch 32/500
28/28 [=====] - 2s 69ms/step - loss: 2.3648 - f1_score:
0.3060 - val_loss: 2.3131 - val_f1_score: 0.3202
Epoch 33/500
28/28 [=====] - 2s 70ms/step - loss: 2.3418 - f1_score:
0.3126 - val_loss: 2.3467 - val_f1_score: 0.3078
```

```
Epoch 34/500
28/28 [=====] - 2s 70ms/step - loss: 2.3090 - f1_score: 0.3231 - val_loss: 2.2365 - val_f1_score: 0.3283
Epoch 35/500
28/28 [=====] - ETA: 0s - loss: 2.2598 - f1_score: 0.3207

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 399ms/step - loss: 2.2598 - f1_score: 0.3207 - val_loss: 2.2124 - val_f1_score: 0.3477
Epoch 36/500
28/28 [=====] - 2s 70ms/step - loss: 2.2137 - f1_score: 0.3501 - val_loss: 2.1827 - val_f1_score: 0.3441
Epoch 37/500
28/28 [=====] - 2s 70ms/step - loss: 2.1865 - f1_score: 0.3583 - val_loss: 2.2442 - val_f1_score: 0.3403
Epoch 38/500
28/28 [=====] - ETA: 0s - loss: 2.1337 - f1_score: 0.3685

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 9s 345ms/step - loss: 2.1337 - f1_score: 0.3685 - val_loss: 2.1596 - val_f1_score: 0.3942
Epoch 39/500
28/28 [=====] - 2s 69ms/step - loss: 2.1363 - f1_score: 0.3657 - val_loss: 2.1413 - val_f1_score: 0.3870
Epoch 40/500
28/28 [=====] - 2s 70ms/step - loss: 2.0784 - f1_score: 0.3869 - val_loss: 2.0868 - val_f1_score: 0.3669
Epoch 41/500
28/28 [=====] - ETA: 0s - loss: 2.0562 - f1_score: 0.3896

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
```

```
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 400ms/step - loss: 2.0562 -
f1_score: 0.3896 - val_loss: 2.0732 - val_f1_score: 0.4089
Epoch 42/500
28/28 [=====] - 2s 70ms/step - loss: 2.0213 - f1_score:
0.3978 - val_loss: 2.0570 - val_f1_score: 0.4050
Epoch 43/500
28/28 [=====] - 2s 70ms/step - loss: 1.9977 - f1_score:
0.4025 - val_loss: 2.0539 - val_f1_score: 0.4071
Epoch 44/500
28/28 [=====] - ETA: 0s - loss: 1.9697 - f1_score:
0.4183

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 357ms/step - loss: 1.9697 -
f1_score: 0.4183 - val_loss: 2.0524 - val_f1_score: 0.4371
Epoch 45/500
28/28 [=====] - ETA: 0s - loss: 1.9492 - f1_score:
0.4237

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 350ms/step - loss: 1.9492 -
f1_score: 0.4237 - val_loss: 2.0098 - val_f1_score: 0.4528
Epoch 46/500
28/28 [=====] - 2s 69ms/step - loss: 1.9094 - f1_score:
0.4399 - val_loss: 2.0283 - val_f1_score: 0.4049
Epoch 47/500
28/28 [=====] - ETA: 0s - loss: 1.8874 - f1_score:
0.4466

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 16s 589ms/step - loss: 1.8874 -
f1_score: 0.4466 - val_loss: 1.9515 - val_f1_score: 0.4529
Epoch 48/500
28/28 [=====] - 2s 70ms/step - loss: 1.8629 - f1_score:
0.4456 - val_loss: 2.0134 - val_f1_score: 0.4324
Epoch 49/500
28/28 [=====] - ETA: 0s - loss: 1.8464 - f1_score:
0.4588

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 12s 429ms/step - loss: 1.8464 -
f1_score: 0.4588 - val_loss: 1.9242 - val_f1_score: 0.4675
Epoch 50/500
28/28 [=====] - 2s 69ms/step - loss: 1.8124 - f1_score:
0.4610 - val_loss: 1.9470 - val_f1_score: 0.4527
Epoch 51/500
28/28 [=====] - 2s 69ms/step - loss: 1.7717 - f1_score:
0.4770 - val_loss: 1.9465 - val_f1_score: 0.4250
Epoch 52/500
28/28 [=====] - 2s 69ms/step - loss: 1.7714 - f1_score:
0.4664 - val_loss: 1.9172 - val_f1_score: 0.4517
Epoch 53/500
28/28 [=====] - 2s 69ms/step - loss: 1.7212 - f1_score:
0.4928 - val_loss: 1.8925 - val_f1_score: 0.4582
Epoch 54/500
28/28 [=====] - ETA: 0s - loss: 1.6979 - f1_score:
0.4962

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
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28/28 [=====] - 11s 402ms/step - loss: 1.6979 -  
f1_score: 0.4962 - val_loss: 1.9029 - val_f1_score: 0.4725  
Epoch 55/500  
28/28 [=====] - ETA: 0s - loss: 1.6733 - f1_score:  
0.4987  
  
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 1D-CNN + 1 GRU Trial 698/assets  
  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 11s 392ms/step - loss: 1.6733 -  
f1_score: 0.4987 - val_loss: 1.8314 - val_f1_score: 0.4804  
Epoch 56/500  
28/28 [=====] - ETA: 0s - loss: 1.6658 - f1_score:  
0.5104  
  
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 1D-CNN + 1 GRU Trial 698/assets  
  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 10s 383ms/step - loss: 1.6658 -  
f1_score: 0.5104 - val_loss: 1.7832 - val_f1_score: 0.5054  
Epoch 57/500  
28/28 [=====] - 2s 69ms/step - loss: 1.6092 - f1_score:  
0.5275 - val_loss: 1.8262 - val_f1_score: 0.4837  
Epoch 58/500  
28/28 [=====] - 2s 73ms/step - loss: 1.5767 - f1_score:  
0.5355 - val_loss: 1.8942 - val_f1_score: 0.4762  
Epoch 59/500  
28/28 [=====] - ETA: 0s - loss: 1.5910 - f1_score:  
0.5273  
  
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 1D-CNN + 1 GRU Trial 698/assets  
  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 10s 355ms/step - loss: 1.5910 -  
f1_score: 0.5273 - val_loss: 1.7652 - val_f1_score: 0.5075  
Epoch 60/500
```

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28/28 [=====] - ETA: 0s - loss: 1.5562 - f1_score: 0.5353
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 371ms/step - loss: 1.5562 - f1_score: 0.5353 - val_loss: 1.7416 - val_f1_score: 0.5314
Epoch 61/500
28/28 [=====] - 2s 69ms/step - loss: 1.5130 - f1_score: 0.5583 - val_loss: 1.7400 - val_f1_score: 0.5245
Epoch 62/500
28/28 [=====] - ETA: 0s - loss: 1.5113 - f1_score: 0.5570
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 362ms/step - loss: 1.5113 - f1_score: 0.5570 - val_loss: 1.6869 - val_f1_score: 0.5439
Epoch 63/500
28/28 [=====] - 2s 71ms/step - loss: 1.4859 - f1_score: 0.5663 - val_loss: 1.6824 - val_f1_score: 0.5424
Epoch 64/500
28/28 [=====] - 2s 70ms/step - loss: 1.4793 - f1_score: 0.5669 - val_loss: 1.7128 - val_f1_score: 0.5295
Epoch 65/500
28/28 [=====] - 2s 70ms/step - loss: 1.4233 - f1_score: 0.5773 - val_loss: 1.6673 - val_f1_score: 0.5323
Epoch 66/500
28/28 [=====] - ETA: 0s - loss: 1.4242 - f1_score: 0.5839
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
```

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28/28 [=====] - 10s 356ms/step - loss: 1.4242 -  
f1_score: 0.5839 - val_loss: 1.6349 - val_f1_score: 0.5518  
Epoch 67/500  
28/28 [=====] - ETA: 0s - loss: 1.4112 - f1_score:  
0.5931  
  
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 1D-CNN + 1 GRU Trial 698/assets  
  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 11s 395ms/step - loss: 1.4112 -  
f1_score: 0.5931 - val_loss: 1.6761 - val_f1_score: 0.5587  
Epoch 68/500  
28/28 [=====] - 2s 70ms/step - loss: 1.3867 - f1_score:  
0.6024 - val_loss: 1.7110 - val_f1_score: 0.5452  
Epoch 69/500  
28/28 [=====] - 2s 70ms/step - loss: 1.3733 - f1_score:  
0.5930 - val_loss: 1.6556 - val_f1_score: 0.5573  
Epoch 70/500  
28/28 [=====] - ETA: 0s - loss: 1.3546 - f1_score:  
0.5999  
  
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 1D-CNN + 1 GRU Trial 698/assets  
  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 11s 399ms/step - loss: 1.3546 -  
f1_score: 0.5999 - val_loss: 1.5593 - val_f1_score: 0.5927  
Epoch 71/500  
28/28 [=====] - 2s 70ms/step - loss: 1.3221 - f1_score:  
0.6078 - val_loss: 1.5836 - val_f1_score: 0.5695  
Epoch 72/500  
28/28 [=====] - 2s 70ms/step - loss: 1.3087 - f1_score:  
0.6197 - val_loss: 1.5970 - val_f1_score: 0.5824  
Epoch 73/500  
28/28 [=====] - 2s 70ms/step - loss: 1.3024 - f1_score:  
0.6210 - val_loss: 1.6886 - val_f1_score: 0.5484  
Epoch 74/500  
28/28 [=====] - 2s 70ms/step - loss: 1.2950 - f1_score:  
0.6169 - val_loss: 1.5712 - val_f1_score: 0.5893  
Epoch 75/500  
28/28 [=====] - 2s 70ms/step - loss: 1.2560 - f1_score:
```

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0.6279 - val_loss: 1.5130 - val_f1_score: 0.5838
Epoch 76/500
28/28 [=====] - 2s 70ms/step - loss: 1.2203 - f1_score: 0.6507 - val_loss: 1.5622 - val_f1_score: 0.5789
Epoch 77/500
28/28 [=====] - 2s 70ms/step - loss: 1.2273 - f1_score: 0.6501 - val_loss: 1.5328 - val_f1_score: 0.5825
Epoch 78/500
28/28 [=====] - ETA: 0s - loss: 1.2173 - f1_score: 0.6433

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 350ms/step - loss: 1.2173 - f1_score: 0.6433 - val_loss: 1.4863 - val_f1_score: 0.6158
Epoch 79/500
28/28 [=====] - 2s 70ms/step - loss: 1.2073 - f1_score: 0.6504 - val_loss: 1.4767 - val_f1_score: 0.5858
Epoch 80/500
28/28 [=====] - 2s 70ms/step - loss: 1.1972 - f1_score: 0.6554 - val_loss: 1.4611 - val_f1_score: 0.6114
Epoch 81/500
28/28 [=====] - 2s 71ms/step - loss: 1.1794 - f1_score: 0.6789 - val_loss: 1.4734 - val_f1_score: 0.6073
Epoch 82/500
28/28 [=====] - 2s 71ms/step - loss: 1.1433 - f1_score: 0.6833 - val_loss: 1.4986 - val_f1_score: 0.6114
Epoch 83/500
28/28 [=====] - ETA: 0s - loss: 1.1600 - f1_score: 0.6670

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 410ms/step - loss: 1.1600 - f1_score: 0.6670 - val_loss: 1.4419 - val_f1_score: 0.6446
Epoch 84/500
28/28 [=====] - 2s 70ms/step - loss: 1.1281 - f1_score: 0.6632 - val_loss: 1.4868 - val_f1_score: 0.6221
```

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Epoch 85/500
28/28 [=====] - 2s 71ms/step - loss: 1.1237 - f1_score: 0.6766 - val_loss: 1.4731 - val_f1_score: 0.6122
Epoch 86/500
28/28 [=====] - 2s 71ms/step - loss: 1.0996 - f1_score: 0.6873 - val_loss: 1.4665 - val_f1_score: 0.6156
Epoch 87/500
28/28 [=====] - 2s 71ms/step - loss: 1.0688 - f1_score: 0.6978 - val_loss: 1.4159 - val_f1_score: 0.6230
Epoch 88/500
28/28 [=====] - 2s 71ms/step - loss: 1.0697 - f1_score: 0.6958 - val_loss: 1.5356 - val_f1_score: 0.5666
Epoch 89/500
28/28 [=====] - 2s 71ms/step - loss: 1.0570 - f1_score: 0.7011 - val_loss: 1.4305 - val_f1_score: 0.6366
Epoch 90/500
28/28 [=====] - ETA: 0s - loss: 1.0487 - f1_score: 0.6986

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 378ms/step - loss: 1.0487 - f1_score: 0.6986 - val_loss: 1.3906 - val_f1_score: 0.6600
Epoch 91/500
28/28 [=====] - 2s 70ms/step - loss: 1.0488 - f1_score: 0.7031 - val_loss: 1.4210 - val_f1_score: 0.5933
Epoch 92/500
28/28 [=====] - 2s 70ms/step - loss: 1.0204 - f1_score: 0.7114 - val_loss: 1.4168 - val_f1_score: 0.6103
Epoch 93/500
28/28 [=====] - 2s 71ms/step - loss: 1.0163 - f1_score: 0.7093 - val_loss: 1.3995 - val_f1_score: 0.6131
Epoch 94/500
28/28 [=====] - 2s 70ms/step - loss: 0.9971 - f1_score: 0.7172 - val_loss: 1.3825 - val_f1_score: 0.6210
Epoch 95/500
28/28 [=====] - 2s 70ms/step - loss: 0.9950 - f1_score: 0.7199 - val_loss: 1.4678 - val_f1_score: 0.6142
Epoch 96/500
28/28 [=====] - 2s 74ms/step - loss: 0.9631 - f1_score: 0.7297 - val_loss: 1.4160 - val_f1_score: 0.6169
Epoch 97/500
28/28 [=====] - 2s 70ms/step - loss: 0.9431 - f1_score:
```

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0.7335 - val_loss: 1.3210 - val_f1_score: 0.6510
Epoch 98/500
28/28 [=====] - 2s 70ms/step - loss: 0.9344 - f1_score: 0.7351 - val_loss: 1.4188 - val_f1_score: 0.6413
Epoch 99/500
28/28 [=====] - 2s 70ms/step - loss: 0.9179 - f1_score: 0.7522 - val_loss: 1.3621 - val_f1_score: 0.6389
Epoch 100/500
28/28 [=====] - 2s 72ms/step - loss: 0.9325 - f1_score: 0.7373 - val_loss: 1.3338 - val_f1_score: 0.6387
Epoch 101/500
28/28 [=====] - ETA: 0s - loss: 0.9044 - f1_score: 0.7417
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 423ms/step - loss: 0.9044 - f1_score: 0.7417 - val_loss: 1.3312 - val_f1_score: 0.6618
Epoch 102/500
28/28 [=====] - 2s 70ms/step - loss: 0.9075 - f1_score: 0.7409 - val_loss: 1.4020 - val_f1_score: 0.6269
Epoch 103/500
28/28 [=====] - 2s 69ms/step - loss: 0.8943 - f1_score: 0.7456 - val_loss: 1.3994 - val_f1_score: 0.6267
Epoch 104/500
28/28 [=====] - 2s 70ms/step - loss: 0.8905 - f1_score: 0.7494 - val_loss: 1.3654 - val_f1_score: 0.6536
Epoch 105/500
28/28 [=====] - 2s 69ms/step - loss: 0.8697 - f1_score: 0.7653 - val_loss: 1.3199 - val_f1_score: 0.6485
Epoch 106/500
28/28 [=====] - 2s 69ms/step - loss: 0.8688 - f1_score: 0.7613 - val_loss: 1.3524 - val_f1_score: 0.6578
Epoch 107/500
28/28 [=====] - ETA: 0s - loss: 0.8684 - f1_score: 0.7591
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 1D-CNN + 1 GRU Trial 698/assets
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INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 12s 428ms/step - loss: 0.8684 -  
f1_score: 0.7591 - val_loss: 1.3263 - val_f1_score: 0.6685  
Epoch 108/500  
28/28 [=====] - 2s 70ms/step - loss: 0.8220 - f1_score:  
0.7680 - val_loss: 1.3808 - val_f1_score: 0.6355  
Epoch 109/500  
28/28 [=====] - 2s 70ms/step - loss: 0.8320 - f1_score:  
0.7634 - val_loss: 1.3119 - val_f1_score: 0.6534  
Epoch 110/500  
28/28 [=====] - 2s 70ms/step - loss: 0.8280 - f1_score:  
0.7677 - val_loss: 1.4235 - val_f1_score: 0.6506  
Epoch 111/500  
28/28 [=====] - 2s 71ms/step - loss: 0.8294 - f1_score:  
0.7698 - val_loss: 1.3656 - val_f1_score: 0.6611  
Epoch 112/500  
28/28 [=====] - 2s 70ms/step - loss: 0.8041 - f1_score:  
0.7774 - val_loss: 1.4291 - val_f1_score: 0.6207  
Epoch 113/500  
28/28 [=====] - 2s 71ms/step - loss: 0.7949 - f1_score:  
0.7829 - val_loss: 1.3628 - val_f1_score: 0.6675  
Epoch 114/500  
28/28 [=====] - 2s 70ms/step - loss: 0.7817 - f1_score:  
0.7816 - val_loss: 1.3192 - val_f1_score: 0.6610  
Epoch 115/500  
28/28 [=====] - 2s 70ms/step - loss: 0.7843 - f1_score:  
0.7764 - val_loss: 1.3348 - val_f1_score: 0.6651  
Epoch 116/500  
28/28 [=====] - ETA: 0s - loss: 0.7496 - f1_score:  
0.7915  
  
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 1D-CNN + 1 GRU Trial 698/assets  
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets  
28/28 [=====] - 10s 379ms/step - loss: 0.7496 -  
f1_score: 0.7915 - val_loss: 1.3188 - val_f1_score: 0.6729  
Epoch 117/500  
28/28 [=====] - 2s 72ms/step - loss: 0.7488 - f1_score:  
0.7935 - val_loss: 1.2779 - val_f1_score: 0.6669  
Epoch 118/500  
28/28 [=====] - 2s 70ms/step - loss: 0.7421 - f1_score:  
0.7927 - val_loss: 1.3394 - val_f1_score: 0.6390  
Epoch 119/500
```

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28/28 [=====] - ETA: 0s - loss: 0.7270 - f1_score: 0.8024
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 363ms/step - loss: 0.7270 - f1_score: 0.8024 - val_loss: 1.3016 - val_f1_score: 0.6761
Epoch 120/500
28/28 [=====] - 2s 69ms/step - loss: 0.7491 - f1_score: 0.7935 - val_loss: 1.2963 - val_f1_score: 0.6580
Epoch 121/500
28/28 [=====] - 2s 70ms/step - loss: 0.7118 - f1_score: 0.8114 - val_loss: 1.2994 - val_f1_score: 0.6648
Epoch 122/500
28/28 [=====] - ETA: 0s - loss: 0.7254 - f1_score: 0.8019
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 15s 550ms/step - loss: 0.7254 - f1_score: 0.8019 - val_loss: 1.2919 - val_f1_score: 0.6846
Epoch 123/500
28/28 [=====] - 2s 69ms/step - loss: 0.7065 - f1_score: 0.8171 - val_loss: 1.3605 - val_f1_score: 0.6729
Epoch 124/500
28/28 [=====] - 2s 69ms/step - loss: 0.6917 - f1_score: 0.8098 - val_loss: 1.3187 - val_f1_score: 0.6699
Epoch 125/500
28/28 [=====] - 2s 69ms/step - loss: 0.6642 - f1_score: 0.8181 - val_loss: 1.3706 - val_f1_score: 0.6429
Epoch 126/500
28/28 [=====] - 2s 70ms/step - loss: 0.6788 - f1_score: 0.8177 - val_loss: 1.2788 - val_f1_score: 0.6767
Epoch 127/500
28/28 [=====] - 2s 70ms/step - loss: 0.6773 - f1_score: 0.8229 - val_loss: 1.3095 - val_f1_score: 0.6686
Epoch 128/500
28/28 [=====] - 2s 70ms/step - loss: 0.6704 - f1_score:
```

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0.8219 - val_loss: 1.4807 - val_f1_score: 0.6495
Epoch 129/500
28/28 [=====] - 2s 69ms/step - loss: 0.6622 - f1_score: 0.8201 - val_loss: 1.3759 - val_f1_score: 0.6694
Epoch 130/500
28/28 [=====] - 2s 70ms/step - loss: 0.6542 - f1_score: 0.8335 - val_loss: 1.3369 - val_f1_score: 0.6788
Epoch 131/500
28/28 [=====] - 2s 70ms/step - loss: 0.6214 - f1_score: 0.8366 - val_loss: 1.3577 - val_f1_score: 0.6624
Epoch 132/500
28/28 [=====] - 2s 70ms/step - loss: 0.6407 - f1_score: 0.8296 - val_loss: 1.2751 - val_f1_score: 0.6775
Epoch 133/500
28/28 [=====] - 2s 71ms/step - loss: 0.6286 - f1_score: 0.8352 - val_loss: 1.2745 - val_f1_score: 0.6790
Epoch 134/500
28/28 [=====] - ETA: 0s - loss: 0.6194 - f1_score: 0.8285
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 10s 363ms/step - loss: 0.6194 - f1_score: 0.8285 - val_loss: 1.2971 - val_f1_score: 0.6967
Epoch 135/500
28/28 [=====] - 2s 70ms/step - loss: 0.6113 - f1_score: 0.8358 - val_loss: 1.2822 - val_f1_score: 0.6882
Epoch 136/500
28/28 [=====] - ETA: 0s - loss: 0.6131 - f1_score: 0.8351
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 408ms/step - loss: 0.6131 - f1_score: 0.8351 - val_loss: 1.2825 - val_f1_score: 0.7059
Epoch 137/500
28/28 [=====] - 2s 71ms/step - loss: 0.5782 - f1_score: 0.8543 - val_loss: 1.3908 - val_f1_score: 0.6610
```

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Epoch 138/500
28/28 [=====] - 2s 72ms/step - loss: 0.5939 - f1_score: 0.8481 - val_loss: 1.2764 - val_f1_score: 0.6985
Epoch 139/500
28/28 [=====] - 2s 72ms/step - loss: 0.5970 - f1_score: 0.8418 - val_loss: 1.3084 - val_f1_score: 0.6733
Epoch 140/500
28/28 [=====] - 2s 73ms/step - loss: 0.5736 - f1_score: 0.8562 - val_loss: 1.3166 - val_f1_score: 0.6719
Epoch 141/500
28/28 [=====] - 2s 71ms/step - loss: 0.5661 - f1_score: 0.8506 - val_loss: 1.3064 - val_f1_score: 0.6819
Epoch 142/500
28/28 [=====] - 2s 71ms/step - loss: 0.5455 - f1_score: 0.8563 - val_loss: 1.2797 - val_f1_score: 0.6575
Epoch 143/500
28/28 [=====] - 2s 70ms/step - loss: 0.5698 - f1_score: 0.8481 - val_loss: 1.3801 - val_f1_score: 0.6626
Epoch 144/500
28/28 [=====] - 2s 70ms/step - loss: 0.5585 - f1_score: 0.8554 - val_loss: 1.3315 - val_f1_score: 0.6643
Epoch 145/500
28/28 [=====] - 2s 73ms/step - loss: 0.5404 - f1_score: 0.8629 - val_loss: 1.2642 - val_f1_score: 0.6911
Epoch 146/500
28/28 [=====] - 2s 75ms/step - loss: 0.5317 - f1_score: 0.8654 - val_loss: 1.2237 - val_f1_score: 0.6976
Epoch 147/500
28/28 [=====] - 2s 70ms/step - loss: 0.5340 - f1_score: 0.8687 - val_loss: 1.3230 - val_f1_score: 0.6857
Epoch 148/500
28/28 [=====] - 2s 71ms/step - loss: 0.5233 - f1_score: 0.8699 - val_loss: 1.2466 - val_f1_score: 0.6978
Epoch 149/500
28/28 [=====] - 2s 71ms/step - loss: 0.5356 - f1_score: 0.8619 - val_loss: 1.3465 - val_f1_score: 0.6795
Epoch 150/500
28/28 [=====] - 2s 71ms/step - loss: 0.5111 - f1_score: 0.8708 - val_loss: 1.2942 - val_f1_score: 0.6902
Epoch 151/500
28/28 [=====] - 2s 70ms/step - loss: 0.5089 - f1_score: 0.8698 - val_loss: 1.3632 - val_f1_score: 0.6686
Epoch 152/500
28/28 [=====] - 2s 71ms/step - loss: 0.5122 - f1_score: 0.8736 - val_loss: 1.3188 - val_f1_score: 0.6824
Epoch 153/500
28/28 [=====] - 2s 71ms/step - loss: 0.5009 - f1_score: 0.8743 - val_loss: 1.2963 - val_f1_score: 0.6906
```

Epoch 154/500  
28/28 [=====] - 2s 71ms/step - loss: 0.4837 - f1\_score: 0.8802 - val\_loss: 1.3366 - val\_f1\_score: 0.6852  
Epoch 155/500  
28/28 [=====] - 2s 71ms/step - loss: 0.4883 - f1\_score: 0.8802 - val\_loss: 1.3288 - val\_f1\_score: 0.6908  
Epoch 156/500  
28/28 [=====] - 2s 71ms/step - loss: 0.4731 - f1\_score: 0.8836 - val\_loss: 1.3189 - val\_f1\_score: 0.6901  
Epoch 157/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4839 - f1\_score: 0.8778 - val\_loss: 1.2765 - val\_f1\_score: 0.6996  
Epoch 158/500  
28/28 [=====] - 2s 73ms/step - loss: 0.4847 - f1\_score: 0.8736 - val\_loss: 1.3002 - val\_f1\_score: 0.6808  
Epoch 159/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4570 - f1\_score: 0.8933 - val\_loss: 1.2850 - val\_f1\_score: 0.6939  
Epoch 160/500  
28/28 [=====] - 2s 74ms/step - loss: 0.4798 - f1\_score: 0.8774 - val\_loss: 1.3300 - val\_f1\_score: 0.6827  
Epoch 161/500  
28/28 [=====] - 2s 74ms/step - loss: 0.4695 - f1\_score: 0.8775 - val\_loss: 1.2754 - val\_f1\_score: 0.6872  
Epoch 162/500  
28/28 [=====] - 2s 75ms/step - loss: 0.4608 - f1\_score: 0.8827 - val\_loss: 1.2818 - val\_f1\_score: 0.6839  
Epoch 163/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4544 - f1\_score: 0.8872 - val\_loss: 1.3003 - val\_f1\_score: 0.6927  
Epoch 164/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4306 - f1\_score: 0.9018 - val\_loss: 1.3400 - val\_f1\_score: 0.6863  
Epoch 165/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4426 - f1\_score: 0.8946 - val\_loss: 1.3725 - val\_f1\_score: 0.6614  
Epoch 166/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4339 - f1\_score: 0.8928 - val\_loss: 1.3106 - val\_f1\_score: 0.6900  
Epoch 167/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4374 - f1\_score: 0.8973 - val\_loss: 1.3966 - val\_f1\_score: 0.6758  
Epoch 168/500  
28/28 [=====] - 2s 72ms/step - loss: 0.4302 - f1\_score: 0.8893 - val\_loss: 1.3063 - val\_f1\_score: 0.7020  
Epoch 169/500  
28/28 [=====] - ETA: 0s - loss: 0.4220 - f1\_score: 0.8933

```
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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 13s 471ms/step - loss: 0.4220 -
f1_score: 0.8933 - val_loss: 1.3843 - val_f1_score: 0.7066
Epoch 170/500
28/28 [=====] - 2s 71ms/step - loss: 0.4245 - f1_score:
0.8976 - val_loss: 1.2902 - val_f1_score: 0.6910
Epoch 171/500
28/28 [=====] - ETA: 0s - loss: 0.4250 - f1_score:
0.8999

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 11s 396ms/step - loss: 0.4250 -
f1_score: 0.8999 - val_loss: 1.2098 - val_f1_score: 0.7249
Epoch 172/500
28/28 [=====] - 2s 71ms/step - loss: 0.4086 - f1_score:
0.9035 - val_loss: 1.3207 - val_f1_score: 0.7013
Epoch 173/500
28/28 [=====] - 2s 72ms/step - loss: 0.4057 - f1_score:
0.9102 - val_loss: 1.3761 - val_f1_score: 0.6524
Epoch 174/500
28/28 [=====] - 2s 72ms/step - loss: 0.4071 - f1_score:
0.9013 - val_loss: 1.2815 - val_f1_score: 0.7066
Epoch 175/500
28/28 [=====] - 2s 72ms/step - loss: 0.4105 - f1_score:
0.8983 - val_loss: 1.3115 - val_f1_score: 0.6943
Epoch 176/500
28/28 [=====] - 2s 72ms/step - loss: 0.3881 - f1_score:
0.9137 - val_loss: 1.3280 - val_f1_score: 0.6914
Epoch 177/500
28/28 [=====] - 2s 72ms/step - loss: 0.3808 - f1_score:
0.9064 - val_loss: 1.3824 - val_f1_score: 0.6570
Epoch 178/500
28/28 [=====] - 2s 70ms/step - loss: 0.3968 - f1_score:
0.9143 - val_loss: 1.3086 - val_f1_score: 0.6852
Epoch 179/500
```

```
28/28 [=====] - 2s 71ms/step - loss: 0.3800 - f1_score: 0.9095 - val_loss: 1.3998 - val_f1_score: 0.6913
Epoch 180/500
28/28 [=====] - 2s 70ms/step - loss: 0.3799 - f1_score: 0.9112 - val_loss: 1.2987 - val_f1_score: 0.6970
Epoch 181/500
28/28 [=====] - 2s 71ms/step - loss: 0.3747 - f1_score: 0.9142 - val_loss: 1.2853 - val_f1_score: 0.6994
Epoch 182/500
28/28 [=====] - 2s 74ms/step - loss: 0.3442 - f1_score: 0.9294 - val_loss: 1.3312 - val_f1_score: 0.7064
Epoch 183/500
28/28 [=====] - 2s 72ms/step - loss: 0.3637 - f1_score: 0.9154 - val_loss: 1.3070 - val_f1_score: 0.7016
Epoch 184/500
28/28 [=====] - 2s 72ms/step - loss: 0.3728 - f1_score: 0.9121 - val_loss: 1.3724 - val_f1_score: 0.6890
Epoch 185/500
28/28 [=====] - 2s 71ms/step - loss: 0.3540 - f1_score: 0.9244 - val_loss: 1.2857 - val_f1_score: 0.6937
Epoch 186/500
28/28 [=====] - 2s 72ms/step - loss: 0.3550 - f1_score: 0.9224 - val_loss: 1.3031 - val_f1_score: 0.6993
Epoch 187/500
28/28 [=====] - 2s 71ms/step - loss: 0.3565 - f1_score: 0.9170 - val_loss: 1.3607 - val_f1_score: 0.6916
Epoch 188/500
28/28 [=====] - 2s 71ms/step - loss: 0.3393 - f1_score: 0.9234 - val_loss: 1.3467 - val_f1_score: 0.6958
Epoch 189/500
28/28 [=====] - 2s 72ms/step - loss: 0.3535 - f1_score: 0.9198 - val_loss: 1.3647 - val_f1_score: 0.6912
Epoch 190/500
28/28 [=====] - 2s 72ms/step - loss: 0.3437 - f1_score: 0.9283 - val_loss: 1.4094 - val_f1_score: 0.6903
Epoch 191/500
28/28 [=====] - 2s 72ms/step - loss: 0.3423 - f1_score: 0.9264 - val_loss: 1.3541 - val_f1_score: 0.6987
Epoch 192/500
28/28 [=====] - 2s 72ms/step - loss: 0.3411 - f1_score: 0.9287 - val_loss: 1.3610 - val_f1_score: 0.6951
Epoch 193/500
28/28 [=====] - 2s 72ms/step - loss: 0.3213 - f1_score: 0.9300 - val_loss: 1.4756 - val_f1_score: 0.6668
Epoch 194/500
28/28 [=====] - 2s 72ms/step - loss: 0.3257 - f1_score: 0.9313 - val_loss: 1.3609 - val_f1_score: 0.6984
Epoch 195/500
```

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28/28 [=====] - 2s 72ms/step - loss: 0.3298 - f1_score: 0.9284 - val_loss: 1.2888 - val_f1_score: 0.7050
Epoch 196/500
28/28 [=====] - 2s 71ms/step - loss: 0.3283 - f1_score: 0.9232 - val_loss: 1.3441 - val_f1_score: 0.6876
Epoch 197/500
28/28 [=====] - 2s 72ms/step - loss: 0.3297 - f1_score: 0.9222 - val_loss: 1.3869 - val_f1_score: 0.6732
Epoch 198/500
28/28 [=====] - 2s 73ms/step - loss: 0.3142 - f1_score: 0.9360 - val_loss: 1.3607 - val_f1_score: 0.6872
Epoch 199/500
28/28 [=====] - 2s 73ms/step - loss: 0.3039 - f1_score: 0.9379 - val_loss: 1.4707 - val_f1_score: 0.6571
Epoch 200/500
28/28 [=====] - 2s 72ms/step - loss: 0.3137 - f1_score: 0.9338 - val_loss: 1.4173 - val_f1_score: 0.6927
Epoch 201/500
28/28 [=====] - 2s 71ms/step - loss: 0.2946 - f1_score: 0.9422 - val_loss: 1.4847 - val_f1_score: 0.6657
Epoch 202/500
28/28 [=====] - 2s 76ms/step - loss: 0.2986 - f1_score: 0.9378 - val_loss: 1.3729 - val_f1_score: 0.6985
Epoch 203/500
28/28 [=====] - 2s 81ms/step - loss: 0.3010 - f1_score: 0.9351 - val_loss: 1.3613 - val_f1_score: 0.7028
Epoch 204/500
28/28 [=====] - 2s 71ms/step - loss: 0.3061 - f1_score: 0.9380 - val_loss: 1.3547 - val_f1_score: 0.6932
Epoch 205/500
28/28 [=====] - 2s 71ms/step - loss: 0.3048 - f1_score: 0.9339 - val_loss: 1.3662 - val_f1_score: 0.6996
Epoch 206/500
28/28 [=====] - 2s 72ms/step - loss: 0.3029 - f1_score: 0.9405 - val_loss: 1.4237 - val_f1_score: 0.6958
Epoch 207/500
28/28 [=====] - 2s 71ms/step - loss: 0.2830 - f1_score: 0.9393 - val_loss: 1.3928 - val_f1_score: 0.6906
Epoch 208/500
28/28 [=====] - 2s 71ms/step - loss: 0.2825 - f1_score: 0.9452 - val_loss: 1.3605 - val_f1_score: 0.6955
Epoch 209/500
28/28 [=====] - 2s 71ms/step - loss: 0.2875 - f1_score: 0.9410 - val_loss: 1.4112 - val_f1_score: 0.7005
Epoch 210/500
28/28 [=====] - 2s 71ms/step - loss: 0.2779 - f1_score: 0.9444 - val_loss: 1.4214 - val_f1_score: 0.7064
Epoch 211/500
```

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28/28 [=====] - 2s 71ms/step - loss: 0.2891 - f1_score: 0.9379 - val_loss: 1.3914 - val_f1_score: 0.7122
Epoch 212/500
28/28 [=====] - 2s 73ms/step - loss: 0.2578 - f1_score: 0.9540 - val_loss: 1.4148 - val_f1_score: 0.6849
Epoch 213/500
28/28 [=====] - 2s 75ms/step - loss: 0.2658 - f1_score: 0.9480 - val_loss: 1.3567 - val_f1_score: 0.6965
Epoch 214/500
28/28 [=====] - 2s 73ms/step - loss: 0.2848 - f1_score: 0.9377 - val_loss: 1.4412 - val_f1_score: 0.7001
Epoch 215/500
28/28 [=====] - 2s 71ms/step - loss: 0.2584 - f1_score: 0.9493 - val_loss: 1.3560 - val_f1_score: 0.7024
Epoch 216/500
28/28 [=====] - 2s 72ms/step - loss: 0.2742 - f1_score: 0.9444 - val_loss: 1.4153 - val_f1_score: 0.6866
Epoch 217/500
28/28 [=====] - 2s 72ms/step - loss: 0.2577 - f1_score: 0.9519 - val_loss: 1.4798 - val_f1_score: 0.7107
Epoch 218/500
28/28 [=====] - 2s 71ms/step - loss: 0.2697 - f1_score: 0.9484 - val_loss: 1.3068 - val_f1_score: 0.7153
Epoch 219/500
28/28 [=====] - 2s 71ms/step - loss: 0.2580 - f1_score: 0.9472 - val_loss: 1.3727 - val_f1_score: 0.6931
Epoch 220/500
28/28 [=====] - 2s 72ms/step - loss: 0.2431 - f1_score: 0.9637 - val_loss: 1.3766 - val_f1_score: 0.7110
Epoch 221/500
28/28 [=====] - 2s 73ms/step - loss: 0.2555 - f1_score: 0.9484 - val_loss: 1.3879 - val_f1_score: 0.7157
Epoch 222/500
28/28 [=====] - 2s 73ms/step - loss: 0.2556 - f1_score: 0.9487 - val_loss: 1.4209 - val_f1_score: 0.7080
Epoch 223/500
28/28 [=====] - 2s 74ms/step - loss: 0.2400 - f1_score: 0.9607 - val_loss: 1.3678 - val_f1_score: 0.6987
Epoch 224/500
28/28 [=====] - 2s 73ms/step - loss: 0.2472 - f1_score: 0.9473 - val_loss: 1.5405 - val_f1_score: 0.6830
Epoch 225/500
28/28 [=====] - 2s 74ms/step - loss: 0.2570 - f1_score: 0.9485 - val_loss: 1.3482 - val_f1_score: 0.7020
Epoch 226/500
28/28 [=====] - 2s 74ms/step - loss: 0.2411 - f1_score: 0.9590 - val_loss: 1.4562 - val_f1_score: 0.6786
Epoch 227/500
```

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28/28 [=====] - 2s 72ms/step - loss: 0.2453 - f1_score: 0.9503 - val_loss: 1.3915 - val_f1_score: 0.7010
Epoch 228/500
28/28 [=====] - 2s 73ms/step - loss: 0.2420 - f1_score: 0.9547 - val_loss: 1.3895 - val_f1_score: 0.6936
Epoch 229/500
28/28 [=====] - 2s 72ms/step - loss: 0.2318 - f1_score: 0.9582 - val_loss: 1.3816 - val_f1_score: 0.7025
Epoch 230/500
28/28 [=====] - 2s 74ms/step - loss: 0.2383 - f1_score: 0.9547 - val_loss: 1.3698 - val_f1_score: 0.6954
Epoch 231/500
28/28 [=====] - 2s 76ms/step - loss: 0.2377 - f1_score: 0.9557 - val_loss: 1.3755 - val_f1_score: 0.7079
Epoch 232/500
28/28 [=====] - 2s 74ms/step - loss: 0.2256 - f1_score: 0.9582 - val_loss: 1.4751 - val_f1_score: 0.6884
Epoch 233/500
28/28 [=====] - 2s 75ms/step - loss: 0.2186 - f1_score: 0.9657 - val_loss: 1.5014 - val_f1_score: 0.7045
Epoch 234/500
28/28 [=====] - 2s 73ms/step - loss: 0.2365 - f1_score: 0.9510 - val_loss: 1.4537 - val_f1_score: 0.6960
Epoch 235/500
28/28 [=====] - 2s 76ms/step - loss: 0.2274 - f1_score: 0.9559 - val_loss: 1.4395 - val_f1_score: 0.6815
Epoch 236/500
28/28 [=====] - 2s 74ms/step - loss: 0.2167 - f1_score: 0.9587 - val_loss: 1.3990 - val_f1_score: 0.6915
Epoch 237/500
28/28 [=====] - ETA: 0s - loss: 0.2211 - f1_score: 0.9599

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 1D-CNN + 1 GRU Trial 698/assets
INFO:tensorflow:Assets written to: 2 1D-CNN + 1 GRU Trial 698/assets
28/28 [=====] - 14s 509ms/step - loss: 0.2211 - f1_score: 0.9599 - val_loss: 1.3137 - val_f1_score: 0.7387
Epoch 238/500
28/28 [=====] - 2s 71ms/step - loss: 0.2146 - f1_score: 0.9612 - val_loss: 1.5006 - val_f1_score: 0.6713
Epoch 239/500
28/28 [=====] - 2s 71ms/step - loss: 0.2082 - f1_score: 0.9687 - val_loss: 1.4343 - val_f1_score: 0.7017

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Epoch 240/500
28/28 [=====] - 2s 71ms/step - loss: 0.2433 - f1_score: 0.9504 - val_loss: 1.4233 - val_f1_score: 0.7025
Epoch 241/500
28/28 [=====] - 2s 71ms/step - loss: 0.2235 - f1_score: 0.9567 - val_loss: 1.4888 - val_f1_score: 0.6989
Epoch 242/500
28/28 [=====] - 2s 71ms/step - loss: 0.2200 - f1_score: 0.9618 - val_loss: 1.4996 - val_f1_score: 0.6875
Epoch 243/500
28/28 [=====] - 2s 71ms/step - loss: 0.2425 - f1_score: 0.9498 - val_loss: 1.4386 - val_f1_score: 0.6972
Epoch 244/500
28/28 [=====] - 2s 77ms/step - loss: 0.2209 - f1_score: 0.9578 - val_loss: 1.4344 - val_f1_score: 0.6925
Epoch 245/500
28/28 [=====] - 2s 72ms/step - loss: 0.2251 - f1_score: 0.9614 - val_loss: 1.4229 - val_f1_score: 0.7083
Epoch 246/500
28/28 [=====] - 2s 72ms/step - loss: 0.2102 - f1_score: 0.9649 - val_loss: 1.6253 - val_f1_score: 0.6670
Epoch 247/500
28/28 [=====] - 2s 72ms/step - loss: 0.2162 - f1_score: 0.9575 - val_loss: 1.5255 - val_f1_score: 0.6786
Epoch 248/500
28/28 [=====] - 2s 72ms/step - loss: 0.2135 - f1_score: 0.9597 - val_loss: 1.3882 - val_f1_score: 0.7293
Epoch 249/500
28/28 [=====] - 2s 74ms/step - loss: 0.1962 - f1_score: 0.9695 - val_loss: 1.4420 - val_f1_score: 0.6991
Epoch 250/500
28/28 [=====] - 2s 72ms/step - loss: 0.1953 - f1_score: 0.9710 - val_loss: 1.4447 - val_f1_score: 0.6981
Epoch 251/500
28/28 [=====] - 2s 72ms/step - loss: 0.2000 - f1_score: 0.9629 - val_loss: 1.4206 - val_f1_score: 0.7034
Epoch 252/500
28/28 [=====] - 2s 72ms/step - loss: 0.1917 - f1_score: 0.9685 - val_loss: 1.4718 - val_f1_score: 0.6976
Epoch 253/500
28/28 [=====] - 2s 72ms/step - loss: 0.2104 - f1_score: 0.9630 - val_loss: 1.5695 - val_f1_score: 0.7040
Epoch 254/500
28/28 [=====] - 2s 74ms/step - loss: 0.2245 - f1_score: 0.9557 - val_loss: 1.4368 - val_f1_score: 0.7201
Epoch 255/500
28/28 [=====] - 2s 72ms/step - loss: 0.1904 - f1_score: 0.9696 - val_loss: 1.6187 - val_f1_score: 0.6804
```

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Epoch 256/500
28/28 [=====] - 2s 72ms/step - loss: 0.1962 - f1_score: 0.9647 - val_loss: 1.5241 - val_f1_score: 0.6825
Epoch 257/500
28/28 [=====] - 2s 72ms/step - loss: 0.2004 - f1_score: 0.9679 - val_loss: 1.5126 - val_f1_score: 0.6847
Epoch 258/500
28/28 [=====] - 2s 72ms/step - loss: 0.1901 - f1_score: 0.9670 - val_loss: 1.4101 - val_f1_score: 0.7163
Epoch 259/500
28/28 [=====] - 2s 73ms/step - loss: 0.1870 - f1_score: 0.9692 - val_loss: 1.5345 - val_f1_score: 0.6951
Epoch 260/500
28/28 [=====] - 2s 72ms/step - loss: 0.1848 - f1_score: 0.9664 - val_loss: 1.4697 - val_f1_score: 0.7107
Epoch 261/500
28/28 [=====] - 2s 73ms/step - loss: 0.1886 - f1_score: 0.9684 - val_loss: 1.5100 - val_f1_score: 0.7264
Epoch 262/500
28/28 [=====] - 2s 73ms/step - loss: 0.1885 - f1_score: 0.9653 - val_loss: 1.4862 - val_f1_score: 0.7093
Epoch 263/500
28/28 [=====] - 2s 73ms/step - loss: 0.1816 - f1_score: 0.9715 - val_loss: 1.5338 - val_f1_score: 0.7057
Epoch 264/500
28/28 [=====] - 2s 73ms/step - loss: 0.1907 - f1_score: 0.9695 - val_loss: 1.5406 - val_f1_score: 0.6883
Epoch 265/500
28/28 [=====] - 2s 74ms/step - loss: 0.1910 - f1_score: 0.9639 - val_loss: 1.5651 - val_f1_score: 0.6906
Epoch 266/500
28/28 [=====] - 2s 73ms/step - loss: 0.1848 - f1_score: 0.9700 - val_loss: 1.4766 - val_f1_score: 0.6924
Epoch 267/500
28/28 [=====] - 2s 72ms/step - loss: 0.1785 - f1_score: 0.9707 - val_loss: 1.5174 - val_f1_score: 0.6933
Epoch 268/500
28/28 [=====] - 2s 72ms/step - loss: 0.1801 - f1_score: 0.9697 - val_loss: 1.4972 - val_f1_score: 0.6821
Epoch 269/500
28/28 [=====] - 2s 73ms/step - loss: 0.1763 - f1_score: 0.9718 - val_loss: 1.6416 - val_f1_score: 0.6778
Epoch 270/500
28/28 [=====] - 2s 72ms/step - loss: 0.1750 - f1_score: 0.9712 - val_loss: 1.5199 - val_f1_score: 0.6930
Epoch 271/500
28/28 [=====] - 2s 72ms/step - loss: 0.1747 - f1_score: 0.9694 - val_loss: 1.5072 - val_f1_score: 0.6827
```

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Epoch 272/500
28/28 [=====] - 2s 73ms/step - loss: 0.1909 - f1_score: 0.9631 - val_loss: 1.5269 - val_f1_score: 0.6817
Epoch 273/500
28/28 [=====] - 2s 74ms/step - loss: 0.1703 - f1_score: 0.9725 - val_loss: 1.4339 - val_f1_score: 0.7202
Epoch 274/500
28/28 [=====] - 2s 74ms/step - loss: 0.1777 - f1_score: 0.9678 - val_loss: 1.6454 - val_f1_score: 0.6698
Epoch 275/500
28/28 [=====] - 2s 73ms/step - loss: 0.1682 - f1_score: 0.9696 - val_loss: 1.5545 - val_f1_score: 0.6874
Epoch 276/500
28/28 [=====] - 2s 74ms/step - loss: 0.1806 - f1_score: 0.9667 - val_loss: 1.5800 - val_f1_score: 0.7003
Epoch 277/500
28/28 [=====] - 2s 73ms/step - loss: 0.1612 - f1_score: 0.9758 - val_loss: 1.4291 - val_f1_score: 0.7005
Epoch 278/500
28/28 [=====] - 2s 73ms/step - loss: 0.1556 - f1_score: 0.9778 - val_loss: 1.4666 - val_f1_score: 0.6961
Epoch 279/500
28/28 [=====] - 2s 73ms/step - loss: 0.1634 - f1_score: 0.9712 - val_loss: 1.4667 - val_f1_score: 0.6990
Epoch 280/500
28/28 [=====] - 2s 74ms/step - loss: 0.1555 - f1_score: 0.9773 - val_loss: 1.4751 - val_f1_score: 0.7122
Epoch 281/500
28/28 [=====] - 2s 73ms/step - loss: 0.1876 - f1_score: 0.9621 - val_loss: 1.4978 - val_f1_score: 0.6902
Epoch 282/500
28/28 [=====] - 2s 73ms/step - loss: 0.1619 - f1_score: 0.9766 - val_loss: 1.4853 - val_f1_score: 0.7146
Epoch 283/500
28/28 [=====] - 2s 73ms/step - loss: 0.1663 - f1_score: 0.9746 - val_loss: 1.5150 - val_f1_score: 0.6995
Epoch 284/500
28/28 [=====] - 2s 73ms/step - loss: 0.1669 - f1_score: 0.9733 - val_loss: 1.4592 - val_f1_score: 0.7179
Epoch 285/500
28/28 [=====] - 2s 73ms/step - loss: 0.1666 - f1_score: 0.9726 - val_loss: 1.4986 - val_f1_score: 0.6982
Epoch 286/500
28/28 [=====] - 2s 73ms/step - loss: 0.1564 - f1_score: 0.9737 - val_loss: 1.5436 - val_f1_score: 0.7133
Epoch 287/500
28/28 [=====] - 2s 72ms/step - loss: 0.1499 - f1_score: 0.9784 - val_loss: 1.4363 - val_f1_score: 0.7110
```

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Epoch 288/500
28/28 [=====] - 2s 73ms/step - loss: 0.1657 - f1_score: 0.9727 - val_loss: 1.5960 - val_f1_score: 0.6755
Epoch 289/500
28/28 [=====] - 2s 73ms/step - loss: 0.1568 - f1_score: 0.9779 - val_loss: 1.6123 - val_f1_score: 0.6782
Epoch 290/500
28/28 [=====] - 2s 72ms/step - loss: 0.1722 - f1_score: 0.9692 - val_loss: 1.5456 - val_f1_score: 0.6896
Epoch 291/500
28/28 [=====] - 2s 72ms/step - loss: 0.1569 - f1_score: 0.9768 - val_loss: 1.6973 - val_f1_score: 0.6847
Epoch 292/500
28/28 [=====] - 2s 76ms/step - loss: 0.1596 - f1_score: 0.9773 - val_loss: 1.5804 - val_f1_score: 0.6917
Epoch 293/500
28/28 [=====] - 2s 75ms/step - loss: 0.1595 - f1_score: 0.9770 - val_loss: 1.5698 - val_f1_score: 0.6999
Epoch 294/500
28/28 [=====] - 2s 74ms/step - loss: 0.1679 - f1_score: 0.9706 - val_loss: 1.5124 - val_f1_score: 0.7045
Epoch 295/500
28/28 [=====] - 2s 75ms/step - loss: 0.1586 - f1_score: 0.9748 - val_loss: 1.5455 - val_f1_score: 0.6973
Epoch 296/500
28/28 [=====] - 2s 73ms/step - loss: 0.1533 - f1_score: 0.9796 - val_loss: 1.5782 - val_f1_score: 0.6897
Epoch 297/500
28/28 [=====] - 2s 73ms/step - loss: 0.1503 - f1_score: 0.9765 - val_loss: 1.4938 - val_f1_score: 0.6980
Epoch 298/500
28/28 [=====] - 2s 72ms/step - loss: 0.1486 - f1_score: 0.9780 - val_loss: 1.4987 - val_f1_score: 0.6988
Epoch 299/500
28/28 [=====] - 2s 73ms/step - loss: 0.1467 - f1_score: 0.9785 - val_loss: 1.6040 - val_f1_score: 0.6736
Epoch 300/500
28/28 [=====] - 2s 74ms/step - loss: 0.1380 - f1_score: 0.9813 - val_loss: 1.6051 - val_f1_score: 0.6982
Epoch 301/500
28/28 [=====] - 2s 73ms/step - loss: 0.1591 - f1_score: 0.9726 - val_loss: 1.5027 - val_f1_score: 0.6863
Epoch 302/500
28/28 [=====] - 2s 72ms/step - loss: 0.1462 - f1_score: 0.9823 - val_loss: 1.5577 - val_f1_score: 0.6937
Epoch 303/500
28/28 [=====] - 2s 73ms/step - loss: 0.1462 - f1_score: 0.9764 - val_loss: 1.5449 - val_f1_score: 0.6999
```

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Epoch 304/500
28/28 [=====] - 2s 73ms/step - loss: 0.1600 - f1_score: 0.9737 - val_loss: 1.6719 - val_f1_score: 0.6826
Epoch 305/500
28/28 [=====] - 2s 72ms/step - loss: 0.1686 - f1_score: 0.9626 - val_loss: 1.5782 - val_f1_score: 0.7139
Epoch 306/500
28/28 [=====] - 2s 73ms/step - loss: 0.1482 - f1_score: 0.9755 - val_loss: 1.6595 - val_f1_score: 0.6827
Epoch 307/500
28/28 [=====] - 2s 72ms/step - loss: 0.1514 - f1_score: 0.9753 - val_loss: 1.4560 - val_f1_score: 0.7219
Epoch 308/500
28/28 [=====] - 2s 73ms/step - loss: 0.1379 - f1_score: 0.9812 - val_loss: 1.6183 - val_f1_score: 0.6978
Epoch 309/500
28/28 [=====] - 2s 73ms/step - loss: 0.1446 - f1_score: 0.9781 - val_loss: 1.5772 - val_f1_score: 0.6811
Epoch 310/500
28/28 [=====] - 2s 72ms/step - loss: 0.1427 - f1_score: 0.9793 - val_loss: 1.6781 - val_f1_score: 0.6770
Epoch 311/500
28/28 [=====] - 2s 72ms/step - loss: 0.1339 - f1_score: 0.9839 - val_loss: 1.5483 - val_f1_score: 0.7042
Epoch 312/500
28/28 [=====] - 2s 72ms/step - loss: 0.1259 - f1_score: 0.9862 - val_loss: 1.5900 - val_f1_score: 0.6930
Epoch 313/500
28/28 [=====] - 2s 73ms/step - loss: 0.1474 - f1_score: 0.9763 - val_loss: 1.5499 - val_f1_score: 0.6996
Epoch 314/500
28/28 [=====] - 2s 72ms/step - loss: 0.1241 - f1_score: 0.9878 - val_loss: 1.6139 - val_f1_score: 0.7099
Epoch 315/500
28/28 [=====] - 2s 72ms/step - loss: 0.1387 - f1_score: 0.9782 - val_loss: 1.5496 - val_f1_score: 0.7230
Epoch 316/500
28/28 [=====] - 2s 73ms/step - loss: 0.1458 - f1_score: 0.9766 - val_loss: 1.5967 - val_f1_score: 0.6810
Epoch 317/500
28/28 [=====] - 2s 73ms/step - loss: 0.1303 - f1_score: 0.9822 - val_loss: 1.6505 - val_f1_score: 0.7096
Epoch 318/500
28/28 [=====] - 2s 72ms/step - loss: 0.1675 - f1_score: 0.9689 - val_loss: 1.5598 - val_f1_score: 0.7057
Epoch 319/500
28/28 [=====] - 2s 72ms/step - loss: 0.1412 - f1_score: 0.9735 - val_loss: 1.7103 - val_f1_score: 0.6974
```

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Epoch 320/500
28/28 [=====] - 2s 73ms/step - loss: 0.1347 - f1_score: 0.9820 - val_loss: 1.5104 - val_f1_score: 0.7207
Epoch 321/500
28/28 [=====] - 2s 75ms/step - loss: 0.1276 - f1_score: 0.9837 - val_loss: 1.5860 - val_f1_score: 0.6935
Epoch 322/500
28/28 [=====] - 2s 75ms/step - loss: 0.1299 - f1_score: 0.9818 - val_loss: 1.6489 - val_f1_score: 0.6952
Epoch 323/500
28/28 [=====] - 2s 75ms/step - loss: 0.1292 - f1_score: 0.9831 - val_loss: 1.7080 - val_f1_score: 0.6770
Epoch 324/500
28/28 [=====] - 2s 75ms/step - loss: 0.1289 - f1_score: 0.9812 - val_loss: 1.5324 - val_f1_score: 0.7082
Epoch 325/500
28/28 [=====] - 2s 72ms/step - loss: 0.1311 - f1_score: 0.9800 - val_loss: 1.5812 - val_f1_score: 0.7100
Epoch 326/500
28/28 [=====] - 2s 73ms/step - loss: 0.1294 - f1_score: 0.9805 - val_loss: 1.5668 - val_f1_score: 0.7085
Epoch 327/500
28/28 [=====] - 2s 73ms/step - loss: 0.1380 - f1_score: 0.9781 - val_loss: 1.6502 - val_f1_score: 0.7108
Epoch 328/500
28/28 [=====] - 2s 73ms/step - loss: 0.1349 - f1_score: 0.9750 - val_loss: 1.6067 - val_f1_score: 0.7017
Epoch 329/500
28/28 [=====] - 2s 73ms/step - loss: 0.1247 - f1_score: 0.9857 - val_loss: 1.7386 - val_f1_score: 0.6509
Epoch 330/500
28/28 [=====] - 2s 73ms/step - loss: 0.1362 - f1_score: 0.9788 - val_loss: 1.5710 - val_f1_score: 0.7006
Epoch 331/500
28/28 [=====] - 2s 72ms/step - loss: 0.1217 - f1_score: 0.9852 - val_loss: 1.5650 - val_f1_score: 0.7129
Epoch 332/500
28/28 [=====] - 2s 73ms/step - loss: 0.1194 - f1_score: 0.9846 - val_loss: 1.6139 - val_f1_score: 0.6952
Epoch 333/500
28/28 [=====] - 2s 72ms/step - loss: 0.1229 - f1_score: 0.9822 - val_loss: 1.6154 - val_f1_score: 0.6894
Epoch 334/500
28/28 [=====] - 2s 72ms/step - loss: 0.1256 - f1_score: 0.9818 - val_loss: 1.5493 - val_f1_score: 0.7203
Epoch 335/500
28/28 [=====] - 2s 73ms/step - loss: 0.1368 - f1_score: 0.9764 - val_loss: 1.6018 - val_f1_score: 0.6902
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Epoch 336/500
28/28 [=====] - 2s 73ms/step - loss: 0.1195 - f1_score: 0.9823 - val_loss: 1.7107 - val_f1_score: 0.6974
Epoch 337/500
28/28 [=====] - 2s 72ms/step - loss: 0.1392 - f1_score: 0.9774 - val_loss: 1.6565 - val_f1_score: 0.7139
Epoch 338/500
28/28 [=====] - 2s 72ms/step - loss: 0.1246 - f1_score: 0.9816 - val_loss: 1.5582 - val_f1_score: 0.7066
Epoch 339/500
28/28 [=====] - 2s 72ms/step - loss: 0.1445 - f1_score: 0.9734 - val_loss: 1.5969 - val_f1_score: 0.7123
Epoch 340/500
28/28 [=====] - 2s 73ms/step - loss: 0.1345 - f1_score: 0.9779 - val_loss: 1.6736 - val_f1_score: 0.6828
Epoch 341/500
28/28 [=====] - 2s 72ms/step - loss: 0.1242 - f1_score: 0.9783 - val_loss: 1.6330 - val_f1_score: 0.6766
Epoch 342/500
28/28 [=====] - 2s 72ms/step - loss: 0.1266 - f1_score: 0.9795 - val_loss: 1.6692 - val_f1_score: 0.7082
Epoch 343/500
28/28 [=====] - 2s 73ms/step - loss: 0.1321 - f1_score: 0.9784 - val_loss: 1.6728 - val_f1_score: 0.6821
Epoch 344/500
28/28 [=====] - 2s 72ms/step - loss: 0.1419 - f1_score: 0.9748 - val_loss: 1.7940 - val_f1_score: 0.6882
Epoch 345/500
28/28 [=====] - 2s 73ms/step - loss: 0.1260 - f1_score: 0.9800 - val_loss: 1.6431 - val_f1_score: 0.6736
Epoch 346/500
28/28 [=====] - 2s 72ms/step - loss: 0.1176 - f1_score: 0.9837 - val_loss: 1.6627 - val_f1_score: 0.6986
Epoch 347/500
28/28 [=====] - 2s 73ms/step - loss: 0.1095 - f1_score: 0.9894 - val_loss: 1.5656 - val_f1_score: 0.7110
Epoch 348/500
28/28 [=====] - 2s 73ms/step - loss: 0.1165 - f1_score: 0.9858 - val_loss: 1.6392 - val_f1_score: 0.7152
Epoch 349/500
28/28 [=====] - 2s 73ms/step - loss: 0.1088 - f1_score: 0.9881 - val_loss: 1.5654 - val_f1_score: 0.7051
Epoch 350/500
28/28 [=====] - 2s 73ms/step - loss: 0.1113 - f1_score: 0.9860 - val_loss: 1.7401 - val_f1_score: 0.6788
Epoch 351/500
28/28 [=====] - 2s 74ms/step - loss: 0.1282 - f1_score: 0.9777 - val_loss: 1.7645 - val_f1_score: 0.6723
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Epoch 352/500
28/28 [=====] - 2s 73ms/step - loss: 0.1149 - f1_score: 0.9840 - val_loss: 1.6234 - val_f1_score: 0.6901
Epoch 353/500
28/28 [=====] - 2s 73ms/step - loss: 0.1149 - f1_score: 0.9848 - val_loss: 1.7597 - val_f1_score: 0.6577
Epoch 354/500
28/28 [=====] - 2s 73ms/step - loss: 0.1118 - f1_score: 0.9865 - val_loss: 1.6266 - val_f1_score: 0.7102
Epoch 355/500
28/28 [=====] - 2s 76ms/step - loss: 0.1108 - f1_score: 0.9867 - val_loss: 1.7048 - val_f1_score: 0.6907
Epoch 356/500
28/28 [=====] - 2s 84ms/step - loss: 0.1091 - f1_score: 0.9861 - val_loss: 1.5832 - val_f1_score: 0.6901
Epoch 357/500
28/28 [=====] - 2s 78ms/step - loss: 0.1113 - f1_score: 0.9854 - val_loss: 1.6432 - val_f1_score: 0.6974
Epoch 358/500
28/28 [=====] - 2s 73ms/step - loss: 0.1148 - f1_score: 0.9859 - val_loss: 1.6228 - val_f1_score: 0.6988
Epoch 359/500
28/28 [=====] - 2s 78ms/step - loss: 0.1369 - f1_score: 0.9768 - val_loss: 2.2437 - val_f1_score: 0.6530
Epoch 360/500
28/28 [=====] - 2s 75ms/step - loss: 0.2194 - f1_score: 0.9487 - val_loss: 1.5980 - val_f1_score: 0.7123
Epoch 361/500
28/28 [=====] - 2s 73ms/step - loss: 0.1182 - f1_score: 0.9838 - val_loss: 1.5904 - val_f1_score: 0.7146
Epoch 362/500
28/28 [=====] - 2s 73ms/step - loss: 0.1144 - f1_score: 0.9834 - val_loss: 1.5668 - val_f1_score: 0.6972
Epoch 363/500
28/28 [=====] - 2s 72ms/step - loss: 0.1095 - f1_score: 0.9861 - val_loss: 1.6805 - val_f1_score: 0.6963
Epoch 364/500
28/28 [=====] - 2s 73ms/step - loss: 0.1063 - f1_score: 0.9864 - val_loss: 1.6980 - val_f1_score: 0.6860
Epoch 365/500
28/28 [=====] - 2s 75ms/step - loss: 0.1084 - f1_score: 0.9840 - val_loss: 1.6722 - val_f1_score: 0.7095
Epoch 366/500
28/28 [=====] - 2s 79ms/step - loss: 0.1186 - f1_score: 0.9825 - val_loss: 1.7031 - val_f1_score: 0.6883
Epoch 367/500
28/28 [=====] - 2s 77ms/step - loss: 0.1042 - f1_score: 0.9889 - val_loss: 1.6297 - val_f1_score: 0.6941
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Epoch 368/500
28/28 [=====] - 2s 78ms/step - loss: 0.1063 - f1_score: 0.9853 - val_loss: 1.6951 - val_f1_score: 0.7078
Epoch 369/500
28/28 [=====] - 2s 76ms/step - loss: 0.0952 - f1_score: 0.9907 - val_loss: 1.6453 - val_f1_score: 0.7088
Epoch 370/500
28/28 [=====] - 2s 75ms/step - loss: 0.0991 - f1_score: 0.9879 - val_loss: 1.6563 - val_f1_score: 0.6994
Epoch 371/500
28/28 [=====] - 2s 75ms/step - loss: 0.0970 - f1_score: 0.9919 - val_loss: 1.6782 - val_f1_score: 0.6980
Epoch 372/500
28/28 [=====] - 2s 73ms/step - loss: 0.1021 - f1_score: 0.9878 - val_loss: 1.5958 - val_f1_score: 0.6924
Epoch 373/500
28/28 [=====] - 2s 73ms/step - loss: 0.0999 - f1_score: 0.9895 - val_loss: 1.5492 - val_f1_score: 0.7271
Epoch 374/500
28/28 [=====] - 2s 74ms/step - loss: 0.0973 - f1_score: 0.9881 - val_loss: 1.5912 - val_f1_score: 0.7028
Epoch 375/500
28/28 [=====] - 2s 74ms/step - loss: 0.0965 - f1_score: 0.9878 - val_loss: 1.6860 - val_f1_score: 0.6883
Epoch 376/500
28/28 [=====] - 2s 75ms/step - loss: 0.1066 - f1_score: 0.9858 - val_loss: 1.9318 - val_f1_score: 0.6775
Epoch 377/500
28/28 [=====] - 2s 75ms/step - loss: 0.1022 - f1_score: 0.9875 - val_loss: 1.6016 - val_f1_score: 0.7232
Epoch 378/500
28/28 [=====] - 2s 73ms/step - loss: 0.1070 - f1_score: 0.9827 - val_loss: 1.6880 - val_f1_score: 0.6986
Epoch 379/500
28/28 [=====] - 2s 76ms/step - loss: 0.1141 - f1_score: 0.9823 - val_loss: 1.6246 - val_f1_score: 0.7106
Epoch 380/500
28/28 [=====] - 2s 74ms/step - loss: 0.1052 - f1_score: 0.9835 - val_loss: 1.5826 - val_f1_score: 0.7162
Epoch 381/500
28/28 [=====] - 2s 74ms/step - loss: 0.1040 - f1_score: 0.9888 - val_loss: 1.7241 - val_f1_score: 0.6881
Epoch 382/500
28/28 [=====] - 2s 74ms/step - loss: 0.1007 - f1_score: 0.9882 - val_loss: 1.6255 - val_f1_score: 0.7028
Epoch 383/500
28/28 [=====] - 2s 78ms/step - loss: 0.0992 - f1_score: 0.9866 - val_loss: 1.6892 - val_f1_score: 0.6918
```

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Epoch 384/500
28/28 [=====] - 2s 74ms/step - loss: 0.0993 - f1_score: 0.9862 - val_loss: 1.6598 - val_f1_score: 0.7042
Epoch 385/500
28/28 [=====] - 2s 74ms/step - loss: 0.0996 - f1_score: 0.9852 - val_loss: 1.6543 - val_f1_score: 0.7174
Epoch 386/500
28/28 [=====] - 2s 74ms/step - loss: 0.0944 - f1_score: 0.9878 - val_loss: 1.8645 - val_f1_score: 0.6848
Epoch 387/500
28/28 [=====] - 2s 75ms/step - loss: 0.1011 - f1_score: 0.9852 - val_loss: 1.8163 - val_f1_score: 0.6923
Epoch 388/500
28/28 [=====] - 2s 74ms/step - loss: 0.1047 - f1_score: 0.9867 - val_loss: 1.7563 - val_f1_score: 0.6834
Epoch 389/500
28/28 [=====] - 2s 73ms/step - loss: 0.0995 - f1_score: 0.9861 - val_loss: 1.7399 - val_f1_score: 0.6909
Epoch 390/500
28/28 [=====] - 2s 73ms/step - loss: 0.0961 - f1_score: 0.9886 - val_loss: 1.6422 - val_f1_score: 0.7213
Epoch 391/500
28/28 [=====] - 2s 73ms/step - loss: 0.0901 - f1_score: 0.9908 - val_loss: 1.6551 - val_f1_score: 0.6746
Epoch 392/500
28/28 [=====] - 2s 74ms/step - loss: 0.0953 - f1_score: 0.9882 - val_loss: 1.7255 - val_f1_score: 0.7044
Epoch 393/500
28/28 [=====] - 2s 73ms/step - loss: 0.0961 - f1_score: 0.9883 - val_loss: 1.8150 - val_f1_score: 0.6905
Epoch 394/500
28/28 [=====] - 2s 73ms/step - loss: 0.1003 - f1_score: 0.9856 - val_loss: 1.5614 - val_f1_score: 0.7095
Epoch 395/500
28/28 [=====] - 2s 77ms/step - loss: 0.0956 - f1_score: 0.9886 - val_loss: 1.6651 - val_f1_score: 0.6917
Epoch 396/500
28/28 [=====] - 2s 74ms/step - loss: 0.0998 - f1_score: 0.9858 - val_loss: 1.7122 - val_f1_score: 0.6980
Epoch 397/500
28/28 [=====] - 2s 75ms/step - loss: 0.0935 - f1_score: 0.9896 - val_loss: 1.6558 - val_f1_score: 0.7138
Epoch 398/500
28/28 [=====] - 2s 75ms/step - loss: 0.1014 - f1_score: 0.9833 - val_loss: 1.8334 - val_f1_score: 0.6531
Epoch 399/500
28/28 [=====] - 2s 80ms/step - loss: 0.0974 - f1_score: 0.9874 - val_loss: 1.7464 - val_f1_score: 0.6944
```

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Epoch 400/500
28/28 [=====] - 2s 74ms/step - loss: 0.1024 - f1_score: 0.9827 - val_loss: 1.7734 - val_f1_score: 0.6801
Epoch 401/500
28/28 [=====] - 2s 74ms/step - loss: 0.0912 - f1_score: 0.9885 - val_loss: 1.6008 - val_f1_score: 0.7115
Epoch 402/500
28/28 [=====] - 2s 75ms/step - loss: 0.0906 - f1_score: 0.9906 - val_loss: 1.8590 - val_f1_score: 0.6889
Epoch 403/500
28/28 [=====] - 2s 75ms/step - loss: 0.0979 - f1_score: 0.9860 - val_loss: 1.5979 - val_f1_score: 0.6959
Epoch 404/500
28/28 [=====] - 2s 74ms/step - loss: 0.0963 - f1_score: 0.9852 - val_loss: 1.6706 - val_f1_score: 0.7069
Epoch 405/500
28/28 [=====] - 2s 74ms/step - loss: 0.1100 - f1_score: 0.9826 - val_loss: 1.8117 - val_f1_score: 0.7088
Epoch 406/500
28/28 [=====] - 2s 74ms/step - loss: 0.0983 - f1_score: 0.9880 - val_loss: 1.8086 - val_f1_score: 0.6930
Epoch 407/500
28/28 [=====] - 2s 75ms/step - loss: 0.0932 - f1_score: 0.9892 - val_loss: 1.7432 - val_f1_score: 0.6915
Epoch 408/500
28/28 [=====] - 2s 78ms/step - loss: 0.0957 - f1_score: 0.9888 - val_loss: 1.8860 - val_f1_score: 0.6784
Epoch 409/500
28/28 [=====] - 2s 79ms/step - loss: 0.0896 - f1_score: 0.9865 - val_loss: 1.7238 - val_f1_score: 0.7093
Epoch 410/500
28/28 [=====] - 2s 78ms/step - loss: 0.0977 - f1_score: 0.9872 - val_loss: 1.6443 - val_f1_score: 0.7123
Epoch 411/500
28/28 [=====] - 2s 77ms/step - loss: 0.0962 - f1_score: 0.9867 - val_loss: 1.8248 - val_f1_score: 0.6936
Epoch 412/500
28/28 [=====] - 2s 75ms/step - loss: 0.1051 - f1_score: 0.9815 - val_loss: 1.6310 - val_f1_score: 0.6983
Epoch 413/500
28/28 [=====] - 2s 73ms/step - loss: 0.1213 - f1_score: 0.9784 - val_loss: 1.7564 - val_f1_score: 0.6856
Epoch 414/500
28/28 [=====] - 2s 76ms/step - loss: 0.0990 - f1_score: 0.9864 - val_loss: 1.7293 - val_f1_score: 0.7095
Epoch 415/500
28/28 [=====] - 2s 75ms/step - loss: 0.0990 - f1_score: 0.9871 - val_loss: 1.6489 - val_f1_score: 0.7237
```

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Epoch 416/500
28/28 [=====] - 2s 76ms/step - loss: 0.1161 - f1_score: 0.9788 - val_loss: 2.1614 - val_f1_score: 0.6391
Epoch 417/500
28/28 [=====] - 2s 77ms/step - loss: 0.0981 - f1_score: 0.9854 - val_loss: 1.6911 - val_f1_score: 0.7141
Epoch 418/500
28/28 [=====] - 2s 80ms/step - loss: 0.1029 - f1_score: 0.9865 - val_loss: 1.7622 - val_f1_score: 0.7071
Epoch 419/500
28/28 [=====] - 2s 73ms/step - loss: 0.0893 - f1_score: 0.9875 - val_loss: 1.6111 - val_f1_score: 0.7099
Epoch 420/500
28/28 [=====] - 2s 77ms/step - loss: 0.0872 - f1_score: 0.9887 - val_loss: 1.7093 - val_f1_score: 0.7026
Epoch 421/500
28/28 [=====] - 2s 83ms/step - loss: 0.0783 - f1_score: 0.9932 - val_loss: 1.6221 - val_f1_score: 0.7030
Epoch 422/500
28/28 [=====] - 2s 84ms/step - loss: 0.0830 - f1_score: 0.9909 - val_loss: 1.8103 - val_f1_score: 0.6894
Epoch 423/500
28/28 [=====] - 2s 76ms/step - loss: 0.0885 - f1_score: 0.9880 - val_loss: 1.6163 - val_f1_score: 0.7158
Epoch 424/500
28/28 [=====] - 2s 77ms/step - loss: 0.0904 - f1_score: 0.9860 - val_loss: 1.5921 - val_f1_score: 0.7221
Epoch 425/500
28/28 [=====] - 2s 78ms/step - loss: 0.0813 - f1_score: 0.9909 - val_loss: 1.7249 - val_f1_score: 0.7143
Epoch 426/500
28/28 [=====] - 2s 76ms/step - loss: 0.0828 - f1_score: 0.9908 - val_loss: 1.6553 - val_f1_score: 0.7135
Epoch 427/500
28/28 [=====] - 2s 76ms/step - loss: 0.0897 - f1_score: 0.9856 - val_loss: 1.8451 - val_f1_score: 0.6629
Epoch 428/500
28/28 [=====] - 2s 75ms/step - loss: 0.0837 - f1_score: 0.9930 - val_loss: 1.6729 - val_f1_score: 0.6980
Epoch 429/500
28/28 [=====] - 2s 74ms/step - loss: 0.0828 - f1_score: 0.9891 - val_loss: 1.6417 - val_f1_score: 0.7300
Epoch 430/500
28/28 [=====] - 2s 74ms/step - loss: 0.0917 - f1_score: 0.9858 - val_loss: 1.8467 - val_f1_score: 0.6906
Epoch 431/500
28/28 [=====] - 2s 74ms/step - loss: 0.0961 - f1_score: 0.9860 - val_loss: 1.7570 - val_f1_score: 0.7022
```

Epoch 432/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0806 - f1\_score: 0.9905 - val\_loss: 1.6665 - val\_f1\_score: 0.7345  
Epoch 433/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0932 - f1\_score: 0.9844 - val\_loss: 1.8001 - val\_f1\_score: 0.6965  
Epoch 434/500  
28/28 [=====] - 2s 82ms/step - loss: 0.0994 - f1\_score: 0.9821 - val\_loss: 1.6680 - val\_f1\_score: 0.7016  
Epoch 435/500  
28/28 [=====] - 2s 81ms/step - loss: 0.0889 - f1\_score: 0.9850 - val\_loss: 1.7735 - val\_f1\_score: 0.7053  
Epoch 436/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0885 - f1\_score: 0.9885 - val\_loss: 1.6063 - val\_f1\_score: 0.6854  
Epoch 437/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0913 - f1\_score: 0.9857 - val\_loss: 1.8282 - val\_f1\_score: 0.6949  
Epoch 438/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0970 - f1\_score: 0.9850 - val\_loss: 1.7451 - val\_f1\_score: 0.7125  
Epoch 439/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0858 - f1\_score: 0.9877 - val\_loss: 1.7419 - val\_f1\_score: 0.7216  
Epoch 440/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0916 - f1\_score: 0.9879 - val\_loss: 1.7111 - val\_f1\_score: 0.6897  
Epoch 441/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0868 - f1\_score: 0.9888 - val\_loss: 1.7415 - val\_f1\_score: 0.6930  
Epoch 442/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0832 - f1\_score: 0.9900 - val\_loss: 1.6599 - val\_f1\_score: 0.7044  
Epoch 443/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0798 - f1\_score: 0.9912 - val\_loss: 1.6269 - val\_f1\_score: 0.6886  
Epoch 444/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0875 - f1\_score: 0.9894 - val\_loss: 1.6552 - val\_f1\_score: 0.6946  
Epoch 445/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0876 - f1\_score: 0.9883 - val\_loss: 1.7251 - val\_f1\_score: 0.7099  
Epoch 446/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0874 - f1\_score: 0.9891 - val\_loss: 1.5998 - val\_f1\_score: 0.6942  
Epoch 447/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0884 - f1\_score: 0.9847 - val\_loss: 1.7614 - val\_f1\_score: 0.7095

Epoch 448/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0797 - f1\_score: 0.9920 - val\_loss: 1.8313 - val\_f1\_score: 0.7049  
Epoch 449/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0829 - f1\_score: 0.9871 - val\_loss: 1.8435 - val\_f1\_score: 0.6860  
Epoch 450/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0871 - f1\_score: 0.9873 - val\_loss: 1.9233 - val\_f1\_score: 0.6652  
Epoch 451/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0874 - f1\_score: 0.9899 - val\_loss: 1.7150 - val\_f1\_score: 0.7107  
Epoch 452/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0878 - f1\_score: 0.9873 - val\_loss: 1.6813 - val\_f1\_score: 0.6845  
Epoch 453/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0833 - f1\_score: 0.9871 - val\_loss: 1.8037 - val\_f1\_score: 0.7007  
Epoch 454/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0862 - f1\_score: 0.9864 - val\_loss: 1.8936 - val\_f1\_score: 0.6967  
Epoch 455/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0779 - f1\_score: 0.9914 - val\_loss: 1.6555 - val\_f1\_score: 0.7146  
Epoch 456/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0816 - f1\_score: 0.9888 - val\_loss: 1.7834 - val\_f1\_score: 0.7171  
Epoch 457/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0808 - f1\_score: 0.9919 - val\_loss: 1.7282 - val\_f1\_score: 0.6903  
Epoch 458/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0842 - f1\_score: 0.9902 - val\_loss: 1.7839 - val\_f1\_score: 0.6976  
Epoch 459/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0782 - f1\_score: 0.9881 - val\_loss: 1.6644 - val\_f1\_score: 0.7045  
Epoch 460/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0722 - f1\_score: 0.9922 - val\_loss: 1.7342 - val\_f1\_score: 0.7042  
Epoch 461/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0667 - f1\_score: 0.9940 - val\_loss: 1.7294 - val\_f1\_score: 0.6794  
Epoch 462/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0900 - f1\_score: 0.9856 - val\_loss: 1.7502 - val\_f1\_score: 0.6867  
Epoch 463/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0821 - f1\_score: 0.9902 - val\_loss: 1.7348 - val\_f1\_score: 0.7175

Epoch 464/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0816 - f1\_score: 0.9883 - val\_loss: 1.7383 - val\_f1\_score: 0.7119  
Epoch 465/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0995 - f1\_score: 0.9827 - val\_loss: 1.7648 - val\_f1\_score: 0.7036  
Epoch 466/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0828 - f1\_score: 0.9872 - val\_loss: 1.7580 - val\_f1\_score: 0.6931  
Epoch 467/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0846 - f1\_score: 0.9883 - val\_loss: 1.7529 - val\_f1\_score: 0.6843  
Epoch 468/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0735 - f1\_score: 0.9912 - val\_loss: 1.6994 - val\_f1\_score: 0.7045  
Epoch 469/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0760 - f1\_score: 0.9918 - val\_loss: 1.6837 - val\_f1\_score: 0.6972  
Epoch 470/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0691 - f1\_score: 0.9942 - val\_loss: 1.8803 - val\_f1\_score: 0.6597  
Epoch 471/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0804 - f1\_score: 0.9897 - val\_loss: 1.7402 - val\_f1\_score: 0.7227  
Epoch 472/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0904 - f1\_score: 0.9832 - val\_loss: 1.9241 - val\_f1\_score: 0.6666  
Epoch 473/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0794 - f1\_score: 0.9877 - val\_loss: 1.7340 - val\_f1\_score: 0.6840  
Epoch 474/500  
28/28 [=====] - 2s 79ms/step - loss: 0.0857 - f1\_score: 0.9881 - val\_loss: 1.5669 - val\_f1\_score: 0.7278  
Epoch 475/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0759 - f1\_score: 0.9916 - val\_loss: 1.7072 - val\_f1\_score: 0.6903  
Epoch 476/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0703 - f1\_score: 0.9929 - val\_loss: 1.8547 - val\_f1\_score: 0.6892  
Epoch 477/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0692 - f1\_score: 0.9904 - val\_loss: 1.7547 - val\_f1\_score: 0.6982  
Epoch 478/500  
28/28 [=====] - 2s 76ms/step - loss: 0.0657 - f1\_score: 0.9933 - val\_loss: 1.6858 - val\_f1\_score: 0.7208  
Epoch 479/500  
28/28 [=====] - 2s 78ms/step - loss: 0.0830 - f1\_score: 0.9868 - val\_loss: 1.9282 - val\_f1\_score: 0.6593

Epoch 480/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0679 - f1\_score: 0.9938 - val\_loss: 1.7780 - val\_f1\_score: 0.6947  
Epoch 481/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0742 - f1\_score: 0.9905 - val\_loss: 1.8931 - val\_f1\_score: 0.6613  
Epoch 482/500  
28/28 [=====] - 2s 73ms/step - loss: 0.0720 - f1\_score: 0.9901 - val\_loss: 1.6597 - val\_f1\_score: 0.7095  
Epoch 483/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0670 - f1\_score: 0.9929 - val\_loss: 1.6986 - val\_f1\_score: 0.6930  
Epoch 484/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0722 - f1\_score: 0.9913 - val\_loss: 1.6847 - val\_f1\_score: 0.7087  
Epoch 485/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0622 - f1\_score: 0.9958 - val\_loss: 1.7939 - val\_f1\_score: 0.7041  
Epoch 486/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0658 - f1\_score: 0.9943 - val\_loss: 1.9098 - val\_f1\_score: 0.6731  
Epoch 487/500  
28/28 [=====] - 2s 84ms/step - loss: 0.0919 - f1\_score: 0.9867 - val\_loss: 1.8820 - val\_f1\_score: 0.6806  
Epoch 488/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0850 - f1\_score: 0.9881 - val\_loss: 1.9505 - val\_f1\_score: 0.6545  
Epoch 489/500  
28/28 [=====] - 2s 73ms/step - loss: 0.1266 - f1\_score: 0.9736 - val\_loss: 1.8466 - val\_f1\_score: 0.6767  
Epoch 490/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0789 - f1\_score: 0.9872 - val\_loss: 1.6765 - val\_f1\_score: 0.6995  
Epoch 491/500  
28/28 [=====] - 2s 75ms/step - loss: 0.0680 - f1\_score: 0.9935 - val\_loss: 1.6809 - val\_f1\_score: 0.6909  
Epoch 492/500  
28/28 [=====] - 2s 74ms/step - loss: 0.0715 - f1\_score: 0.9915 - val\_loss: 1.9379 - val\_f1\_score: 0.6864  
Epoch 493/500  
28/28 [=====] - 2s 77ms/step - loss: 0.0723 - f1\_score: 0.9920 - val\_loss: 1.8172 - val\_f1\_score: 0.6749  
Epoch 494/500  
28/28 [=====] - 2s 78ms/step - loss: 0.0729 - f1\_score: 0.9914 - val\_loss: 1.7980 - val\_f1\_score: 0.7033  
Epoch 495/500  
28/28 [=====] - 2s 79ms/step - loss: 0.0783 - f1\_score: 0.9882 - val\_loss: 1.7996 - val\_f1\_score: 0.6985

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Epoch 496/500
28/28 [=====] - 2s 79ms/step - loss: 0.0765 - f1_score: 0.9881 - val_loss: 1.8637 - val_f1_score: 0.6723
Epoch 497/500
28/28 [=====] - 2s 80ms/step - loss: 0.0707 - f1_score: 0.9919 - val_loss: 1.8953 - val_f1_score: 0.6953
Epoch 498/500
28/28 [=====] - 2s 79ms/step - loss: 0.0747 - f1_score: 0.9905 - val_loss: 1.7849 - val_f1_score: 0.7033
Epoch 499/500
28/28 [=====] - 2s 75ms/step - loss: 0.0667 - f1_score: 0.9901 - val_loss: 1.7979 - val_f1_score: 0.7055
Epoch 500/500
28/28 [=====] - 2s 76ms/step - loss: 0.0653 - f1_score: 0.9932 - val_loss: 1.6598 - val_f1_score: 0.6973

```

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

	precision	recall	f1-score	support
AXE	0.800	1.000	0.889	8
BACKPACK	0.714	0.833	0.769	6
BASKETBALL	1.000	1.000	1.000	10
BEE	0.778	0.700	0.737	10
BELT	0.800	1.000	0.889	4
BITE	1.000	0.375	0.545	8
BREAKFAST	1.000	0.667	0.800	6
CANCER	1.000	0.875	0.933	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	0.333	0.333	0.333	6
DECIDE	0.800	0.667	0.727	6
DEMAND	1.000	0.750	0.857	8
DEVELOP	0.600	0.500	0.545	6
DINNER	0.714	0.625	0.667	8
DOG	0.500	0.667	0.571	6
DOWNSIZE	0.800	1.000	0.889	8
DRAG	1.000	0.250	0.400	4
EAT	0.833	0.833	0.833	6
EDIT	0.625	0.833	0.714	6
ELEVATOR	0.571	1.000	0.727	8
FINE	1.000	0.500	0.667	4

FLOAT	0.400	0.500	0.444	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.889	1.000	0.941	8
HALLOWEEN	0.800	1.000	0.889	8
HOSPITAL	0.833	0.833	0.833	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	0.125	0.222	8
LUNCH	0.857	0.750	0.800	8
MAPLE	0.667	0.500	0.571	4
MEAT	0.375	0.500	0.429	6
MECHANIC	0.667	1.000	0.800	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.600	0.750	0.667	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	0.250	0.250	0.250	4
RIVER	0.556	0.833	0.667	6
ROCKINGCHAIR	0.800	1.000	0.889	8
SHAVE	0.667	1.000	0.800	10
SINK	0.250	0.167	0.200	6
SQUEEZE	0.500	0.500	0.500	4
THEY	1.000	1.000	1.000	4
TWINS	0.727	1.000	0.842	8
WHATFOR	0.667	0.600	0.632	10
accuracy			0.731	324
macro avg	0.745	0.705	0.697	324
weighted avg	0.760	0.731	0.718	324

```
[127]: # convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)
```

```
hist_csv_file = '2 1D-CNN + 1 GRU Trial 698/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

```
[128]: hist_df = pd.read_csv('2 1D-CNN + 1 GRU Trial 698/history.csv', index_col=0)
hist_df.tail()
```

```
[128]:      loss  f1_score  val_loss  val_f1_score
495  0.076451  0.988074  1.863722      0.672334
496  0.070669  0.991913  1.895288      0.695279
497  0.074715  0.990478  1.784943      0.703256
```

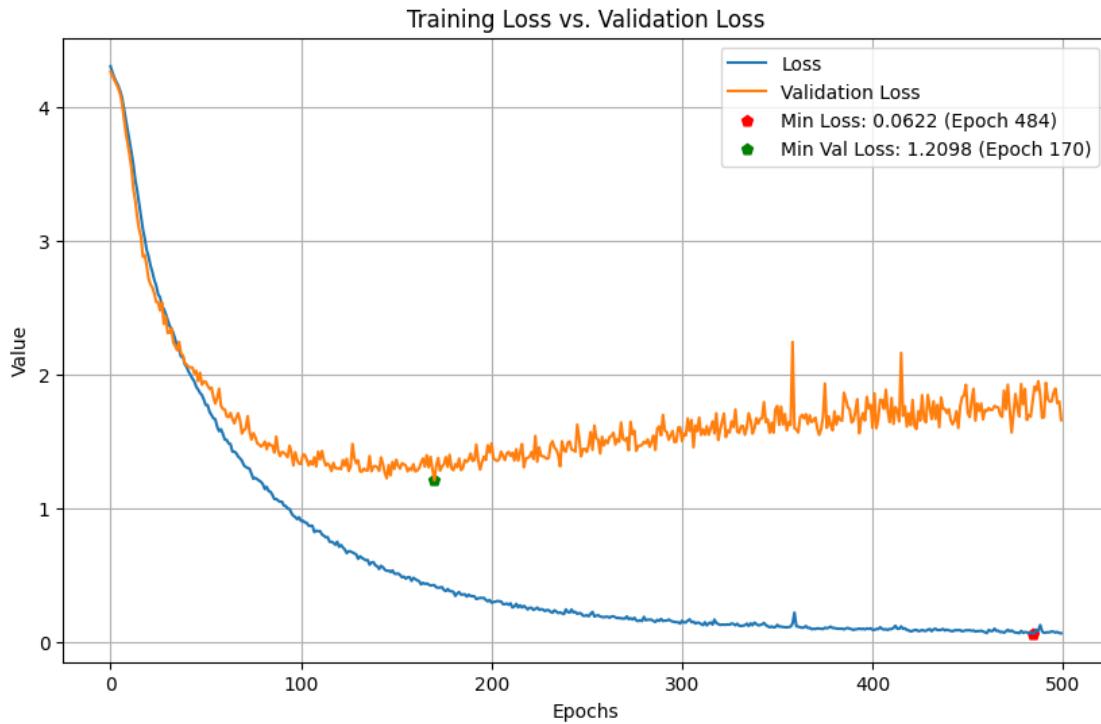
```
498  0.066731  0.990053  1.797919      0.705461
499  0.065315  0.993155  1.659775      0.697256
```

```
[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()

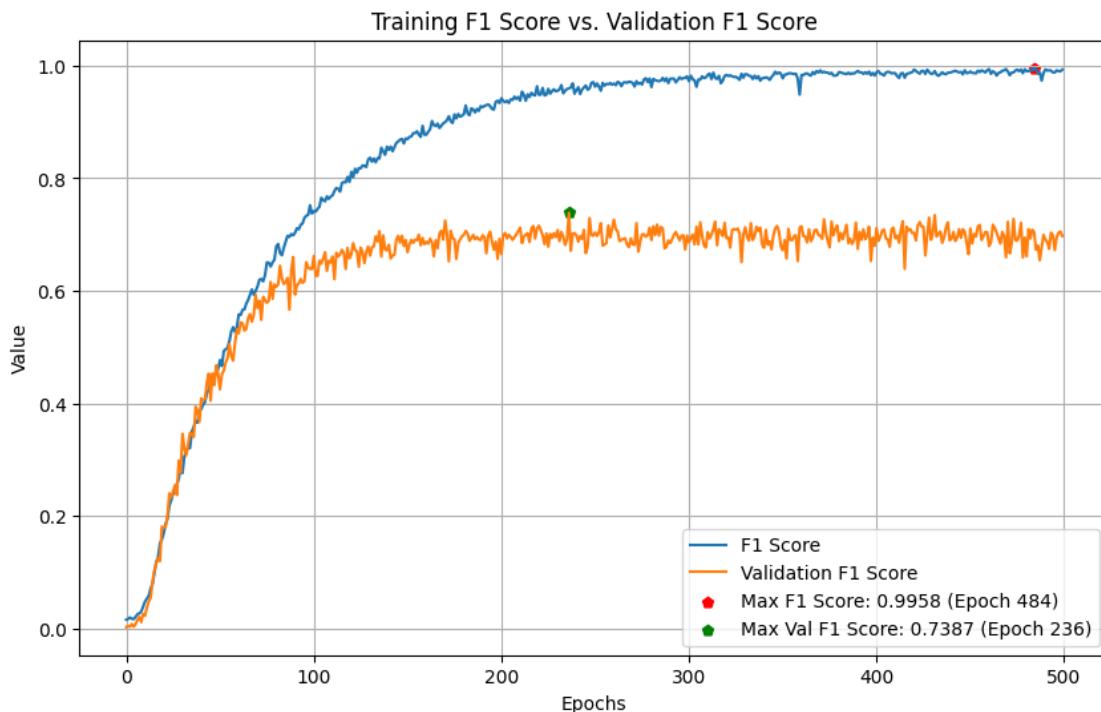
max_f1 = hist_df['f1_score'][max_f1_epoch]
max_val_f1 = hist_df['val_f1_score'][max_val_f1_epoch]

# 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("2 1D-CNN + 1 GRU Trial 698")
```

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

Model: "sequential\_1"

Layer (type)	Output Shape	Param #
<hr/>		
conv1d_2 (Conv1D)	(None, 127, 200)	319400
<hr/>		
max_pooling1d_2 (MaxPooling 1D)	(None, 15, 200)	0
<hr/>		
conv1d_3 (Conv1D)	(None, 14, 200)	80200
<hr/>		
max_pooling1d_3 (MaxPooling)	(None, 14, 200)	0

1D)

dropout_2 (Dropout)	(None, 14, 200)	0
gru_1 (GRU)	(None, 175)	197925
dropout_3 (Dropout)	(None, 175)	0
dense_2 (Dense)	(None, 100)	17600
dense_3 (Dense)	(None, 50)	5050

=====

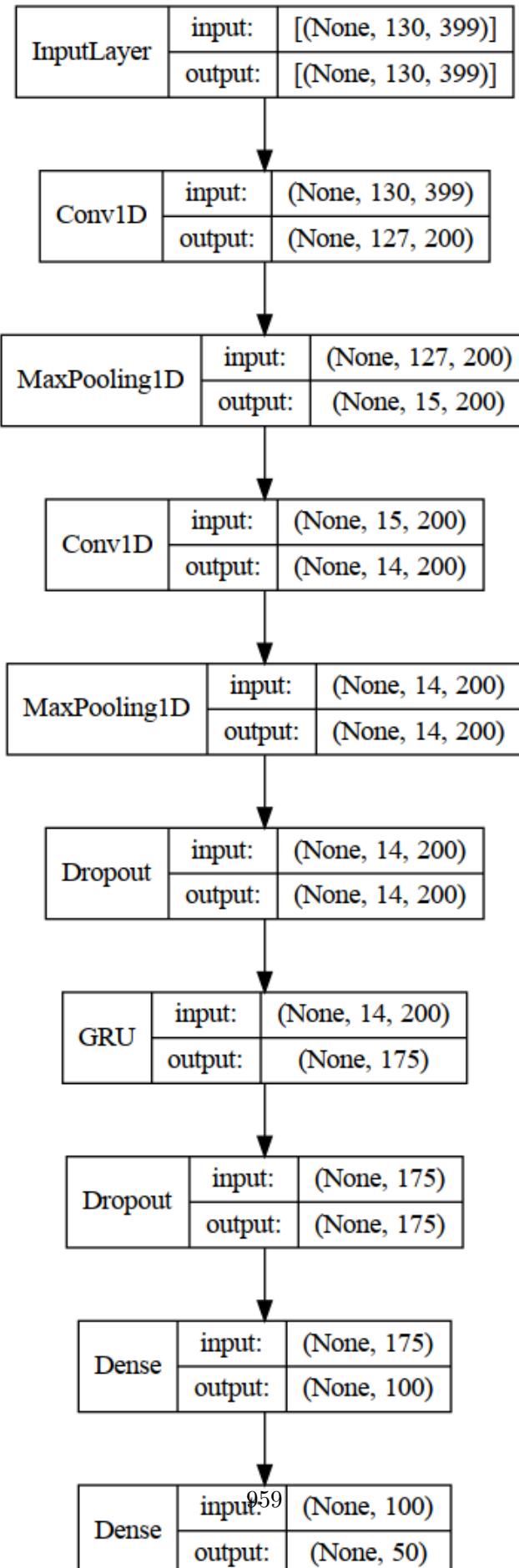
Total params: 620,175

Trainable params: 620,175

Non-trainable params: 0

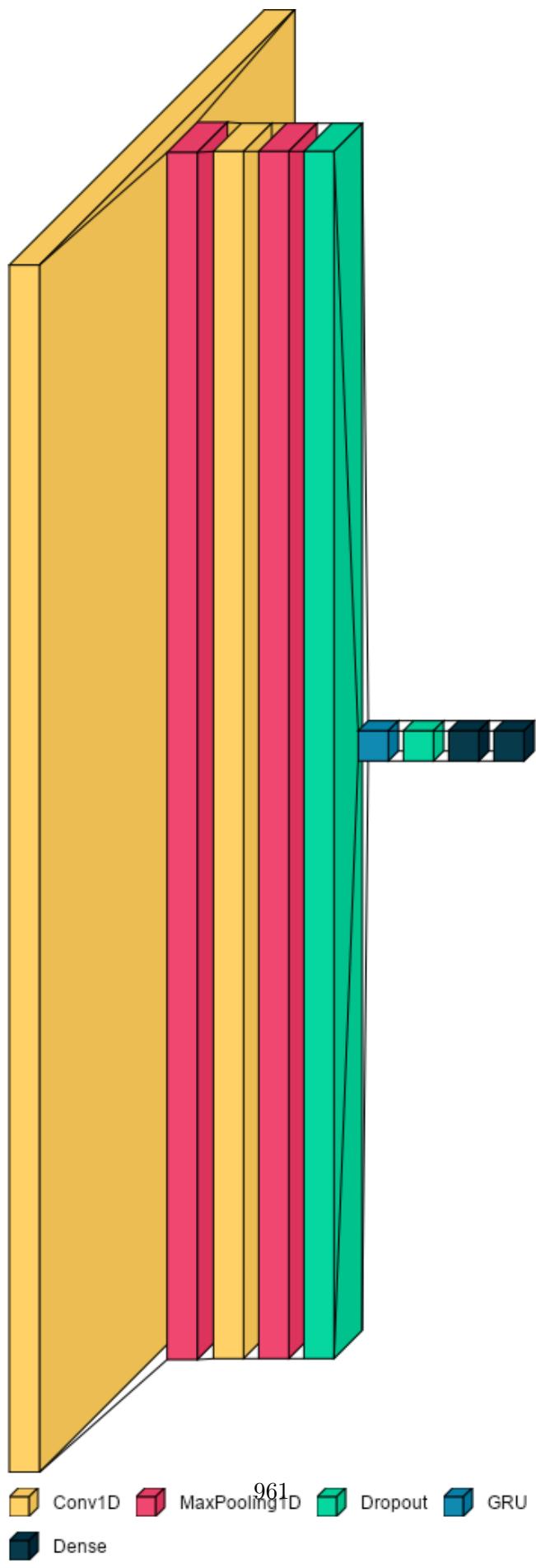
[133]: plot\_model(reconstructed\_model, show\_shapes=True, show\_layer\_names=False)

[133]:



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

```
[134]:
```



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

11/11 [=====] - 1s 15ms/step - loss: 1.3137 - f1_score: 0.7387
```

[135]: [1.3137201070785522, 0.7386768460273743]

```
[136]: reconstructed_model.evaluate(Xtrain, Ytrain, batch_size=96)

28/28 [=====] - 1s 31ms/step - loss: 0.1068 - f1_score: 0.9985
```

[136]: [0.10675598680973053, 0.9985218644142151]

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

	precision	recall	f1-score	support
AXE	0.889	1.000	0.941	8
BACKPACK	0.714	0.833	0.769	6
BASKETBALL	0.909	1.000	0.952	10
BEE	0.778	0.700	0.737	10
BELT	0.800	1.000	0.889	4
BITE	0.750	0.375	0.500	8
BREAKFAST	1.000	0.667	0.800	6
CANCER	0.889	1.000	0.941	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	0.667	0.667	0.667	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.800	0.667	0.727	6
DINNER	0.700	0.875	0.778	8
DOG	0.375	0.500	0.429	6
DOWNSIZE	0.800	1.000	0.889	8
DRAG	1.000	0.250	0.400	4
EAT	1.000	1.000	1.000	6
EDIT	0.857	1.000	0.923	6
ELEVATOR	0.667	1.000	0.800	8
FINE	1.000	0.500	0.667	4

FLOAT	0.400	0.500	0.444	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	0.889	1.000	0.941	8
HALLOWEEN	0.800	1.000	0.889	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	0.833	0.625	0.714	8
LUNCH	1.000	0.750	0.857	8
MAPLE	0.500	0.500	0.500	4
MEAT	0.500	0.333	0.400	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.625	0.769	8
MOVIE	0.500	0.625	0.556	8
NOON	1.000	1.000	1.000	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.714	0.833	0.769	6
RAZOR	0.500	0.500	0.500	4
RIVER	0.714	0.833	0.769	6
ROCKINGCHAIR	0.889	1.000	0.941	8
SHAVE	0.833	1.000	0.909	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	0.727	1.000	0.842	8
WHATFOR	0.818	0.900	0.857	10
accuracy			0.775	324
macro avg	0.786	0.744	0.739	324
weighted avg	0.795	0.775	0.763	324

## 4.9 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_999463/1222377179.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='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=[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/CSPNext/hyperband/',
project_name='1_1D_CNN+1_LSTM',
overwrite=False)

```

2023-09-12 23:18:08.144326: 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.

2023-09-12 23:18:08.574514: 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

[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 53s]  
val_f1_score: 0.4777938723564148
```

```
Best val_f1_score So Far: 0.6883143484592438  
Total elapsed time: 14h 07m 33s  
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.  
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.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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object: (root).optimizer._variables.6
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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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```

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`.
```

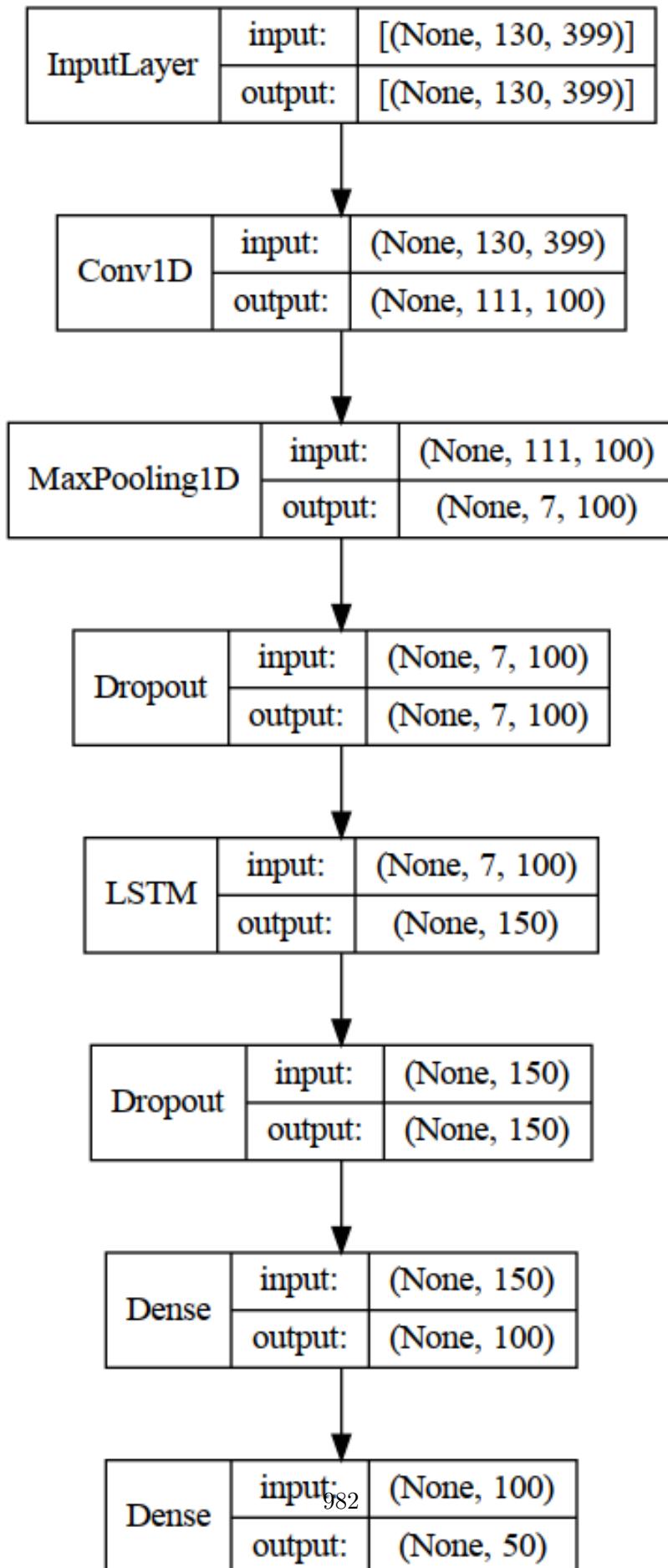
```
Current values:  
NotebookApp.iopub_msg_rate_limit=100.0 (msgs/sec)  
NotebookApp.rate_limit_window=3.0 (secs)
```

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

```
Model: "sequential"  
-----  
Layer (type)          Output Shape       Param #  
=====-----  
conv1d (Conv1D)      (None, 111, 100)    798100  
max_pooling1d (MaxPooling1D) (None, 7, 100) 0  
)  
dropout (Dropout)     (None, 7, 100)       0  
lstm (LSTM)          (None, 150)         150600  
dropout_1 (Dropout)   (None, 150)         0  
dense (Dense)        (None, 100)         15100  
dense_1 (Dense)      (None, 50)          5050  
-----  
Total params: 968,850  
Trainable params: 968,850  
Non-trainable params: 0
```

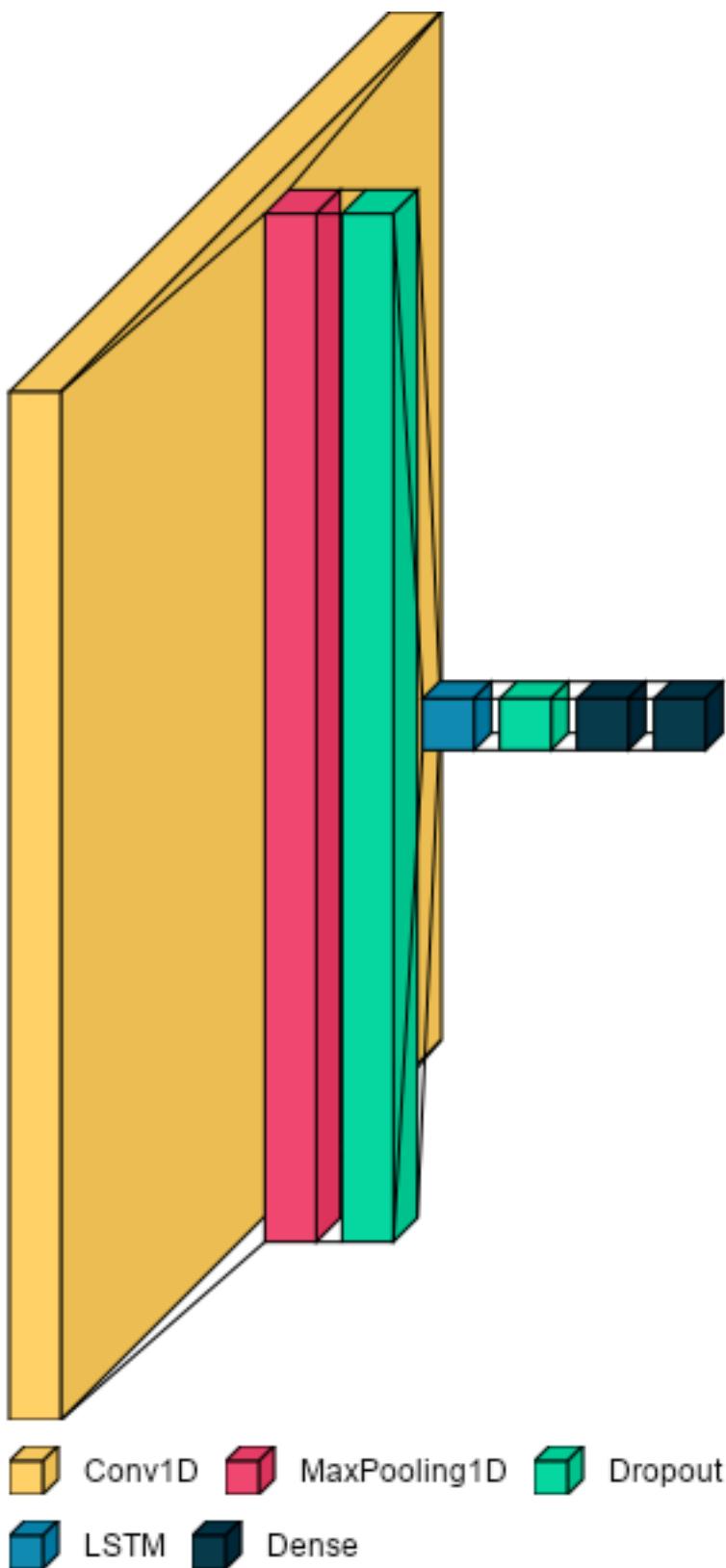
```
[128]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[128]:
```



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

```
[129]:
```



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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/1_1D_CNN+1_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

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: 0.6883143484592438

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: 0.6740089356899261

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: 0.6632281839847565
```

```
Trial 0426 summary  
Hyperparameters:  
dense_activation: mish  
filters_1: 175  
kernel_1: 15  
pool_1: 20  
dropout_1: 0.1500000000000002  
units_1: 200  
regularizer: 0.0008286694843864185  
dropout_2: 0.3500000000000003  
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: 0.652114987373352
```

```
Trial 0598 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: 0.641700267791748
```

```
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: 0.3000000000000004
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: 0.6389544010162354
```

```
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: 0590
Score: 0.6190114319324493
```

```
Trial 0599 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: 0594
Score: 0.6096761524677277
```

```
Trial 0594 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: 0583
Score: 0.6089325547218323
```

```
Trial 0715 summary
Hyperparameters:
dense_activation: relu
filters_1: 100
kernel_1: 5
pool_1: 15
dropout_1: 0.1500000000000002
units_1: 200
regularizer: 0.0003995944477297615
dropout_2: 0.3000000000000004
units_2: 100
learning_rate: 0.0001455536401374643
```

```
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0707
Score: 0.6067018806934357
```

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

```
11/11 [=====] - 2s 55ms/step - loss: 1.3643 - f1_score: 0.6908
```

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

```
84/84 [=====] - 1s 17ms/step - loss: 0.4791 - f1_score: 0.9052
```

```
[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 13ms/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	0.333	0.200	0.250	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.375	0.545	8
BREAKFAST	0.500	0.667	0.571	6
CANCER	0.667	1.000	0.800	8
CHRISTMAS	1.000	0.833	0.909	6
CONFUSED	1.000	0.333	0.500	6
DARK	1.000	1.000	1.000	4
DEAF	0.250	0.167	0.200	6
DECIDE	0.714	0.833	0.769	6
DEMAND	1.000	0.875	0.933	8
DEVELOP	0.667	0.667	0.667	6
DINNER	0.667	1.000	0.800	8
DOG	0.222	0.333	0.267	6
DOWNSIZE	0.857	0.750	0.800	8
DRAG	1.000	0.750	0.857	4
EAT	0.750	0.500	0.600	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.333	0.375	0.353	8
FINE	0.500	0.250	0.333	4

FLOAT	1.000	0.500	0.667	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	1.000	0.750	0.857	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	1.000	0.833	0.909	6
HURDLE/TRIP	1.000	0.250	0.400	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.545	0.750	0.632	8
LUNCH	0.857	0.750	0.800	8
MAPLE	0.500	0.500	0.500	4
MEAT	0.750	1.000	0.857	6
MECHANIC	0.800	1.000	0.889	4
MICROSCOPE	1.000	0.250	0.400	8
MOVIE	0.750	0.750	0.750	8
NOON	1.000	1.000	1.000	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.235	0.667	0.348	6
RAZOR	1.000	0.750	0.857	4
RIVER	0.545	1.000	0.706	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	0.000	0.000	0.000	4
THEY	1.000	0.750	0.857	4
TWINS	0.533	1.000	0.696	8
WHATFOR	0.571	0.400	0.471	10
accuracy			0.704	324
macro avg	0.765	0.691	0.691	324
weighted avg	0.760	0.704	0.697	324

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

```
[135]: model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath='1 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 [=====] - 7s 112ms/step - loss: 4.4356 -  
f1_score: 0.0184 - val_loss: 4.3240 - val_f1_score: 0.0030  
Epoch 2/500  
28/28 [=====] - 2s 81ms/step - loss: 4.4153 - f1_score:  
0.0198 - val_loss: 4.3213 - val_f1_score: 0.0013  
Epoch 3/500  
28/28 [=====] - 2s 82ms/step - loss: 4.3907 - f1_score:  
0.0162 - val_loss: 4.3019 - val_f1_score: 0.0017  
Epoch 4/500  
28/28 [=====] - 2s 82ms/step - loss: 4.3770 - f1_score:  
0.0186 - val_loss: 4.2881 - val_f1_score: 0.0145  
Epoch 5/500  
28/28 [=====] - 2s 82ms/step - loss: 4.3678 - f1_score:  
0.0217 - val_loss: 4.2829 - val_f1_score: 0.0030  
Epoch 6/500  
28/28 [=====] - 2s 83ms/step - loss: 4.3621 - f1_score:  
0.0207 - val_loss: 4.2636 - val_f1_score: 0.0075  
Epoch 7/500  
28/28 [=====] - 2s 82ms/step - loss: 4.3277 - f1_score:  
0.0168 - val_loss: 4.2533 - val_f1_score: 0.0057  
Epoch 8/500  
28/28 [=====] - 2s 83ms/step - loss: 4.2995 - f1_score:  
0.0278 - val_loss: 4.2344 - val_f1_score: 0.0158  
Epoch 9/500  
28/28 [=====] - 2s 82ms/step - loss: 4.3025 - f1_score:  
0.0233 - val_loss: 4.2112 - val_f1_score: 0.0073  
Epoch 10/500  
28/28 [=====] - 2s 83ms/step - loss: 4.2707 - f1_score:  
0.0302 - val_loss: 4.2141 - val_f1_score: 0.0225  
Epoch 11/500  
28/28 [=====] - 2s 82ms/step - loss: 4.2614 - f1_score:  
0.0209 - val_loss: 4.1800 - val_f1_score: 0.0147  
Epoch 12/500  
28/28 [=====] - 2s 84ms/step - loss: 4.2275 - f1_score:  
0.0273 - val_loss: 4.1357 - val_f1_score: 0.0153  
Epoch 13/500  
28/28 [=====] - 2s 84ms/step - loss: 4.1923 - f1_score:  
0.0358 - val_loss: 4.1001 - val_f1_score: 0.0258  
Epoch 14/500  
28/28 [=====] - 2s 86ms/step - loss: 4.1546 - f1_score:  
0.0359 - val_loss: 4.0610 - val_f1_score: 0.0088  
Epoch 15/500
```

```
28/28 [=====] - 2s 84ms/step - loss: 4.1141 - f1_score: 0.0332 - val_loss: 4.0065 - val_f1_score: 0.0286
Epoch 16/500
28/28 [=====] - 2s 88ms/step - loss: 4.0688 - f1_score: 0.0338 - val_loss: 3.9592 - val_f1_score: 0.0192
Epoch 17/500
28/28 [=====] - 2s 85ms/step - loss: 4.0219 - f1_score: 0.0363 - val_loss: 3.8927 - val_f1_score: 0.0464
Epoch 18/500
28/28 [=====] - 2s 85ms/step - loss: 3.9992 - f1_score: 0.0459 - val_loss: 3.8706 - val_f1_score: 0.0436
Epoch 19/500
28/28 [=====] - 2s 85ms/step - loss: 3.9381 - f1_score: 0.0455 - val_loss: 3.7936 - val_f1_score: 0.0393
Epoch 20/500
28/28 [=====] - 2s 85ms/step - loss: 3.9019 - f1_score: 0.0547 - val_loss: 3.7456 - val_f1_score: 0.0406
Epoch 21/500
28/28 [=====] - 2s 86ms/step - loss: 3.8700 - f1_score: 0.0533 - val_loss: 3.6709 - val_f1_score: 0.0439
Epoch 22/500
28/28 [=====] - 2s 85ms/step - loss: 3.8070 - f1_score: 0.0579 - val_loss: 3.6300 - val_f1_score: 0.0739
Epoch 23/500
28/28 [=====] - 2s 87ms/step - loss: 3.7758 - f1_score: 0.0570 - val_loss: 3.5706 - val_f1_score: 0.0454
Epoch 24/500
28/28 [=====] - 2s 86ms/step - loss: 3.7133 - f1_score: 0.0734 - val_loss: 3.5262 - val_f1_score: 0.0624
Epoch 25/500
28/28 [=====] - 2s 89ms/step - loss: 3.6683 - f1_score: 0.0761 - val_loss: 3.4547 - val_f1_score: 0.0745
Epoch 26/500
28/28 [=====] - 2s 85ms/step - loss: 3.6257 - f1_score: 0.0867 - val_loss: 3.4149 - val_f1_score: 0.0730
Epoch 27/500
28/28 [=====] - 2s 88ms/step - loss: 3.5537 - f1_score: 0.0927 - val_loss: 3.3350 - val_f1_score: 0.0865
Epoch 28/500
28/28 [=====] - 2s 87ms/step - loss: 3.5094 - f1_score: 0.0999 - val_loss: 3.2734 - val_f1_score: 0.0944
Epoch 29/500
28/28 [=====] - 2s 87ms/step - loss: 3.4581 - f1_score: 0.1032 - val_loss: 3.2877 - val_f1_score: 0.0950
Epoch 30/500
28/28 [=====] - 2s 86ms/step - loss: 3.4130 - f1_score: 0.1166 - val_loss: 3.2122 - val_f1_score: 0.0781
Epoch 31/500
```

```
28/28 [=====] - 2s 87ms/step - loss: 3.3409 - f1_score: 0.1239 - val_loss: 3.1667 - val_f1_score: 0.1196
Epoch 32/500
28/28 [=====] - 2s 86ms/step - loss: 3.3208 - f1_score: 0.1247 - val_loss: 3.1561 - val_f1_score: 0.1257
Epoch 33/500
28/28 [=====] - 2s 88ms/step - loss: 3.2983 - f1_score: 0.1218 - val_loss: 3.0916 - val_f1_score: 0.1089
Epoch 34/500
28/28 [=====] - 2s 85ms/step - loss: 3.2425 - f1_score: 0.1384 - val_loss: 3.0500 - val_f1_score: 0.1339
Epoch 35/500
28/28 [=====] - 2s 89ms/step - loss: 3.2167 - f1_score: 0.1422 - val_loss: 3.0438 - val_f1_score: 0.1477
Epoch 36/500
28/28 [=====] - 2s 85ms/step - loss: 3.1747 - f1_score: 0.1478 - val_loss: 2.9858 - val_f1_score: 0.1777
Epoch 37/500
28/28 [=====] - 2s 88ms/step - loss: 3.1471 - f1_score: 0.1530 - val_loss: 2.9879 - val_f1_score: 0.1688
Epoch 38/500
28/28 [=====] - 2s 88ms/step - loss: 3.1357 - f1_score: 0.1597 - val_loss: 2.9710 - val_f1_score: 0.1729
Epoch 39/500
28/28 [=====] - 2s 88ms/step - loss: 3.0747 - f1_score: 0.1760 - val_loss: 2.9805 - val_f1_score: 0.1302
Epoch 40/500
28/28 [=====] - 2s 86ms/step - loss: 3.0612 - f1_score: 0.1768 - val_loss: 2.8793 - val_f1_score: 0.1740
Epoch 41/500
28/28 [=====] - 2s 87ms/step - loss: 3.0131 - f1_score: 0.1876 - val_loss: 2.8740 - val_f1_score: 0.1991
Epoch 42/500
28/28 [=====] - 2s 85ms/step - loss: 3.0027 - f1_score: 0.1846 - val_loss: 2.8434 - val_f1_score: 0.1914
Epoch 43/500
28/28 [=====] - 3s 92ms/step - loss: 2.9651 - f1_score: 0.1961 - val_loss: 2.8472 - val_f1_score: 0.1904
Epoch 44/500
28/28 [=====] - 2s 87ms/step - loss: 2.9426 - f1_score: 0.1929 - val_loss: 2.8058 - val_f1_score: 0.2058
Epoch 45/500
28/28 [=====] - 2s 88ms/step - loss: 2.9303 - f1_score: 0.1955 - val_loss: 2.7868 - val_f1_score: 0.2084
Epoch 46/500
28/28 [=====] - 2s 85ms/step - loss: 2.8865 - f1_score: 0.2148 - val_loss: 2.7923 - val_f1_score: 0.2058
Epoch 47/500
```

```
28/28 [=====] - 2s 89ms/step - loss: 2.8927 - f1_score: 0.1981 - val_loss: 2.7609 - val_f1_score: 0.1940
Epoch 48/500
28/28 [=====] - 2s 87ms/step - loss: 2.8590 - f1_score: 0.2174 - val_loss: 2.7844 - val_f1_score: 0.1916
Epoch 49/500
28/28 [=====] - 3s 90ms/step - loss: 2.8345 - f1_score: 0.2149 - val_loss: 2.7215 - val_f1_score: 0.2293
Epoch 50/500
28/28 [=====] - 2s 87ms/step - loss: 2.8239 - f1_score: 0.2194 - val_loss: 2.7197 - val_f1_score: 0.2000
Epoch 51/500
28/28 [=====] - 3s 91ms/step - loss: 2.8076 - f1_score: 0.2234 - val_loss: 2.7400 - val_f1_score: 0.2162
Epoch 52/500
28/28 [=====] - 2s 85ms/step - loss: 2.7853 - f1_score: 0.2258 - val_loss: 2.7184 - val_f1_score: 0.2284
Epoch 53/500
28/28 [=====] - 2s 89ms/step - loss: 2.7493 - f1_score: 0.2336 - val_loss: 2.6977 - val_f1_score: 0.2305
Epoch 54/500
28/28 [=====] - 2s 86ms/step - loss: 2.7497 - f1_score: 0.2318 - val_loss: 2.6882 - val_f1_score: 0.2273
Epoch 55/500
28/28 [=====] - 2s 86ms/step - loss: 2.7051 - f1_score: 0.2411 - val_loss: 2.6099 - val_f1_score: 0.2499
Epoch 56/500
28/28 [=====] - 2s 86ms/step - loss: 2.7064 - f1_score: 0.2514 - val_loss: 2.6381 - val_f1_score: 0.2569
Epoch 57/500
28/28 [=====] - 2s 86ms/step - loss: 2.6688 - f1_score: 0.2488 - val_loss: 2.6324 - val_f1_score: 0.2778
Epoch 58/500
28/28 [=====] - 2s 88ms/step - loss: 2.6809 - f1_score: 0.2548 - val_loss: 2.5905 - val_f1_score: 0.2485
Epoch 59/500
28/28 [=====] - 2s 85ms/step - loss: 2.6371 - f1_score: 0.2613 - val_loss: 2.5442 - val_f1_score: 0.2732
Epoch 60/500
28/28 [=====] - 2s 88ms/step - loss: 2.6327 - f1_score: 0.2678 - val_loss: 2.6024 - val_f1_score: 0.2738
Epoch 61/500
28/28 [=====] - 2s 86ms/step - loss: 2.6080 - f1_score: 0.2737 - val_loss: 2.5174 - val_f1_score: 0.3061
Epoch 62/500
28/28 [=====] - 2s 88ms/step - loss: 2.5730 - f1_score: 0.2840 - val_loss: 2.5321 - val_f1_score: 0.3216
Epoch 63/500
```

```
28/28 [=====] - 2s 85ms/step - loss: 2.5856 - f1_score: 0.2627 - val_loss: 2.4715 - val_f1_score: 0.3199
Epoch 64/500
28/28 [=====] - 2s 88ms/step - loss: 2.5515 - f1_score: 0.2859 - val_loss: 2.5139 - val_f1_score: 0.3105
Epoch 65/500
28/28 [=====] - 2s 86ms/step - loss: 2.5478 - f1_score: 0.2751 - val_loss: 2.5345 - val_f1_score: 0.3001
Epoch 66/500
28/28 [=====] - 2s 87ms/step - loss: 2.5258 - f1_score: 0.2908 - val_loss: 2.4374 - val_f1_score: 0.3130
Epoch 67/500
28/28 [=====] - 2s 86ms/step - loss: 2.5054 - f1_score: 0.3029 - val_loss: 2.4462 - val_f1_score: 0.3113
Epoch 68/500
28/28 [=====] - 2s 87ms/step - loss: 2.4951 - f1_score: 0.3053 - val_loss: 2.4728 - val_f1_score: 0.2756
Epoch 69/500
28/28 [=====] - 2s 86ms/step - loss: 2.4940 - f1_score: 0.2881 - val_loss: 2.3970 - val_f1_score: 0.3483
Epoch 70/500
28/28 [=====] - 2s 89ms/step - loss: 2.4614 - f1_score: 0.3168 - val_loss: 2.3991 - val_f1_score: 0.3363
Epoch 71/500
28/28 [=====] - 2s 87ms/step - loss: 2.4398 - f1_score: 0.3033 - val_loss: 2.4228 - val_f1_score: 0.3256
Epoch 72/500
28/28 [=====] - 2s 88ms/step - loss: 2.4177 - f1_score: 0.3092 - val_loss: 2.3916 - val_f1_score: 0.3325
Epoch 73/500
28/28 [=====] - 2s 86ms/step - loss: 2.4056 - f1_score: 0.3222 - val_loss: 2.4108 - val_f1_score: 0.3292
Epoch 74/500
28/28 [=====] - 2s 89ms/step - loss: 2.3795 - f1_score: 0.3276 - val_loss: 2.3693 - val_f1_score: 0.3565
Epoch 75/500
28/28 [=====] - 2s 88ms/step - loss: 2.3616 - f1_score: 0.3467 - val_loss: 2.3838 - val_f1_score: 0.3393
Epoch 76/500
28/28 [=====] - 2s 89ms/step - loss: 2.3379 - f1_score: 0.3277 - val_loss: 2.3352 - val_f1_score: 0.3660
Epoch 77/500
28/28 [=====] - 2s 86ms/step - loss: 2.3372 - f1_score: 0.3310 - val_loss: 2.3229 - val_f1_score: 0.3541
Epoch 78/500
28/28 [=====] - 2s 87ms/step - loss: 2.3070 - f1_score: 0.3524 - val_loss: 2.2856 - val_f1_score: 0.3541
Epoch 79/500
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28/28 [=====] - 2s 86ms/step - loss: 2.3032 - f1_score: 0.3459 - val_loss: 2.3090 - val_f1_score: 0.3464
Epoch 80/500
28/28 [=====] - 2s 90ms/step - loss: 2.3075 - f1_score: 0.3380 - val_loss: 2.3199 - val_f1_score: 0.3400
Epoch 81/500
28/28 [=====] - 3s 91ms/step - loss: 2.2790 - f1_score: 0.3509 - val_loss: 2.2831 - val_f1_score: 0.3554
Epoch 82/500
28/28 [=====] - 2s 88ms/step - loss: 2.2870 - f1_score: 0.3531 - val_loss: 2.2714 - val_f1_score: 0.3613
Epoch 83/500
28/28 [=====] - 2s 89ms/step - loss: 2.2526 - f1_score: 0.3721 - val_loss: 2.2336 - val_f1_score: 0.3812
Epoch 84/500
28/28 [=====] - 2s 89ms/step - loss: 2.2589 - f1_score: 0.3558 - val_loss: 2.2597 - val_f1_score: 0.3562
Epoch 85/500
28/28 [=====] - 2s 86ms/step - loss: 2.2260 - f1_score: 0.3709 - val_loss: 2.2211 - val_f1_score: 0.3924
Epoch 86/500
28/28 [=====] - 2s 88ms/step - loss: 2.2099 - f1_score: 0.3697 - val_loss: 2.2953 - val_f1_score: 0.3562
Epoch 87/500
28/28 [=====] - 2s 86ms/step - loss: 2.2089 - f1_score: 0.3729 - val_loss: 2.1945 - val_f1_score: 0.3856
Epoch 88/500
28/28 [=====] - 2s 89ms/step - loss: 2.1615 - f1_score: 0.3856 - val_loss: 2.2257 - val_f1_score: 0.3725
Epoch 89/500
28/28 [=====] - 2s 87ms/step - loss: 2.1635 - f1_score: 0.3828 - val_loss: 2.1628 - val_f1_score: 0.3916
Epoch 90/500
28/28 [=====] - 2s 89ms/step - loss: 2.1368 - f1_score: 0.3863 - val_loss: 2.1423 - val_f1_score: 0.3977
Epoch 91/500
28/28 [=====] - 2s 87ms/step - loss: 2.1399 - f1_score: 0.3893 - val_loss: 2.1246 - val_f1_score: 0.3937
Epoch 92/500
28/28 [=====] - 2s 88ms/step - loss: 2.1283 - f1_score: 0.3986 - val_loss: 2.1938 - val_f1_score: 0.3976
Epoch 93/500
28/28 [=====] - 2s 86ms/step - loss: 2.1295 - f1_score: 0.3885 - val_loss: 2.1355 - val_f1_score: 0.3829
Epoch 94/500
28/28 [=====] - 3s 90ms/step - loss: 2.1059 - f1_score: 0.3954 - val_loss: 2.1759 - val_f1_score: 0.3766
Epoch 95/500
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28/28 [=====] - 2s 86ms/step - loss: 2.1033 - f1_score: 0.4016 - val_loss: 2.1362 - val_f1_score: 0.3843
Epoch 96/500
28/28 [=====] - 3s 92ms/step - loss: 2.0859 - f1_score: 0.4097 - val_loss: 2.0665 - val_f1_score: 0.4158
Epoch 97/500
28/28 [=====] - 2s 87ms/step - loss: 2.0480 - f1_score: 0.4254 - val_loss: 2.1127 - val_f1_score: 0.3913
Epoch 98/500
28/28 [=====] - 3s 91ms/step - loss: 2.0495 - f1_score: 0.4262 - val_loss: 2.1313 - val_f1_score: 0.3897
Epoch 99/500
28/28 [=====] - 2s 87ms/step - loss: 2.0447 - f1_score: 0.4146 - val_loss: 2.0915 - val_f1_score: 0.4108
Epoch 100/500
28/28 [=====] - 3s 90ms/step - loss: 2.0096 - f1_score: 0.4296 - val_loss: 2.0711 - val_f1_score: 0.4223
Epoch 101/500
28/28 [=====] - 2s 85ms/step - loss: 2.0301 - f1_score: 0.4223 - val_loss: 2.1011 - val_f1_score: 0.4035
Epoch 102/500
28/28 [=====] - 2s 86ms/step - loss: 2.0332 - f1_score: 0.4210 - val_loss: 2.1083 - val_f1_score: 0.3987
Epoch 103/500
28/28 [=====] - 3s 88ms/step - loss: 2.0050 - f1_score: 0.4388 - val_loss: 2.0669 - val_f1_score: 0.4193
Epoch 104/500
28/28 [=====] - 2s 87ms/step - loss: 1.9866 - f1_score: 0.4309 - val_loss: 2.0661 - val_f1_score: 0.4151
Epoch 105/500
28/28 [=====] - 2s 87ms/step - loss: 1.9833 - f1_score: 0.4329 - val_loss: 2.0550 - val_f1_score: 0.4063
Epoch 106/500
28/28 [=====] - 2s 88ms/step - loss: 1.9669 - f1_score: 0.4429 - val_loss: 2.0363 - val_f1_score: 0.4182
Epoch 107/500
28/28 [=====] - 2s 88ms/step - loss: 1.9545 - f1_score: 0.4492 - val_loss: 2.0181 - val_f1_score: 0.4087
Epoch 108/500
28/28 [=====] - 2s 86ms/step - loss: 1.9371 - f1_score: 0.4438 - val_loss: 1.9777 - val_f1_score: 0.4672
Epoch 109/500
28/28 [=====] - 3s 91ms/step - loss: 1.9429 - f1_score: 0.4544 - val_loss: 2.0251 - val_f1_score: 0.4090
Epoch 110/500
28/28 [=====] - 2s 86ms/step - loss: 1.9322 - f1_score: 0.4456 - val_loss: 2.0504 - val_f1_score: 0.4285
Epoch 111/500
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28/28 [=====] - 3s 90ms/step - loss: 1.8969 - f1_score: 0.4532 - val_loss: 1.9852 - val_f1_score: 0.4379
Epoch 112/500
28/28 [=====] - 2s 86ms/step - loss: 1.8827 - f1_score: 0.4497 - val_loss: 2.0089 - val_f1_score: 0.4456
Epoch 113/500
28/28 [=====] - 2s 90ms/step - loss: 1.8727 - f1_score: 0.4621 - val_loss: 1.9568 - val_f1_score: 0.4494
Epoch 114/500
28/28 [=====] - 2s 86ms/step - loss: 1.8490 - f1_score: 0.4648 - val_loss: 1.9857 - val_f1_score: 0.4499
Epoch 115/500
28/28 [=====] - 2s 89ms/step - loss: 1.8796 - f1_score: 0.4589 - val_loss: 1.9215 - val_f1_score: 0.4580
Epoch 116/500
28/28 [=====] - 2s 87ms/step - loss: 1.8425 - f1_score: 0.4828 - val_loss: 1.9344 - val_f1_score: 0.4433
Epoch 117/500
28/28 [=====] - 3s 91ms/step - loss: 1.8589 - f1_score: 0.4586 - val_loss: 1.9798 - val_f1_score: 0.4654
Epoch 118/500
28/28 [=====] - 2s 86ms/step - loss: 1.8143 - f1_score: 0.4752 - val_loss: 1.9789 - val_f1_score: 0.4458
Epoch 119/500
28/28 [=====] - 2s 88ms/step - loss: 1.8454 - f1_score: 0.4732 - val_loss: 1.9421 - val_f1_score: 0.4571
Epoch 120/500
28/28 [=====] - 2s 86ms/step - loss: 1.8021 - f1_score: 0.4796 - val_loss: 1.9461 - val_f1_score: 0.4666
Epoch 121/500
28/28 [=====] - 2s 89ms/step - loss: 1.8181 - f1_score: 0.4822 - val_loss: 1.8714 - val_f1_score: 0.4723
Epoch 122/500
28/28 [=====] - 2s 86ms/step - loss: 1.7732 - f1_score: 0.4947 - val_loss: 1.8522 - val_f1_score: 0.4874
Epoch 123/500
28/28 [=====] - 3s 94ms/step - loss: 1.7727 - f1_score: 0.5023 - val_loss: 1.9258 - val_f1_score: 0.4531
Epoch 124/500
28/28 [=====] - 2s 86ms/step - loss: 1.7498 - f1_score: 0.5077 - val_loss: 1.8918 - val_f1_score: 0.5105
Epoch 125/500
28/28 [=====] - 2s 89ms/step - loss: 1.7666 - f1_score: 0.4999 - val_loss: 1.8546 - val_f1_score: 0.4942
Epoch 126/500
28/28 [=====] - 2s 87ms/step - loss: 1.7829 - f1_score: 0.4784 - val_loss: 1.8543 - val_f1_score: 0.4732
Epoch 127/500
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28/28 [=====] - 2s 88ms/step - loss: 1.7516 - f1_score: 0.5126 - val_loss: 1.8425 - val_f1_score: 0.4833
Epoch 128/500
28/28 [=====] - 3s 91ms/step - loss: 1.7313 - f1_score: 0.5021 - val_loss: 2.0168 - val_f1_score: 0.4457
Epoch 129/500
28/28 [=====] - 3s 90ms/step - loss: 1.7498 - f1_score: 0.5028 - val_loss: 1.8862 - val_f1_score: 0.4832
Epoch 130/500
28/28 [=====] - 2s 87ms/step - loss: 1.7397 - f1_score: 0.5092 - val_loss: 1.8052 - val_f1_score: 0.4779
Epoch 131/500
28/28 [=====] - 2s 88ms/step - loss: 1.6935 - f1_score: 0.5177 - val_loss: 1.8414 - val_f1_score: 0.5080
Epoch 132/500
28/28 [=====] - 2s 86ms/step - loss: 1.7157 - f1_score: 0.5184 - val_loss: 1.8410 - val_f1_score: 0.4839
Epoch 133/500
28/28 [=====] - 2s 89ms/step - loss: 1.7067 - f1_score: 0.5043 - val_loss: 1.8425 - val_f1_score: 0.4992
Epoch 134/500
28/28 [=====] - 2s 88ms/step - loss: 1.6700 - f1_score: 0.5176 - val_loss: 1.7968 - val_f1_score: 0.4892
Epoch 135/500
28/28 [=====] - 2s 88ms/step - loss: 1.6822 - f1_score: 0.5251 - val_loss: 1.8044 - val_f1_score: 0.4976
Epoch 136/500
28/28 [=====] - 2s 86ms/step - loss: 1.6810 - f1_score: 0.5096 - val_loss: 1.8126 - val_f1_score: 0.4973
Epoch 137/500
28/28 [=====] - 2s 88ms/step - loss: 1.6733 - f1_score: 0.5234 - val_loss: 1.8195 - val_f1_score: 0.5159
Epoch 138/500
28/28 [=====] - 2s 87ms/step - loss: 1.6798 - f1_score: 0.5110 - val_loss: 1.7234 - val_f1_score: 0.5136
Epoch 139/500
28/28 [=====] - 3s 94ms/step - loss: 1.6683 - f1_score: 0.5175 - val_loss: 1.7681 - val_f1_score: 0.5192
Epoch 140/500
28/28 [=====] - 2s 86ms/step - loss: 1.6470 - f1_score: 0.5347 - val_loss: 1.7650 - val_f1_score: 0.5160
Epoch 141/500
28/28 [=====] - 2s 89ms/step - loss: 1.6570 - f1_score: 0.5122 - val_loss: 1.7350 - val_f1_score: 0.5233
Epoch 142/500
28/28 [=====] - 2s 87ms/step - loss: 1.6217 - f1_score: 0.5336 - val_loss: 1.7971 - val_f1_score: 0.5080
Epoch 143/500
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28/28 [=====] - 2s 88ms/step - loss: 1.6199 - f1_score: 0.5330 - val_loss: 1.8158 - val_f1_score: 0.4981
Epoch 144/500
28/28 [=====] - 2s 86ms/step - loss: 1.6309 - f1_score: 0.5356 - val_loss: 1.7369 - val_f1_score: 0.4937
Epoch 145/500
28/28 [=====] - 2s 88ms/step - loss: 1.5989 - f1_score: 0.5414 - val_loss: 1.8056 - val_f1_score: 0.5306
Epoch 146/500
28/28 [=====] - 2s 86ms/step - loss: 1.5930 - f1_score: 0.5402 - val_loss: 1.7673 - val_f1_score: 0.5280
Epoch 147/500
28/28 [=====] - 2s 90ms/step - loss: 1.6249 - f1_score: 0.5341 - val_loss: 1.7671 - val_f1_score: 0.5270
Epoch 148/500
28/28 [=====] - 2s 88ms/step - loss: 1.5872 - f1_score: 0.5578 - val_loss: 1.7969 - val_f1_score: 0.5090
Epoch 149/500
28/28 [=====] - 3s 90ms/step - loss: 1.5620 - f1_score: 0.5517 - val_loss: 1.7426 - val_f1_score: 0.5257
Epoch 150/500
28/28 [=====] - 2s 88ms/step - loss: 1.5454 - f1_score: 0.5624 - val_loss: 1.7196 - val_f1_score: 0.5125
Epoch 151/500
28/28 [=====] - 2s 89ms/step - loss: 1.5679 - f1_score: 0.5386 - val_loss: 1.7319 - val_f1_score: 0.5285
Epoch 152/500
28/28 [=====] - 2s 86ms/step - loss: 1.5171 - f1_score: 0.5646 - val_loss: 1.7449 - val_f1_score: 0.5125
Epoch 153/500
28/28 [=====] - 2s 89ms/step - loss: 1.5525 - f1_score: 0.5556 - val_loss: 1.7085 - val_f1_score: 0.5299
Epoch 154/500
28/28 [=====] - 2s 86ms/step - loss: 1.5362 - f1_score: 0.5620 - val_loss: 1.8045 - val_f1_score: 0.5357
Epoch 155/500
28/28 [=====] - 2s 88ms/step - loss: 1.5170 - f1_score: 0.5802 - val_loss: 1.7106 - val_f1_score: 0.5457
Epoch 156/500
28/28 [=====] - 2s 89ms/step - loss: 1.5285 - f1_score: 0.5645 - val_loss: 1.7336 - val_f1_score: 0.5424
Epoch 157/500
28/28 [=====] - 2s 88ms/step - loss: 1.4833 - f1_score: 0.5638 - val_loss: 1.6532 - val_f1_score: 0.5200
Epoch 158/500
28/28 [=====] - 2s 86ms/step - loss: 1.5199 - f1_score: 0.5568 - val_loss: 1.6754 - val_f1_score: 0.5272
Epoch 159/500
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28/28 [=====] - 2s 90ms/step - loss: 1.5039 - f1_score: 0.5714 - val_loss: 1.6411 - val_f1_score: 0.5444
Epoch 160/500
28/28 [=====] - 2s 86ms/step - loss: 1.4910 - f1_score: 0.5697 - val_loss: 1.6889 - val_f1_score: 0.5380
Epoch 161/500
28/28 [=====] - 3s 95ms/step - loss: 1.5169 - f1_score: 0.5691 - val_loss: 1.6428 - val_f1_score: 0.5333
Epoch 162/500
28/28 [=====] - 3s 90ms/step - loss: 1.4785 - f1_score: 0.5682 - val_loss: 1.6309 - val_f1_score: 0.5682
Epoch 163/500
28/28 [=====] - 2s 89ms/step - loss: 1.4918 - f1_score: 0.5817 - val_loss: 1.6647 - val_f1_score: 0.5393
Epoch 164/500
28/28 [=====] - 2s 86ms/step - loss: 1.4694 - f1_score: 0.5708 - val_loss: 1.6758 - val_f1_score: 0.5446
Epoch 165/500
28/28 [=====] - 3s 90ms/step - loss: 1.4962 - f1_score: 0.5594 - val_loss: 1.6245 - val_f1_score: 0.5501
Epoch 166/500
28/28 [=====] - 2s 86ms/step - loss: 1.4816 - f1_score: 0.5683 - val_loss: 1.6610 - val_f1_score: 0.5290
Epoch 167/500
28/28 [=====] - 3s 91ms/step - loss: 1.4863 - f1_score: 0.5639 - val_loss: 1.6772 - val_f1_score: 0.5494
Epoch 168/500
28/28 [=====] - 2s 86ms/step - loss: 1.4573 - f1_score: 0.5813 - val_loss: 1.6013 - val_f1_score: 0.5669
Epoch 169/500
28/28 [=====] - 3s 93ms/step - loss: 1.4484 - f1_score: 0.5799 - val_loss: 1.6300 - val_f1_score: 0.5565
Epoch 170/500
28/28 [=====] - 2s 86ms/step - loss: 1.4359 - f1_score: 0.5885 - val_loss: 1.6283 - val_f1_score: 0.5385
Epoch 171/500
28/28 [=====] - 3s 92ms/step - loss: 1.4336 - f1_score: 0.5875 - val_loss: 1.6214 - val_f1_score: 0.5540
Epoch 172/500
28/28 [=====] - 2s 88ms/step - loss: 1.4245 - f1_score: 0.5880 - val_loss: 1.7363 - val_f1_score: 0.5342
Epoch 173/500
28/28 [=====] - 3s 91ms/step - loss: 1.4114 - f1_score: 0.5913 - val_loss: 1.6339 - val_f1_score: 0.5663
Epoch 174/500
28/28 [=====] - 2s 85ms/step - loss: 1.4216 - f1_score: 0.5882 - val_loss: 1.5643 - val_f1_score: 0.5711
Epoch 175/500
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28/28 [=====] - 3s 91ms/step - loss: 1.4175 - f1_score: 0.5955 - val_loss: 1.6618 - val_f1_score: 0.5738
Epoch 176/500
28/28 [=====] - 2s 86ms/step - loss: 1.4189 - f1_score: 0.5870 - val_loss: 1.6897 - val_f1_score: 0.5576
Epoch 177/500
28/28 [=====] - 2s 87ms/step - loss: 1.4320 - f1_score: 0.5857 - val_loss: 1.6154 - val_f1_score: 0.5493
Epoch 178/500
28/28 [=====] - 2s 87ms/step - loss: 1.4147 - f1_score: 0.5928 - val_loss: 1.5737 - val_f1_score: 0.5943
Epoch 179/500
28/28 [=====] - 2s 87ms/step - loss: 1.3842 - f1_score: 0.6033 - val_loss: 1.5766 - val_f1_score: 0.5717
Epoch 180/500
28/28 [=====] - 2s 88ms/step - loss: 1.3621 - f1_score: 0.6074 - val_loss: 1.5936 - val_f1_score: 0.5690
Epoch 181/500
28/28 [=====] - 2s 86ms/step - loss: 1.3632 - f1_score: 0.6102 - val_loss: 1.5449 - val_f1_score: 0.5733
Epoch 182/500
28/28 [=====] - 3s 89ms/step - loss: 1.3615 - f1_score: 0.6156 - val_loss: 1.6170 - val_f1_score: 0.5775
Epoch 183/500
28/28 [=====] - 2s 86ms/step - loss: 1.3713 - f1_score: 0.5935 - val_loss: 1.6041 - val_f1_score: 0.5699
Epoch 184/500
28/28 [=====] - 2s 89ms/step - loss: 1.3620 - f1_score: 0.6075 - val_loss: 1.5624 - val_f1_score: 0.5964
Epoch 185/500
28/28 [=====] - 2s 86ms/step - loss: 1.3683 - f1_score: 0.5988 - val_loss: 1.5465 - val_f1_score: 0.5934
Epoch 186/500
28/28 [=====] - 2s 88ms/step - loss: 1.3174 - f1_score: 0.6194 - val_loss: 1.5269 - val_f1_score: 0.6015
Epoch 187/500
28/28 [=====] - 2s 86ms/step - loss: 1.3402 - f1_score: 0.6178 - val_loss: 1.5504 - val_f1_score: 0.5841
Epoch 188/500
28/28 [=====] - 2s 88ms/step - loss: 1.3216 - f1_score: 0.6276 - val_loss: 1.5523 - val_f1_score: 0.6003
Epoch 189/500
28/28 [=====] - 2s 87ms/step - loss: 1.3375 - f1_score: 0.6165 - val_loss: 1.5514 - val_f1_score: 0.6004
Epoch 190/500
28/28 [=====] - 2s 89ms/step - loss: 1.3313 - f1_score: 0.6176 - val_loss: 1.5731 - val_f1_score: 0.5877
Epoch 191/500
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28/28 [=====] - 2s 86ms/step - loss: 1.3048 - f1_score: 0.6186 - val_loss: 1.5567 - val_f1_score: 0.5756
Epoch 192/500
28/28 [=====] - 2s 89ms/step - loss: 1.3066 - f1_score: 0.6218 - val_loss: 1.5810 - val_f1_score: 0.5849
Epoch 193/500
28/28 [=====] - 2s 86ms/step - loss: 1.3499 - f1_score: 0.6117 - val_loss: 1.5480 - val_f1_score: 0.5981
Epoch 194/500
28/28 [=====] - 2s 89ms/step - loss: 1.2927 - f1_score: 0.6262 - val_loss: 1.4884 - val_f1_score: 0.6248
Epoch 195/500
28/28 [=====] - 2s 87ms/step - loss: 1.3125 - f1_score: 0.6208 - val_loss: 1.5326 - val_f1_score: 0.6049
Epoch 196/500
28/28 [=====] - 3s 92ms/step - loss: 1.2811 - f1_score: 0.6287 - val_loss: 1.5086 - val_f1_score: 0.5959
Epoch 197/500
28/28 [=====] - 2s 86ms/step - loss: 1.2840 - f1_score: 0.6315 - val_loss: 1.5071 - val_f1_score: 0.6164
Epoch 198/500
28/28 [=====] - 2s 89ms/step - loss: 1.2843 - f1_score: 0.6408 - val_loss: 1.5171 - val_f1_score: 0.6016
Epoch 199/500
28/28 [=====] - 2s 86ms/step - loss: 1.2654 - f1_score: 0.6363 - val_loss: 1.5059 - val_f1_score: 0.6124
Epoch 200/500
28/28 [=====] - 2s 88ms/step - loss: 1.2724 - f1_score: 0.6344 - val_loss: 1.5188 - val_f1_score: 0.6138
Epoch 201/500
28/28 [=====] - 2s 88ms/step - loss: 1.2620 - f1_score: 0.6289 - val_loss: 1.5215 - val_f1_score: 0.6040
Epoch 202/500
28/28 [=====] - 2s 87ms/step - loss: 1.2439 - f1_score: 0.6424 - val_loss: 1.5612 - val_f1_score: 0.6071
Epoch 203/500
28/28 [=====] - 2s 87ms/step - loss: 1.2456 - f1_score: 0.6526 - val_loss: 1.5003 - val_f1_score: 0.5978
Epoch 204/500
28/28 [=====] - 2s 89ms/step - loss: 1.2430 - f1_score: 0.6291 - val_loss: 1.4949 - val_f1_score: 0.6151
Epoch 205/500
28/28 [=====] - 2s 87ms/step - loss: 1.2379 - f1_score: 0.6444 - val_loss: 1.4832 - val_f1_score: 0.6260
Epoch 206/500
28/28 [=====] - 3s 91ms/step - loss: 1.2293 - f1_score: 0.6425 - val_loss: 1.4939 - val_f1_score: 0.5808
Epoch 207/500
```

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28/28 [=====] - 2s 86ms/step - loss: 1.2528 - f1_score: 0.6270 - val_loss: 1.5224 - val_f1_score: 0.5922
Epoch 208/500
28/28 [=====] - 2s 89ms/step - loss: 1.2274 - f1_score: 0.6378 - val_loss: 1.5849 - val_f1_score: 0.5963
Epoch 209/500
28/28 [=====] - 2s 86ms/step - loss: 1.2136 - f1_score: 0.6546 - val_loss: 1.5574 - val_f1_score: 0.5945
Epoch 210/500
28/28 [=====] - 3s 93ms/step - loss: 1.2347 - f1_score: 0.6329 - val_loss: 1.5355 - val_f1_score: 0.6108
Epoch 211/500
28/28 [=====] - 2s 87ms/step - loss: 1.2228 - f1_score: 0.6508 - val_loss: 1.5262 - val_f1_score: 0.6104
Epoch 212/500
28/28 [=====] - 2s 89ms/step - loss: 1.2307 - f1_score: 0.6361 - val_loss: 1.5098 - val_f1_score: 0.6441
Epoch 213/500
28/28 [=====] - 2s 89ms/step - loss: 1.2237 - f1_score: 0.6549 - val_loss: 1.4830 - val_f1_score: 0.6274
Epoch 214/500
28/28 [=====] - 3s 91ms/step - loss: 1.2156 - f1_score: 0.6488 - val_loss: 1.4716 - val_f1_score: 0.6079
Epoch 215/500
28/28 [=====] - 2s 88ms/step - loss: 1.2377 - f1_score: 0.6371 - val_loss: 1.4600 - val_f1_score: 0.6072
Epoch 216/500
28/28 [=====] - 2s 89ms/step - loss: 1.2011 - f1_score: 0.6525 - val_loss: 1.4640 - val_f1_score: 0.6087
Epoch 217/500
28/28 [=====] - 2s 87ms/step - loss: 1.1924 - f1_score: 0.6590 - val_loss: 1.5525 - val_f1_score: 0.6039
Epoch 218/500
28/28 [=====] - 2s 90ms/step - loss: 1.1763 - f1_score: 0.6606 - val_loss: 1.5025 - val_f1_score: 0.6234
Epoch 219/500
28/28 [=====] - 2s 87ms/step - loss: 1.2106 - f1_score: 0.6531 - val_loss: 1.4464 - val_f1_score: 0.6350
Epoch 220/500
28/28 [=====] - 2s 89ms/step - loss: 1.1800 - f1_score: 0.6597 - val_loss: 1.4353 - val_f1_score: 0.6344
Epoch 221/500
28/28 [=====] - 2s 88ms/step - loss: 1.1697 - f1_score: 0.6671 - val_loss: 1.4513 - val_f1_score: 0.6172
Epoch 222/500
28/28 [=====] - 2s 88ms/step - loss: 1.1588 - f1_score: 0.6637 - val_loss: 1.4381 - val_f1_score: 0.6338
Epoch 223/500
```

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28/28 [=====] - 2s 87ms/step - loss: 1.1398 - f1_score: 0.6711 - val_loss: 1.4735 - val_f1_score: 0.6179
Epoch 224/500
28/28 [=====] - 2s 88ms/step - loss: 1.1597 - f1_score: 0.6557 - val_loss: 1.4609 - val_f1_score: 0.6267
Epoch 225/500
28/28 [=====] - 2s 87ms/step - loss: 1.1645 - f1_score: 0.6635 - val_loss: 1.4029 - val_f1_score: 0.6234
Epoch 226/500
28/28 [=====] - 2s 89ms/step - loss: 1.1551 - f1_score: 0.6645 - val_loss: 1.4471 - val_f1_score: 0.6081
Epoch 227/500
28/28 [=====] - 2s 86ms/step - loss: 1.1562 - f1_score: 0.6592 - val_loss: 1.4798 - val_f1_score: 0.6378
Epoch 228/500
28/28 [=====] - 2s 89ms/step - loss: 1.1954 - f1_score: 0.6605 - val_loss: 1.5756 - val_f1_score: 0.5926
Epoch 229/500
28/28 [=====] - 2s 89ms/step - loss: 1.1392 - f1_score: 0.6606 - val_loss: 1.4678 - val_f1_score: 0.6151
Epoch 230/500
28/28 [=====] - 3s 94ms/step - loss: 1.1634 - f1_score: 0.6623 - val_loss: 1.4755 - val_f1_score: 0.6098
Epoch 231/500
28/28 [=====] - 3s 91ms/step - loss: 1.1148 - f1_score: 0.6866 - val_loss: 1.4578 - val_f1_score: 0.6318
Epoch 232/500
28/28 [=====] - 2s 89ms/step - loss: 1.1170 - f1_score: 0.6709 - val_loss: 1.4112 - val_f1_score: 0.6308
Epoch 233/500
28/28 [=====] - 2s 87ms/step - loss: 1.1192 - f1_score: 0.6800 - val_loss: 1.4321 - val_f1_score: 0.6444
Epoch 234/500
28/28 [=====] - 2s 89ms/step - loss: 1.1275 - f1_score: 0.6814 - val_loss: 1.4605 - val_f1_score: 0.6202
Epoch 235/500
28/28 [=====] - 2s 87ms/step - loss: 1.1117 - f1_score: 0.6816 - val_loss: 1.4811 - val_f1_score: 0.6440
Epoch 236/500
28/28 [=====] - 2s 89ms/step - loss: 1.1268 - f1_score: 0.6770 - val_loss: 1.4501 - val_f1_score: 0.6412
Epoch 237/500
28/28 [=====] - 2s 88ms/step - loss: 1.1238 - f1_score: 0.6729 - val_loss: 1.4638 - val_f1_score: 0.6266
Epoch 238/500
28/28 [=====] - 3s 90ms/step - loss: 1.1157 - f1_score: 0.6789 - val_loss: 1.4488 - val_f1_score: 0.6306
Epoch 239/500
```

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28/28 [=====] - 2s 86ms/step - loss: 1.0900 - f1_score: 0.6764 - val_loss: 1.4634 - val_f1_score: 0.6438
Epoch 240/500
28/28 [=====] - 3s 91ms/step - loss: 1.0886 - f1_score: 0.6838 - val_loss: 1.3934 - val_f1_score: 0.6559
Epoch 241/500
28/28 [=====] - 2s 86ms/step - loss: 1.0934 - f1_score: 0.6776 - val_loss: 1.4389 - val_f1_score: 0.6454
Epoch 242/500
28/28 [=====] - 3s 91ms/step - loss: 1.0946 - f1_score: 0.6793 - val_loss: 1.4607 - val_f1_score: 0.6326
Epoch 243/500
28/28 [=====] - 2s 88ms/step - loss: 1.1138 - f1_score: 0.6725 - val_loss: 1.4642 - val_f1_score: 0.6118
Epoch 244/500
28/28 [=====] - 3s 91ms/step - loss: 1.0858 - f1_score: 0.6843 - val_loss: 1.4072 - val_f1_score: 0.6576
Epoch 245/500
28/28 [=====] - 2s 87ms/step - loss: 1.0933 - f1_score: 0.6890 - val_loss: 1.4447 - val_f1_score: 0.6294
Epoch 246/500
28/28 [=====] - 3s 93ms/step - loss: 1.0672 - f1_score: 0.6874 - val_loss: 1.4322 - val_f1_score: 0.6205
Epoch 247/500
28/28 [=====] - 2s 86ms/step - loss: 1.0692 - f1_score: 0.6970 - val_loss: 1.4239 - val_f1_score: 0.6326
Epoch 248/500
28/28 [=====] - 3s 90ms/step - loss: 1.0724 - f1_score: 0.6955 - val_loss: 1.4044 - val_f1_score: 0.6380
Epoch 249/500
28/28 [=====] - 2s 87ms/step - loss: 1.0733 - f1_score: 0.6866 - val_loss: 1.3679 - val_f1_score: 0.6551
Epoch 250/500
28/28 [=====] - 3s 91ms/step - loss: 1.0265 - f1_score: 0.7094 - val_loss: 1.3878 - val_f1_score: 0.6415
Epoch 251/500
28/28 [=====] - 2s 86ms/step - loss: 1.0589 - f1_score: 0.6963 - val_loss: 1.4062 - val_f1_score: 0.6357
Epoch 252/500
28/28 [=====] - 3s 91ms/step - loss: 1.0440 - f1_score: 0.6939 - val_loss: 1.4100 - val_f1_score: 0.6358
Epoch 253/500
28/28 [=====] - 2s 86ms/step - loss: 1.0545 - f1_score: 0.7013 - val_loss: 1.4457 - val_f1_score: 0.6322
Epoch 254/500
28/28 [=====] - 3s 90ms/step - loss: 1.0471 - f1_score: 0.7008 - val_loss: 1.4099 - val_f1_score: 0.6455
Epoch 255/500
```

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28/28 [=====] - 2s 88ms/step - loss: 1.0626 - f1_score: 0.6893 - val_loss: 1.3870 - val_f1_score: 0.6519
Epoch 256/500
28/28 [=====] - 2s 88ms/step - loss: 1.0495 - f1_score: 0.6904 - val_loss: 1.4094 - val_f1_score: 0.6506
Epoch 257/500
28/28 [=====] - 2s 86ms/step - loss: 1.0269 - f1_score: 0.7089 - val_loss: 1.3874 - val_f1_score: 0.6199
Epoch 258/500
28/28 [=====] - 2s 87ms/step - loss: 1.0466 - f1_score: 0.6966 - val_loss: 1.4002 - val_f1_score: 0.6542
Epoch 259/500
28/28 [=====] - 2s 87ms/step - loss: 1.0330 - f1_score: 0.7051 - val_loss: 1.4119 - val_f1_score: 0.6595
Epoch 260/500
28/28 [=====] - 2s 87ms/step - loss: 0.9967 - f1_score: 0.7089 - val_loss: 1.3658 - val_f1_score: 0.6669
Epoch 261/500
28/28 [=====] - 2s 90ms/step - loss: 1.0166 - f1_score: 0.7064 - val_loss: 1.4181 - val_f1_score: 0.6593
Epoch 262/500
28/28 [=====] - 2s 87ms/step - loss: 1.0101 - f1_score: 0.7089 - val_loss: 1.4133 - val_f1_score: 0.6268
Epoch 263/500
28/28 [=====] - 3s 93ms/step - loss: 0.9997 - f1_score: 0.7098 - val_loss: 1.4109 - val_f1_score: 0.6553
Epoch 264/500
28/28 [=====] - 2s 87ms/step - loss: 1.0120 - f1_score: 0.7126 - val_loss: 1.3954 - val_f1_score: 0.6612
Epoch 265/500
28/28 [=====] - 3s 91ms/step - loss: 0.9971 - f1_score: 0.7133 - val_loss: 1.3949 - val_f1_score: 0.6564
Epoch 266/500
28/28 [=====] - 2s 88ms/step - loss: 1.0073 - f1_score: 0.7069 - val_loss: 1.4905 - val_f1_score: 0.5923
Epoch 267/500
28/28 [=====] - 3s 90ms/step - loss: 0.9827 - f1_score: 0.7124 - val_loss: 1.3381 - val_f1_score: 0.6559
Epoch 268/500
28/28 [=====] - 2s 88ms/step - loss: 0.9931 - f1_score: 0.7186 - val_loss: 1.3949 - val_f1_score: 0.6644
Epoch 269/500
28/28 [=====] - 3s 91ms/step - loss: 0.9848 - f1_score: 0.7207 - val_loss: 1.4083 - val_f1_score: 0.6402
Epoch 270/500
28/28 [=====] - 2s 87ms/step - loss: 0.9914 - f1_score: 0.7169 - val_loss: 1.3671 - val_f1_score: 0.6612
Epoch 271/500
```

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28/28 [=====] - 3s 91ms/step - loss: 1.0003 - f1_score: 0.7072 - val_loss: 1.3835 - val_f1_score: 0.6477
Epoch 272/500
28/28 [=====] - 2s 86ms/step - loss: 0.9930 - f1_score: 0.7117 - val_loss: 1.3609 - val_f1_score: 0.6367
Epoch 273/500
28/28 [=====] - 3s 91ms/step - loss: 0.9853 - f1_score: 0.7179 - val_loss: 1.3877 - val_f1_score: 0.6588
Epoch 274/500
28/28 [=====] - 2s 86ms/step - loss: 0.9478 - f1_score: 0.7400 - val_loss: 1.3855 - val_f1_score: 0.6491
Epoch 275/500
28/28 [=====] - 2s 88ms/step - loss: 0.9699 - f1_score: 0.7260 - val_loss: 1.4849 - val_f1_score: 0.6241
Epoch 276/500
28/28 [=====] - 2s 88ms/step - loss: 0.9736 - f1_score: 0.7211 - val_loss: 1.5452 - val_f1_score: 0.5896
Epoch 277/500
28/28 [=====] - 2s 89ms/step - loss: 0.9907 - f1_score: 0.7059 - val_loss: 1.4046 - val_f1_score: 0.6415
Epoch 278/500
28/28 [=====] - 2s 86ms/step - loss: 0.9471 - f1_score: 0.7202 - val_loss: 1.3775 - val_f1_score: 0.6623
Epoch 279/500
28/28 [=====] - 3s 90ms/step - loss: 0.9320 - f1_score: 0.7322 - val_loss: 1.3589 - val_f1_score: 0.6571
Epoch 280/500
28/28 [=====] - 2s 87ms/step - loss: 0.9553 - f1_score: 0.7292 - val_loss: 1.4371 - val_f1_score: 0.6375
Epoch 281/500
28/28 [=====] - 3s 90ms/step - loss: 0.9780 - f1_score: 0.7164 - val_loss: 1.3473 - val_f1_score: 0.6767
Epoch 282/500
28/28 [=====] - 2s 86ms/step - loss: 0.9656 - f1_score: 0.7184 - val_loss: 1.4296 - val_f1_score: 0.6553
Epoch 283/500
28/28 [=====] - 2s 89ms/step - loss: 0.9407 - f1_score: 0.7304 - val_loss: 1.3619 - val_f1_score: 0.6681
Epoch 284/500
28/28 [=====] - 2s 87ms/step - loss: 0.9410 - f1_score: 0.7258 - val_loss: 1.3497 - val_f1_score: 0.6492
Epoch 285/500
28/28 [=====] - 2s 89ms/step - loss: 0.9309 - f1_score: 0.7363 - val_loss: 1.3422 - val_f1_score: 0.6606
Epoch 286/500
28/28 [=====] - 2s 86ms/step - loss: 0.9193 - f1_score: 0.7321 - val_loss: 1.3456 - val_f1_score: 0.6739
Epoch 287/500
```

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28/28 [=====] - 2s 89ms/step - loss: 0.9212 - f1_score: 0.7352 - val_loss: 1.3385 - val_f1_score: 0.6710
Epoch 288/500
28/28 [=====] - 2s 87ms/step - loss: 0.9005 - f1_score: 0.7512 - val_loss: 1.3558 - val_f1_score: 0.6702
Epoch 289/500
28/28 [=====] - 2s 88ms/step - loss: 0.9403 - f1_score: 0.7193 - val_loss: 1.3808 - val_f1_score: 0.6310
Epoch 290/500
28/28 [=====] - 2s 88ms/step - loss: 0.8969 - f1_score: 0.7360 - val_loss: 1.3583 - val_f1_score: 0.6593
Epoch 291/500
28/28 [=====] - 2s 88ms/step - loss: 0.9146 - f1_score: 0.7437 - val_loss: 1.3972 - val_f1_score: 0.6158
Epoch 292/500
28/28 [=====] - 2s 87ms/step - loss: 0.9279 - f1_score: 0.7317 - val_loss: 1.4241 - val_f1_score: 0.6200
Epoch 293/500
28/28 [=====] - 2s 88ms/step - loss: 0.9328 - f1_score: 0.7346 - val_loss: 1.3490 - val_f1_score: 0.6694
Epoch 294/500
28/28 [=====] - 2s 88ms/step - loss: 0.8934 - f1_score: 0.7516 - val_loss: 1.2939 - val_f1_score: 0.6787
Epoch 295/500
28/28 [=====] - 2s 88ms/step - loss: 0.8798 - f1_score: 0.7508 - val_loss: 1.3353 - val_f1_score: 0.6738
Epoch 296/500
28/28 [=====] - 2s 86ms/step - loss: 0.8922 - f1_score: 0.7489 - val_loss: 1.3147 - val_f1_score: 0.6755
Epoch 297/500
28/28 [=====] - 2s 88ms/step - loss: 0.8922 - f1_score: 0.7358 - val_loss: 1.3317 - val_f1_score: 0.6599
Epoch 298/500
28/28 [=====] - 2s 88ms/step - loss: 0.8956 - f1_score: 0.7406 - val_loss: 1.3204 - val_f1_score: 0.6740
Epoch 299/500
28/28 [=====] - 3s 90ms/step - loss: 0.8847 - f1_score: 0.7396 - val_loss: 1.2780 - val_f1_score: 0.6711
Epoch 300/500
28/28 [=====] - 2s 87ms/step - loss: 0.8916 - f1_score: 0.7477 - val_loss: 1.2829 - val_f1_score: 0.6841
Epoch 301/500
28/28 [=====] - 2s 89ms/step - loss: 0.9085 - f1_score: 0.7458 - val_loss: 1.2949 - val_f1_score: 0.6786
Epoch 302/500
28/28 [=====] - ETA: 0s - loss: 0.8773 - f1_score: 0.7468
```

```
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_2_layer_call_fn, lstm_cell_2_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 452ms/step - loss: 0.8773 - f1_score: 0.7468 - val_loss: 1.3107 - val_f1_score: 0.6966
Epoch 303/500
28/28 [=====] - 2s 84ms/step - loss: 0.8741 - f1_score: 0.7599 - val_loss: 1.3828 - val_f1_score: 0.6639
Epoch 304/500
28/28 [=====] - 2s 83ms/step - loss: 0.9145 - f1_score: 0.7453 - val_loss: 1.3253 - val_f1_score: 0.6853
Epoch 305/500
28/28 [=====] - 2s 86ms/step - loss: 0.8884 - f1_score: 0.7427 - val_loss: 1.3883 - val_f1_score: 0.6204
Epoch 306/500
28/28 [=====] - 2s 85ms/step - loss: 0.8657 - f1_score: 0.7506 - val_loss: 1.3681 - val_f1_score: 0.6678
Epoch 307/500
28/28 [=====] - 2s 89ms/step - loss: 0.8670 - f1_score: 0.7553 - val_loss: 1.2898 - val_f1_score: 0.6903
Epoch 308/500
28/28 [=====] - 2s 89ms/step - loss: 0.8367 - f1_score: 0.7616 - val_loss: 1.3511 - val_f1_score: 0.6699
Epoch 309/500
28/28 [=====] - 3s 91ms/step - loss: 0.8674 - f1_score: 0.7533 - val_loss: 1.3765 - val_f1_score: 0.6671
Epoch 310/500
28/28 [=====] - 2s 85ms/step - loss: 0.8434 - f1_score: 0.7656 - val_loss: 1.3657 - val_f1_score: 0.6766
Epoch 311/500
28/28 [=====] - 2s 86ms/step - loss: 0.8426 - f1_score: 0.7594 - val_loss: 1.3102 - val_f1_score: 0.6803
Epoch 312/500
28/28 [=====] - 2s 86ms/step - loss: 0.8364 - f1_score: 0.7615 - val_loss: 1.3868 - val_f1_score: 0.6622
Epoch 313/500
28/28 [=====] - 3s 90ms/step - loss: 0.8713 - f1_score: 0.7503 - val_loss: 1.3402 - val_f1_score: 0.6732
Epoch 314/500
28/28 [=====] - 2s 87ms/step - loss: 0.8518 - f1_score: 0.7540 - val_loss: 1.3286 - val_f1_score: 0.6788
Epoch 315/500
28/28 [=====] - 2s 86ms/step - loss: 0.8531 - f1_score:
```

```
0.7555 - val_loss: 1.3285 - val_f1_score: 0.6750
Epoch 316/500
28/28 [=====] - 2s 88ms/step - loss: 0.8635 - f1_score:
0.7496 - val_loss: 1.3367 - val_f1_score: 0.6723
Epoch 317/500
28/28 [=====] - 2s 86ms/step - loss: 0.8646 - f1_score:
0.7561 - val_loss: 1.2929 - val_f1_score: 0.6684
Epoch 318/500
28/28 [=====] - 2s 87ms/step - loss: 0.8326 - f1_score:
0.7626 - val_loss: 1.3856 - val_f1_score: 0.6528
Epoch 319/500
28/28 [=====] - 2s 85ms/step - loss: 0.8474 - f1_score:
0.7548 - val_loss: 1.3247 - val_f1_score: 0.6839
Epoch 320/500
28/28 [=====] - 2s 88ms/step - loss: 0.8513 - f1_score:
0.7598 - val_loss: 1.3332 - val_f1_score: 0.6469
Epoch 321/500
28/28 [=====] - 2s 88ms/step - loss: 0.8482 - f1_score:
0.7539 - val_loss: 1.3274 - val_f1_score: 0.6626
Epoch 322/500
28/28 [=====] - 2s 89ms/step - loss: 0.8319 - f1_score:
0.7652 - val_loss: 1.3653 - val_f1_score: 0.6769
Epoch 323/500
28/28 [=====] - 2s 87ms/step - loss: 0.8295 - f1_score:
0.7620 - val_loss: 1.3417 - val_f1_score: 0.6630
Epoch 324/500
28/28 [=====] - 2s 87ms/step - loss: 0.8432 - f1_score:
0.7604 - val_loss: 1.3057 - val_f1_score: 0.6853
Epoch 325/500
28/28 [=====] - 2s 87ms/step - loss: 0.8245 - f1_score:
0.7571 - val_loss: 1.3807 - val_f1_score: 0.6337
Epoch 326/500
28/28 [=====] - 2s 88ms/step - loss: 0.8294 - f1_score:
0.7572 - val_loss: 1.3110 - val_f1_score: 0.6833
Epoch 327/500
28/28 [=====] - 2s 86ms/step - loss: 0.8089 - f1_score:
0.7685 - val_loss: 1.3519 - val_f1_score: 0.6456
Epoch 328/500
28/28 [=====] - 2s 88ms/step - loss: 0.8157 - f1_score:
0.7699 - val_loss: 1.3323 - val_f1_score: 0.6437
Epoch 329/500
28/28 [=====] - 2s 86ms/step - loss: 0.8414 - f1_score:
0.7569 - val_loss: 1.3659 - val_f1_score: 0.6602
Epoch 330/500
28/28 [=====] - 2s 89ms/step - loss: 0.7927 - f1_score:
0.7831 - val_loss: 1.3611 - val_f1_score: 0.6692
Epoch 331/500
28/28 [=====] - 2s 86ms/step - loss: 0.8189 - f1_score:
```

```
0.7655 - val_loss: 1.3203 - val_f1_score: 0.6598
Epoch 332/500
28/28 [=====] - 2s 89ms/step - loss: 0.8132 - f1_score:
0.7616 - val_loss: 1.3101 - val_f1_score: 0.6598
Epoch 333/500
28/28 [=====] - 2s 86ms/step - loss: 0.8084 - f1_score:
0.7642 - val_loss: 1.3334 - val_f1_score: 0.6636
Epoch 334/500
28/28 [=====] - 2s 87ms/step - loss: 0.8114 - f1_score:
0.7693 - val_loss: 1.3309 - val_f1_score: 0.6691
Epoch 335/500
28/28 [=====] - 3s 91ms/step - loss: 0.7923 - f1_score:
0.7718 - val_loss: 1.3105 - val_f1_score: 0.6784
Epoch 336/500
28/28 [=====] - 2s 89ms/step - loss: 0.8075 - f1_score:
0.7650 - val_loss: 1.3434 - val_f1_score: 0.6592
Epoch 337/500
28/28 [=====] - 2s 88ms/step - loss: 0.8080 - f1_score:
0.7757 - val_loss: 1.3216 - val_f1_score: 0.6798
Epoch 338/500
28/28 [=====] - 2s 88ms/step - loss: 0.7773 - f1_score:
0.7706 - val_loss: 1.3337 - val_f1_score: 0.6758
Epoch 339/500
28/28 [=====] - 2s 88ms/step - loss: 0.7780 - f1_score:
0.7797 - val_loss: 1.3223 - val_f1_score: 0.6864
Epoch 340/500
28/28 [=====] - 2s 88ms/step - loss: 0.7874 - f1_score:
0.7722 - val_loss: 1.3050 - val_f1_score: 0.6808
Epoch 341/500
28/28 [=====] - 2s 86ms/step - loss: 0.7924 - f1_score:
0.7748 - val_loss: 1.3177 - val_f1_score: 0.6799
Epoch 342/500
28/28 [=====] - 2s 89ms/step - loss: 0.7558 - f1_score:
0.7812 - val_loss: 1.3208 - val_f1_score: 0.6811
Epoch 343/500
28/28 [=====] - 2s 86ms/step - loss: 0.7913 - f1_score:
0.7681 - val_loss: 1.3051 - val_f1_score: 0.6712
Epoch 344/500
28/28 [=====] - 2s 88ms/step - loss: 0.7898 - f1_score:
0.7768 - val_loss: 1.3398 - val_f1_score: 0.6573
Epoch 345/500
28/28 [=====] - 2s 86ms/step - loss: 0.7740 - f1_score:
0.7740 - val_loss: 1.3002 - val_f1_score: 0.6839
Epoch 346/500
28/28 [=====] - 3s 90ms/step - loss: 0.7877 - f1_score:
0.7769 - val_loss: 1.2935 - val_f1_score: 0.6766
Epoch 347/500
28/28 [=====] - 2s 86ms/step - loss: 0.7642 - f1_score:
```

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0.7902 - val_loss: 1.3198 - val_f1_score: 0.6572
Epoch 348/500
28/28 [=====] - 2s 88ms/step - loss: 0.7648 - f1_score: 0.7864 - val_loss: 1.3105 - val_f1_score: 0.6707
Epoch 349/500
28/28 [=====] - 2s 87ms/step - loss: 0.7640 - f1_score: 0.7914 - val_loss: 1.2483 - val_f1_score: 0.6743
Epoch 350/500
28/28 [=====] - 2s 89ms/step - loss: 0.7543 - f1_score: 0.7813 - val_loss: 1.2802 - val_f1_score: 0.6930
Epoch 351/500
28/28 [=====] - 2s 86ms/step - loss: 0.7426 - f1_score: 0.7878 - val_loss: 1.3259 - val_f1_score: 0.6864
Epoch 352/500
28/28 [=====] - ETA: 0s - loss: 0.7636 - f1_score: 0.7828

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_2_layer_call_fn, lstm_cell_2_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 463ms/step - loss: 0.7636 - f1_score: 0.7828 - val_loss: 1.2866 - val_f1_score: 0.7006
Epoch 353/500
28/28 [=====] - 2s 83ms/step - loss: 0.7588 - f1_score: 0.7717 - val_loss: 1.3445 - val_f1_score: 0.6599
Epoch 354/500
28/28 [=====] - 2s 88ms/step - loss: 0.7406 - f1_score: 0.7923 - val_loss: 1.3391 - val_f1_score: 0.6839
Epoch 355/500
28/28 [=====] - 2s 84ms/step - loss: 0.7447 - f1_score: 0.7800 - val_loss: 1.3296 - val_f1_score: 0.6670
Epoch 356/500
28/28 [=====] - 2s 87ms/step - loss: 0.7257 - f1_score: 0.7920 - val_loss: 1.3993 - val_f1_score: 0.6650
Epoch 357/500
28/28 [=====] - 2s 85ms/step - loss: 0.7646 - f1_score: 0.7785 - val_loss: 1.3337 - val_f1_score: 0.6670
Epoch 358/500
28/28 [=====] - 2s 85ms/step - loss: 0.7592 - f1_score: 0.7862 - val_loss: 1.3081 - val_f1_score: 0.6917
Epoch 359/500
28/28 [=====] - 2s 88ms/step - loss: 0.7425 - f1_score: 0.7901 - val_loss: 1.4459 - val_f1_score: 0.6522
Epoch 360/500
```

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28/28 [=====] - 2s 85ms/step - loss: 0.7502 - f1_score: 0.7925 - val_loss: 1.3138 - val_f1_score: 0.6688
Epoch 361/500
28/28 [=====] - 2s 87ms/step - loss: 0.7219 - f1_score: 0.7994 - val_loss: 1.2753 - val_f1_score: 0.6885
Epoch 362/500
28/28 [=====] - 2s 86ms/step - loss: 0.7439 - f1_score: 0.7857 - val_loss: 1.2991 - val_f1_score: 0.6666
Epoch 363/500
28/28 [=====] - 3s 91ms/step - loss: 0.7541 - f1_score: 0.7832 - val_loss: 1.3024 - val_f1_score: 0.6618
Epoch 364/500
28/28 [=====] - 2s 86ms/step - loss: 0.7558 - f1_score: 0.7876 - val_loss: 1.3143 - val_f1_score: 0.6645
Epoch 365/500
28/28 [=====] - 2s 88ms/step - loss: 0.6895 - f1_score: 0.8071 - val_loss: 1.3066 - val_f1_score: 0.6667
Epoch 366/500
28/28 [=====] - 2s 86ms/step - loss: 0.7225 - f1_score: 0.7963 - val_loss: 1.2693 - val_f1_score: 0.6787
Epoch 367/500
28/28 [=====] - 2s 89ms/step - loss: 0.7361 - f1_score: 0.7880 - val_loss: 1.2900 - val_f1_score: 0.6649
Epoch 368/500
28/28 [=====] - 3s 90ms/step - loss: 0.7032 - f1_score: 0.7986 - val_loss: 1.2780 - val_f1_score: 0.6815
Epoch 369/500
28/28 [=====] - 2s 88ms/step - loss: 0.7000 - f1_score: 0.7993 - val_loss: 1.2899 - val_f1_score: 0.6857
Epoch 370/500
28/28 [=====] - 2s 86ms/step - loss: 0.7084 - f1_score: 0.7965 - val_loss: 1.2884 - val_f1_score: 0.6792
Epoch 371/500
28/28 [=====] - 3s 91ms/step - loss: 0.7249 - f1_score: 0.7932 - val_loss: 1.2881 - val_f1_score: 0.6702
Epoch 372/500
28/28 [=====] - 2s 86ms/step - loss: 0.7107 - f1_score: 0.8055 - val_loss: 1.3105 - val_f1_score: 0.6721
Epoch 373/500
28/28 [=====] - 2s 88ms/step - loss: 0.6983 - f1_score: 0.8019 - val_loss: 1.3246 - val_f1_score: 0.6744
Epoch 374/500
28/28 [=====] - 2s 86ms/step - loss: 0.6920 - f1_score: 0.8018 - val_loss: 1.3094 - val_f1_score: 0.6813
Epoch 375/500
28/28 [=====] - 2s 89ms/step - loss: 0.7179 - f1_score: 0.7874 - val_loss: 1.2779 - val_f1_score: 0.6903
Epoch 376/500
```

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28/28 [=====] - 2s 88ms/step - loss: 0.6738 - f1_score: 0.8117 - val_loss: 1.3615 - val_f1_score: 0.6588
Epoch 377/500
28/28 [=====] - ETA: 0s - loss: 0.6820 - f1_score: 0.8082

WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op,
lstm_cell_2_layer_call_fn, lstm_cell_2_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 455ms/step - loss: 0.6820 - f1_score: 0.8082 - val_loss: 1.2712 - val_f1_score: 0.7115
Epoch 378/500
28/28 [=====] - 2s 84ms/step - loss: 0.6966 - f1_score: 0.8023 - val_loss: 1.2612 - val_f1_score: 0.6901
Epoch 379/500
28/28 [=====] - 2s 84ms/step - loss: 0.7164 - f1_score: 0.7946 - val_loss: 1.2773 - val_f1_score: 0.6789
Epoch 380/500
28/28 [=====] - 2s 85ms/step - loss: 0.6783 - f1_score: 0.8108 - val_loss: 1.3269 - val_f1_score: 0.6718
Epoch 381/500
28/28 [=====] - 2s 86ms/step - loss: 0.7105 - f1_score: 0.7973 - val_loss: 1.2831 - val_f1_score: 0.6672
Epoch 382/500
28/28 [=====] - 2s 85ms/step - loss: 0.6983 - f1_score: 0.8045 - val_loss: 1.2948 - val_f1_score: 0.7023
Epoch 383/500
28/28 [=====] - 2s 87ms/step - loss: 0.6866 - f1_score: 0.7981 - val_loss: 1.3218 - val_f1_score: 0.6554
Epoch 384/500
28/28 [=====] - 2s 85ms/step - loss: 0.6890 - f1_score: 0.8065 - val_loss: 1.2658 - val_f1_score: 0.6990
Epoch 385/500
28/28 [=====] - 2s 87ms/step - loss: 0.7183 - f1_score: 0.7967 - val_loss: 1.3535 - val_f1_score: 0.6920
Epoch 386/500
28/28 [=====] - 2s 87ms/step - loss: 0.7096 - f1_score: 0.7938 - val_loss: 1.2799 - val_f1_score: 0.6811
Epoch 387/500
28/28 [=====] - 2s 88ms/step - loss: 0.6980 - f1_score: 0.8066 - val_loss: 1.2698 - val_f1_score: 0.6912
Epoch 388/500
28/28 [=====] - 2s 87ms/step - loss: 0.6549 - f1_score: 0.8159 - val_loss: 1.3083 - val_f1_score: 0.6774
```

Epoch 389/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6842 - f1\_score: 0.8090 - val\_loss: 1.3470 - val\_f1\_score: 0.6444  
Epoch 390/500  
28/28 [=====] - 2s 86ms/step - loss: 0.7017 - f1\_score: 0.8009 - val\_loss: 1.3502 - val\_f1\_score: 0.6541  
Epoch 391/500  
28/28 [=====] - 3s 91ms/step - loss: 0.6699 - f1\_score: 0.8179 - val\_loss: 1.3198 - val\_f1\_score: 0.6729  
Epoch 392/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6414 - f1\_score: 0.8295 - val\_loss: 1.2842 - val\_f1\_score: 0.6769  
Epoch 393/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6780 - f1\_score: 0.8114 - val\_loss: 1.2411 - val\_f1\_score: 0.6934  
Epoch 394/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6934 - f1\_score: 0.8023 - val\_loss: 1.3130 - val\_f1\_score: 0.6727  
Epoch 395/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6877 - f1\_score: 0.7945 - val\_loss: 1.3284 - val\_f1\_score: 0.6694  
Epoch 396/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6595 - f1\_score: 0.8133 - val\_loss: 1.3037 - val\_f1\_score: 0.6848  
Epoch 397/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6605 - f1\_score: 0.8126 - val\_loss: 1.3681 - val\_f1\_score: 0.6632  
Epoch 398/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6795 - f1\_score: 0.8132 - val\_loss: 1.3108 - val\_f1\_score: 0.6729  
Epoch 399/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6965 - f1\_score: 0.7953 - val\_loss: 1.2454 - val\_f1\_score: 0.6910  
Epoch 400/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6553 - f1\_score: 0.8182 - val\_loss: 1.3494 - val\_f1\_score: 0.6766  
Epoch 401/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6492 - f1\_score: 0.8161 - val\_loss: 1.3179 - val\_f1\_score: 0.6762  
Epoch 402/500  
28/28 [=====] - 3s 91ms/step - loss: 0.6537 - f1\_score: 0.8169 - val\_loss: 1.3261 - val\_f1\_score: 0.6819  
Epoch 403/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6610 - f1\_score: 0.8060 - val\_loss: 1.2687 - val\_f1\_score: 0.6871  
Epoch 404/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6700 - f1\_score: 0.8118 - val\_loss: 1.3121 - val\_f1\_score: 0.6801

Epoch 405/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6290 - f1\_score: 0.8240 - val\_loss: 1.3419 - val\_f1\_score: 0.6537  
Epoch 406/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6684 - f1\_score: 0.8126 - val\_loss: 1.2680 - val\_f1\_score: 0.6913  
Epoch 407/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6489 - f1\_score: 0.8156 - val\_loss: 1.3605 - val\_f1\_score: 0.6610  
Epoch 408/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6566 - f1\_score: 0.8159 - val\_loss: 1.2912 - val\_f1\_score: 0.6802  
Epoch 409/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6544 - f1\_score: 0.8098 - val\_loss: 1.3514 - val\_f1\_score: 0.6631  
Epoch 410/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6295 - f1\_score: 0.8270 - val\_loss: 1.3842 - val\_f1\_score: 0.6646  
Epoch 411/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6666 - f1\_score: 0.8047 - val\_loss: 1.2711 - val\_f1\_score: 0.6920  
Epoch 412/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6556 - f1\_score: 0.8150 - val\_loss: 1.2351 - val\_f1\_score: 0.6968  
Epoch 413/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6580 - f1\_score: 0.8146 - val\_loss: 1.2615 - val\_f1\_score: 0.6850  
Epoch 414/500  
28/28 [=====] - 3s 94ms/step - loss: 0.6329 - f1\_score: 0.8212 - val\_loss: 1.2952 - val\_f1\_score: 0.6740  
Epoch 415/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6041 - f1\_score: 0.8396 - val\_loss: 1.3012 - val\_f1\_score: 0.6589  
Epoch 416/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6319 - f1\_score: 0.8200 - val\_loss: 1.3333 - val\_f1\_score: 0.6685  
Epoch 417/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6450 - f1\_score: 0.8151 - val\_loss: 1.3617 - val\_f1\_score: 0.6653  
Epoch 418/500  
28/28 [=====] - 3s 90ms/step - loss: 0.6333 - f1\_score: 0.8148 - val\_loss: 1.3423 - val\_f1\_score: 0.6800  
Epoch 419/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6477 - f1\_score: 0.8190 - val\_loss: 1.3283 - val\_f1\_score: 0.6768  
Epoch 420/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6107 - f1\_score: 0.8252 - val\_loss: 1.3522 - val\_f1\_score: 0.6731

Epoch 421/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6246 - f1\_score: 0.8271 - val\_loss: 1.3206 - val\_f1\_score: 0.6862  
Epoch 422/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6168 - f1\_score: 0.8275 - val\_loss: 1.3041 - val\_f1\_score: 0.6650  
Epoch 423/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6091 - f1\_score: 0.8273 - val\_loss: 1.3918 - val\_f1\_score: 0.6698  
Epoch 424/500  
28/28 [=====] - 3s 92ms/step - loss: 0.6135 - f1\_score: 0.8269 - val\_loss: 1.3033 - val\_f1\_score: 0.6804  
Epoch 425/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6281 - f1\_score: 0.8314 - val\_loss: 1.2835 - val\_f1\_score: 0.6828  
Epoch 426/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6075 - f1\_score: 0.8270 - val\_loss: 1.3283 - val\_f1\_score: 0.6936  
Epoch 427/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6083 - f1\_score: 0.8259 - val\_loss: 1.2661 - val\_f1\_score: 0.6872  
Epoch 428/500  
28/28 [=====] - 3s 93ms/step - loss: 0.6110 - f1\_score: 0.8266 - val\_loss: 1.3631 - val\_f1\_score: 0.6639  
Epoch 429/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6242 - f1\_score: 0.8213 - val\_loss: 1.3226 - val\_f1\_score: 0.6731  
Epoch 430/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6179 - f1\_score: 0.8279 - val\_loss: 1.3506 - val\_f1\_score: 0.6800  
Epoch 431/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6086 - f1\_score: 0.8288 - val\_loss: 1.2842 - val\_f1\_score: 0.6770  
Epoch 432/500  
28/28 [=====] - 2s 89ms/step - loss: 0.5940 - f1\_score: 0.8329 - val\_loss: 1.2825 - val\_f1\_score: 0.6697  
Epoch 433/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6333 - f1\_score: 0.8182 - val\_loss: 1.2559 - val\_f1\_score: 0.6876  
Epoch 434/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6101 - f1\_score: 0.8288 - val\_loss: 1.3585 - val\_f1\_score: 0.6594  
Epoch 435/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5994 - f1\_score: 0.8242 - val\_loss: 1.3180 - val\_f1\_score: 0.6906  
Epoch 436/500  
28/28 [=====] - 2s 88ms/step - loss: 0.6171 - f1\_score: 0.8337 - val\_loss: 1.2721 - val\_f1\_score: 0.6772

Epoch 437/500  
28/28 [=====] - 2s 86ms/step - loss: 0.6110 - f1\_score: 0.8244 - val\_loss: 1.2700 - val\_f1\_score: 0.6864  
Epoch 438/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5842 - f1\_score: 0.8291 - val\_loss: 1.2658 - val\_f1\_score: 0.6967  
Epoch 439/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5965 - f1\_score: 0.8266 - val\_loss: 1.3007 - val\_f1\_score: 0.6761  
Epoch 440/500  
28/28 [=====] - 2s 87ms/step - loss: 0.6048 - f1\_score: 0.8314 - val\_loss: 1.2901 - val\_f1\_score: 0.6871  
Epoch 441/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5973 - f1\_score: 0.8141 - val\_loss: 1.2691 - val\_f1\_score: 0.6997  
Epoch 442/500  
28/28 [=====] - 3s 89ms/step - loss: 0.5899 - f1\_score: 0.8344 - val\_loss: 1.2703 - val\_f1\_score: 0.7059  
Epoch 443/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5914 - f1\_score: 0.8392 - val\_loss: 1.3228 - val\_f1\_score: 0.6749  
Epoch 444/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6058 - f1\_score: 0.8353 - val\_loss: 1.2225 - val\_f1\_score: 0.6985  
Epoch 445/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5664 - f1\_score: 0.8414 - val\_loss: 1.2509 - val\_f1\_score: 0.6952  
Epoch 446/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5867 - f1\_score: 0.8346 - val\_loss: 1.3317 - val\_f1\_score: 0.6790  
Epoch 447/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5811 - f1\_score: 0.8398 - val\_loss: 1.3032 - val\_f1\_score: 0.6979  
Epoch 448/500  
28/28 [=====] - 2s 89ms/step - loss: 0.6022 - f1\_score: 0.8321 - val\_loss: 1.2806 - val\_f1\_score: 0.6739  
Epoch 449/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5714 - f1\_score: 0.8437 - val\_loss: 1.2924 - val\_f1\_score: 0.7021  
Epoch 450/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5693 - f1\_score: 0.8428 - val\_loss: 1.3266 - val\_f1\_score: 0.6833  
Epoch 451/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5653 - f1\_score: 0.8444 - val\_loss: 1.2870 - val\_f1\_score: 0.6844  
Epoch 452/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5520 - f1\_score: 0.8524 - val\_loss: 1.2964 - val\_f1\_score: 0.6773

Epoch 453/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5746 - f1\_score: 0.8348 - val\_loss: 1.3191 - val\_f1\_score: 0.6826  
Epoch 454/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5743 - f1\_score: 0.8376 - val\_loss: 1.3209 - val\_f1\_score: 0.6723  
Epoch 455/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5789 - f1\_score: 0.8426 - val\_loss: 1.2875 - val\_f1\_score: 0.6973  
Epoch 456/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5644 - f1\_score: 0.8455 - val\_loss: 1.2843 - val\_f1\_score: 0.6819  
Epoch 457/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5663 - f1\_score: 0.8427 - val\_loss: 1.2666 - val\_f1\_score: 0.7030  
Epoch 458/500  
28/28 [=====] - 3s 93ms/step - loss: 0.5676 - f1\_score: 0.8363 - val\_loss: 1.3463 - val\_f1\_score: 0.6774  
Epoch 459/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5868 - f1\_score: 0.8355 - val\_loss: 1.3369 - val\_f1\_score: 0.6936  
Epoch 460/500  
28/28 [=====] - 3s 91ms/step - loss: 0.5622 - f1\_score: 0.8402 - val\_loss: 1.2998 - val\_f1\_score: 0.6894  
Epoch 461/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5948 - f1\_score: 0.8366 - val\_loss: 1.2534 - val\_f1\_score: 0.6922  
Epoch 462/500  
28/28 [=====] - 2s 90ms/step - loss: 0.5575 - f1\_score: 0.8548 - val\_loss: 1.3047 - val\_f1\_score: 0.6935  
Epoch 463/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5478 - f1\_score: 0.8477 - val\_loss: 1.2963 - val\_f1\_score: 0.6914  
Epoch 464/500  
28/28 [=====] - 2s 88ms/step - loss: 0.5588 - f1\_score: 0.8410 - val\_loss: 1.3707 - val\_f1\_score: 0.6694  
Epoch 465/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5424 - f1\_score: 0.8544 - val\_loss: 1.3039 - val\_f1\_score: 0.6823  
Epoch 466/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5447 - f1\_score: 0.8468 - val\_loss: 1.3364 - val\_f1\_score: 0.6962  
Epoch 467/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5712 - f1\_score: 0.8324 - val\_loss: 1.3091 - val\_f1\_score: 0.6896  
Epoch 468/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5870 - f1\_score: 0.8388 - val\_loss: 1.2947 - val\_f1\_score: 0.7032

Epoch 469/500  
28/28 [=====] - 3s 88ms/step - loss: 0.5324 - f1\_score: 0.8519 - val\_loss: 1.3506 - val\_f1\_score: 0.6639  
Epoch 470/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5403 - f1\_score: 0.8429 - val\_loss: 1.3341 - val\_f1\_score: 0.6773  
Epoch 471/500  
28/28 [=====] - 2s 89ms/step - loss: 0.5324 - f1\_score: 0.8541 - val\_loss: 1.3497 - val\_f1\_score: 0.6969  
Epoch 472/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5564 - f1\_score: 0.8442 - val\_loss: 1.2609 - val\_f1\_score: 0.6938  
Epoch 473/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5533 - f1\_score: 0.8467 - val\_loss: 1.2769 - val\_f1\_score: 0.7021  
Epoch 474/500  
28/28 [=====] - 2s 86ms/step - loss: 0.5305 - f1\_score: 0.8591 - val\_loss: 1.3150 - val\_f1\_score: 0.6811  
Epoch 475/500  
28/28 [=====] - 2s 89ms/step - loss: 0.5190 - f1\_score: 0.8618 - val\_loss: 1.2696 - val\_f1\_score: 0.7056  
Epoch 476/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5348 - f1\_score: 0.8576 - val\_loss: 1.3200 - val\_f1\_score: 0.6911  
Epoch 477/500  
28/28 [=====] - 3s 92ms/step - loss: 0.5635 - f1\_score: 0.8364 - val\_loss: 1.2935 - val\_f1\_score: 0.6915  
Epoch 478/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5381 - f1\_score: 0.8562 - val\_loss: 1.2797 - val\_f1\_score: 0.6794  
Epoch 479/500  
28/28 [=====] - 2s 89ms/step - loss: 0.5197 - f1\_score: 0.8586 - val\_loss: 1.2634 - val\_f1\_score: 0.6834  
Epoch 480/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5260 - f1\_score: 0.8562 - val\_loss: 1.3648 - val\_f1\_score: 0.6733  
Epoch 481/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5330 - f1\_score: 0.8461 - val\_loss: 1.3613 - val\_f1\_score: 0.6820  
Epoch 482/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5411 - f1\_score: 0.8504 - val\_loss: 1.2965 - val\_f1\_score: 0.7048  
Epoch 483/500  
28/28 [=====] - 3s 90ms/step - loss: 0.5083 - f1\_score: 0.8687 - val\_loss: 1.3173 - val\_f1\_score: 0.6760  
Epoch 484/500  
28/28 [=====] - 2s 87ms/step - loss: 0.5220 - f1\_score: 0.8424 - val\_loss: 1.3123 - val\_f1\_score: 0.6931

```
Epoch 485/500
28/28 [=====] - 2s 88ms/step - loss: 0.5199 - f1_score: 0.8572 - val_loss: 1.3056 - val_f1_score: 0.7031
Epoch 486/500
28/28 [=====] - 2s 87ms/step - loss: 0.5104 - f1_score: 0.8597 - val_loss: 1.2975 - val_f1_score: 0.6850
Epoch 487/500
28/28 [=====] - 2s 89ms/step - loss: 0.4891 - f1_score: 0.8633 - val_loss: 1.3477 - val_f1_score: 0.7009
Epoch 488/500
28/28 [=====] - 2s 87ms/step - loss: 0.5240 - f1_score: 0.8542 - val_loss: 1.3008 - val_f1_score: 0.6748
Epoch 489/500
28/28 [=====] - 2s 89ms/step - loss: 0.5263 - f1_score: 0.8593 - val_loss: 1.3622 - val_f1_score: 0.6759
Epoch 490/500
28/28 [=====] - 2s 87ms/step - loss: 0.5237 - f1_score: 0.8588 - val_loss: 1.3086 - val_f1_score: 0.6857
Epoch 491/500
28/28 [=====] - 2s 89ms/step - loss: 0.5176 - f1_score: 0.8555 - val_loss: 1.3295 - val_f1_score: 0.6945
Epoch 492/500
28/28 [=====] - 2s 86ms/step - loss: 0.5239 - f1_score: 0.8536 - val_loss: 1.3537 - val_f1_score: 0.6642
Epoch 493/500
28/28 [=====] - 2s 89ms/step - loss: 0.5186 - f1_score: 0.8505 - val_loss: 1.3682 - val_f1_score: 0.6644
Epoch 494/500
28/28 [=====] - 2s 86ms/step - loss: 0.5145 - f1_score: 0.8633 - val_loss: 1.3180 - val_f1_score: 0.7008
Epoch 495/500
28/28 [=====] - ETA: 0s - loss: 0.5023 - f1_score: 0.8624
WARNING:absl:Found untraced functions such as _jit_compiled_convolution_op, lstm_cell_2_layer_call_fn, lstm_cell_2_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 458ms/step - loss: 0.5023 - f1_score: 0.8624 - val_loss: 1.3088 - val_f1_score: 0.7160
Epoch 496/500
28/28 [=====] - 2s 83ms/step - loss: 0.5329 - f1_score: 0.8574 - val_loss: 1.2885 - val_f1_score: 0.7037
Epoch 497/500
28/28 [=====] - 2s 85ms/step - loss: 0.5134 - f1_score:
```

```
0.8633 - val_loss: 1.3344 - val_f1_score: 0.6937
Epoch 498/500
28/28 [=====] - 2s 84ms/step - loss: 0.4917 - f1_score:
0.8663 - val_loss: 1.3113 - val_f1_score: 0.6939
Epoch 499/500
28/28 [=====] - 2s 86ms/step - loss: 0.4993 - f1_score:
0.8677 - val_loss: 1.3438 - val_f1_score: 0.6734
Epoch 500/500
28/28 [=====] - 2s 85ms/step - loss: 0.4917 - f1_score:
0.8689 - val_loss: 1.5052 - val_f1_score: 0.6657
```

```
[139]: # convert the history.history dict to a pandas DataFrame:
hist_df = pd.DataFrame(History.history)

hist_csv_file = '1 1DCNN + 1 LSTM/history.csv'
with open(hist_csv_file, mode='w') as f:
    hist_df.to_csv(f)
```

```
[140]: hist_df = pd.read_csv('1 1DCNN + 1 LSTM/history.csv', index_col=0)
hist_df.tail()
```

```
[140]:      loss  f1_score  val_loss  val_f1_score
495  0.532888  0.857369  1.288532      0.703691
496  0.513433  0.863328  1.334399      0.693652
497  0.491707  0.866338  1.311290      0.693930
498  0.499303  0.867664  1.343791      0.673372
499  0.491679  0.868873  1.505212      0.665673
```

```
[141]: # 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]

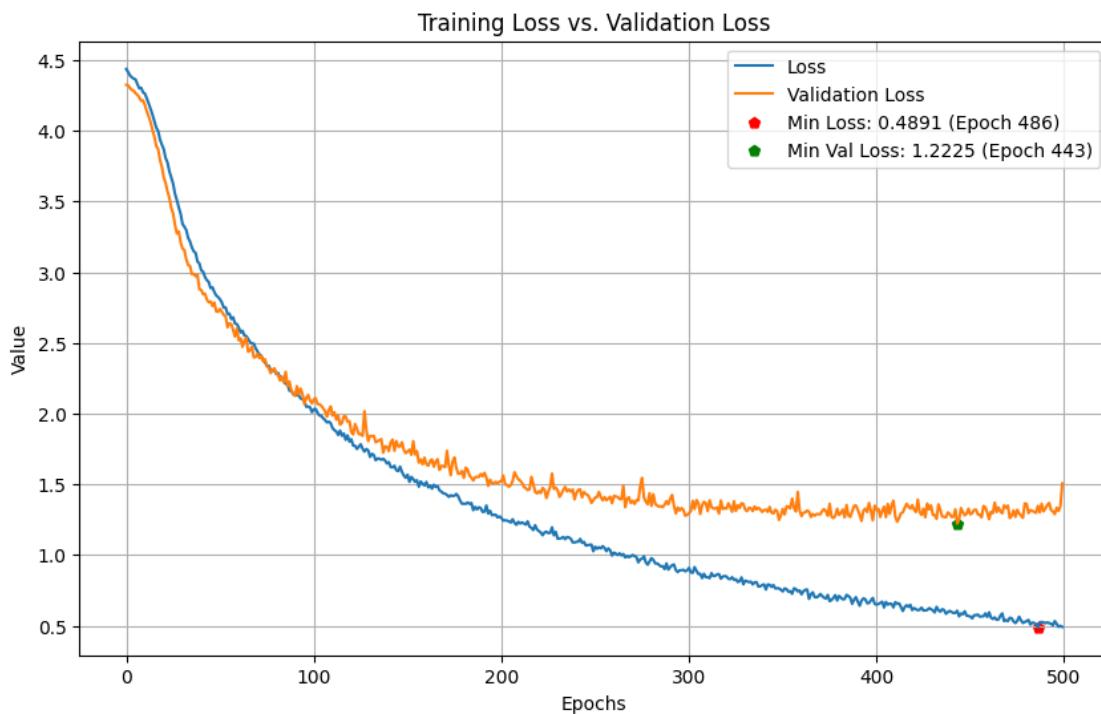
# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (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()

```



```

[142]: # 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')

```

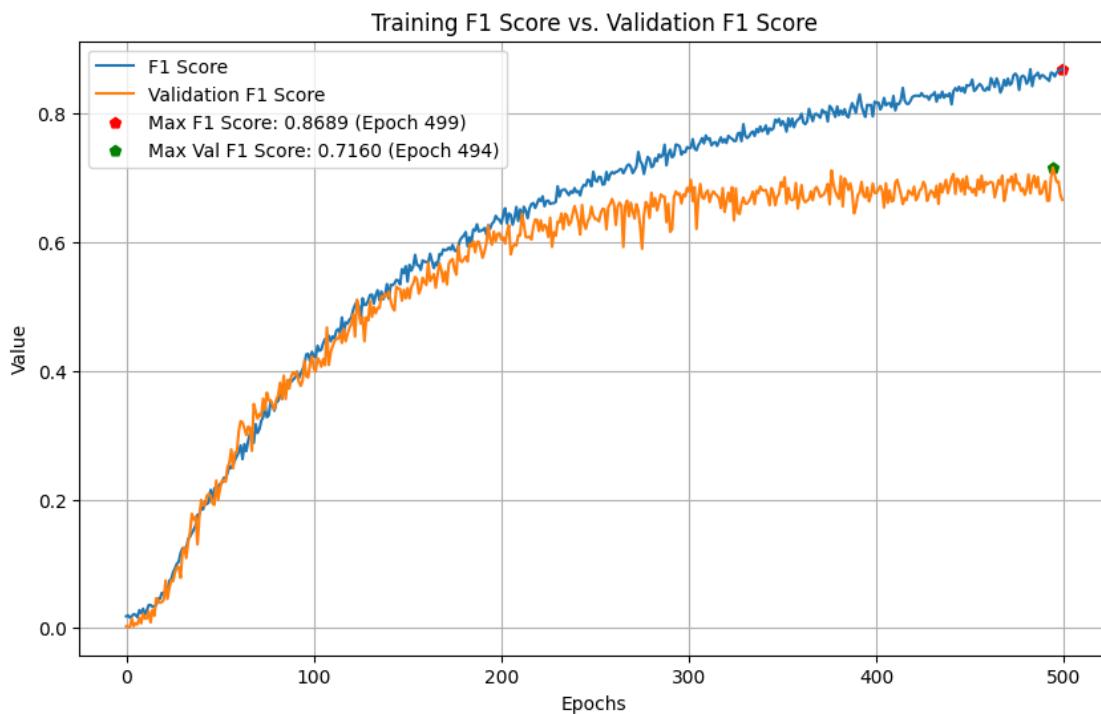
```

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]: 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	0.750	0.857	8
BACKPACK	0.600	1.000	0.750	6
BASKETBALL	0.833	1.000	0.909	10
BEE	0.000	0.000	0.000	10
BELT	1.000	1.000	1.000	4
BITE	1.000	0.875	0.933	8
BREAKFAST	0.400	0.667	0.500	6
CANCER	1.000	0.750	0.857	8
CHRISTMAS	0.857	1.000	0.923	6
CONFUSED	0.333	0.667	0.444	6
DARK	0.667	1.000	0.800	4
DEAF	0.429	0.500	0.462	6
DECIDE	0.600	0.500	0.545	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	0.667	0.667	0.667	6
DINNER	0.833	0.625	0.714	8
DOG	0.750	0.500	0.600	6
DOWNSIZE	1.000	0.750	0.857	8
DRAG	0.000	0.000	0.000	4
EAT	1.000	0.667	0.800	6
EDIT	0.750	1.000	0.857	6
ELEVATOR	0.455	0.625	0.526	8
FINE	1.000	0.500	0.667	4
FLOAT	0.333	0.500	0.400	4
FOREIGNER	1.000	0.667	0.800	6
GUESS	1.000	0.750	0.857	8
HALLOWEEN	1.000	1.000	1.000	8
HOSPITAL	0.833	0.833	0.833	6
HURDLE/TRIP	0.500	0.500	0.500	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.375	0.375	0.375	8
LUNCH	0.625	0.625	0.625	8
MAPLE	0.500	0.750	0.600	4
MEAT	0.333	1.000	0.500	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.125	0.222	8
MOVIE	0.750	0.750	0.750	8
NOON	1.000	0.875	0.933	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.429	0.500	0.462	6
RAZOR	1.000	0.500	0.667	4
RIVER	0.667	1.000	0.800	6

ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.750	0.900	0.818	10
SINK	0.667	0.667	0.667	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.800	1.000	0.889	4
TWINS	0.545	0.750	0.632	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.682	324
macro avg	0.712	0.678	0.666	324
weighted avg	0.727	0.682	0.675	324

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

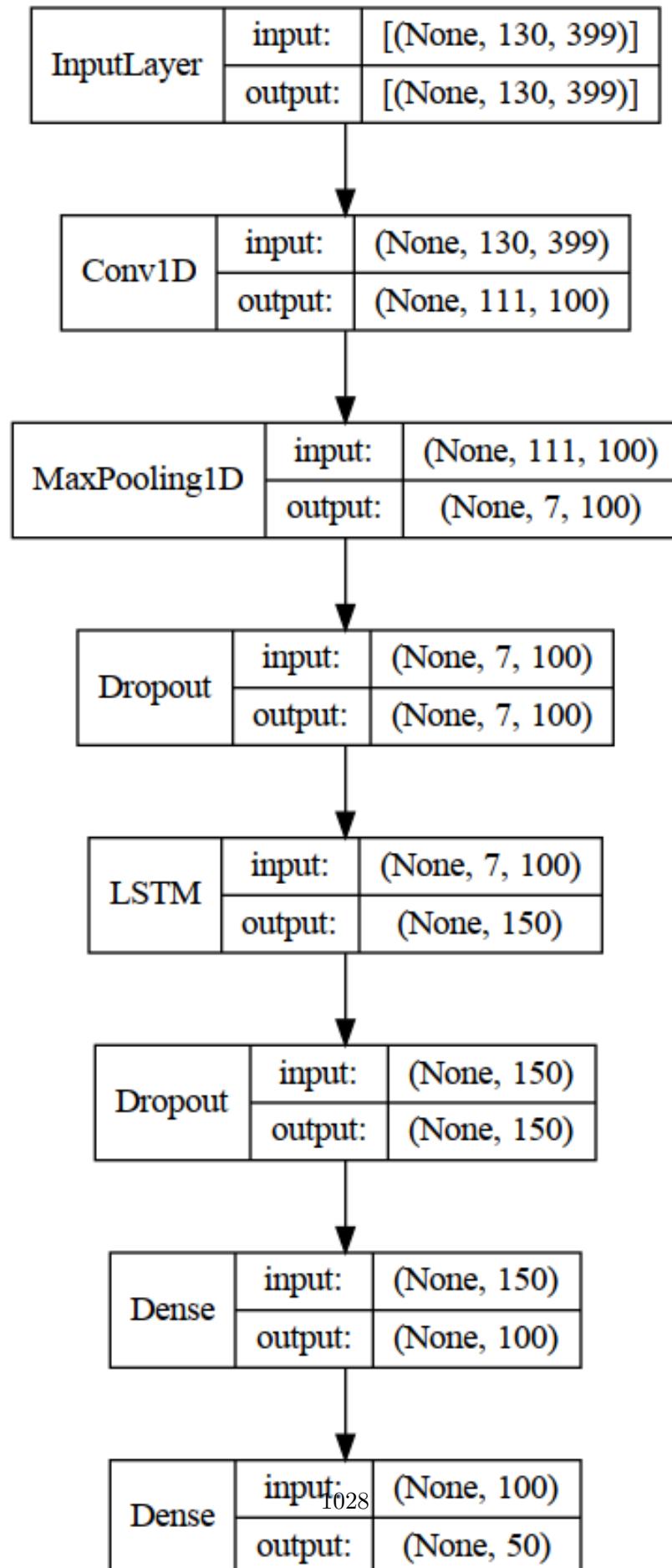
[132]: `reconstructed_model.summary()`

Model: "sequential\_2"

Layer (type)	Output Shape	Param #
<hr/>		
conv1d_2 (Conv1D)	(None, 111, 100)	798100
max_pooling1d_2 (MaxPooling 1D)	(None, 7, 100)	0
dropout_4 (Dropout)	(None, 7, 100)	0
lstm_2 (LSTM)	(None, 150)	150600
dropout_5 (Dropout)	(None, 150)	0
dense_4 (Dense)	(None, 100)	15100
dense_5 (Dense)	(None, 50)	5050
<hr/>		
Total params: 968,850		
Trainable params: 968,850		
Non-trainable params: 0		

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

[133]:



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

11/11 [=====] - 1s 15ms/step - loss: 1.3088 - f1_score: 0.7160

[134]: [1.3088107109069824, 0.7160443067550659]

[135]: reconstructed_model.evaluate(Xtrain, Ytrain)

2023-09-23 17:44:11.761292: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.
2023-09-23 17:44:12.232962: W
tensorflow/core/framework/cpu_allocator_impl.cc:82] Allocation of 555216480
exceeds 10% of free system memory.

84/84 [=====] - 1s 14ms/step - loss: 0.1758 - f1_score: 0.9853

[135]: [0.17579667270183563, 0.9852896332740784]

[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 [=====] - 0s 11ms/step
      precision    recall  f1-score   support
      AXE       0.889   1.000   0.941       8
      BACKPACK   0.600   1.000   0.750       6
      BASKETBALL  0.833   1.000   0.909      10
      BEE        1.000   0.100   0.182      10
      BELT       1.000   1.000   1.000       4
      BITE       1.000   0.875   0.933       8
      BREAKFAST   0.500   0.833   0.625       6
      CANCER     0.889   1.000   0.941       8
      CHRISTMAS   1.000   1.000   1.000       6
      CONFUSED    0.400   0.667   0.500       6
      DARK        0.667   1.000   0.800       4
      DEAF        0.364   0.667   0.471       6
      DECIDE      0.500   0.333   0.400       6
      DEMAND      0.857   0.750   0.800       8
      DEVELOP     0.800   0.667   0.727       6
      DINNER      0.727   1.000   0.842       8
      DOG         0.667   0.667   0.667       6
```

DOWNSIZE	1.000	0.750	0.857	8
DRAG	0.400	0.500	0.444	4
EAT	1.000	0.667	0.800	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.667	0.750	0.706	8
FINE	1.000	0.500	0.667	4
FLOAT	1.000	0.500	0.667	4
FOREIGNER	1.000	0.833	0.909	6
GUESS	1.000	0.625	0.769	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	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.600	0.750	0.667	8
LUNCH	0.750	0.750	0.750	8
MAPLE	0.600	0.750	0.667	4
MEAT	0.462	1.000	0.632	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.500	0.667	8
MOVIE	0.857	0.750	0.800	8
NOON	1.000	0.875	0.933	8
PARTY	0.600	0.750	0.667	8
PATIENT	0.429	0.500	0.462	6
RAZOR	0.667	0.500	0.571	4
RIVER	0.500	0.667	0.571	6
ROCKINGCHAIR	1.000	1.000	1.000	8
SHAVE	0.600	0.900	0.720	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.800	1.000	0.889	4
TWINS	0.615	1.000	0.762	8
WHATFOR	1.000	0.400	0.571	10
accuracy			0.735	324
macro avg	0.785	0.722	0.716	324
weighted avg	0.796	0.735	0.725	324

## 4.10 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_1254069/1222377179.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
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/CSPNext/hyperband/',
    project_name='2_1D_CNN+1_LSTM',
    overwrite=False)
```

```
INFO:tensorflow:Reloading Tuner from
/media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/2_1D_CNN+1_LSTM/tuner0.json
```

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

```
Search space summary
Default search space size: 12
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': 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'}

```

```
[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 04m 43s]
val_f1_score: 0.5450175553560257

Best val_f1_score So Far: 0.7170855700969696
Total elapsed time: 04h 17m 57s
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](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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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
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WARNING:tensorflow:Value in checkpoint could not be found in the restored
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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.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
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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
```

```
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
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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
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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.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)
```

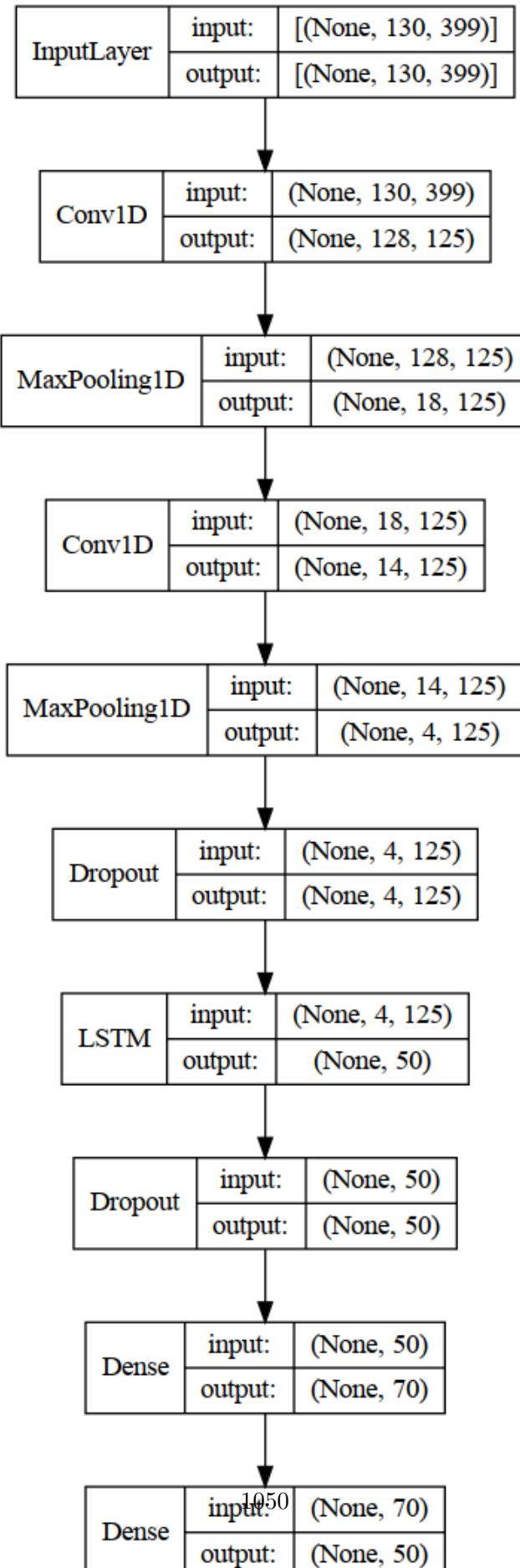
```
[127]: best_model.summary()
```

```
Model: "sequential"
-----
Layer (type)          Output Shape         Param #
=====
conv1d (Conv1D)        (None, 128, 125)     149750
max_pooling1d (MaxPooling1D) (None, 18, 125)   0
)
conv1d_1 (Conv1D)       (None, 14, 125)      78250
max_pooling1d_1 (MaxPooling 1D) (None, 4, 125)   0
dropout (Dropout)       (None, 4, 125)       0
lstm (LSTM)            (None, 50)           35200
dropout_1 (Dropout)     (None, 50)           0
dense (Dense)          (None, 70)           3570
dense_1 (Dense)        (None, 50)           3550
```

```
=====
Total params: 270,320
Trainable params: 270,320
Non-trainable params: 0
```

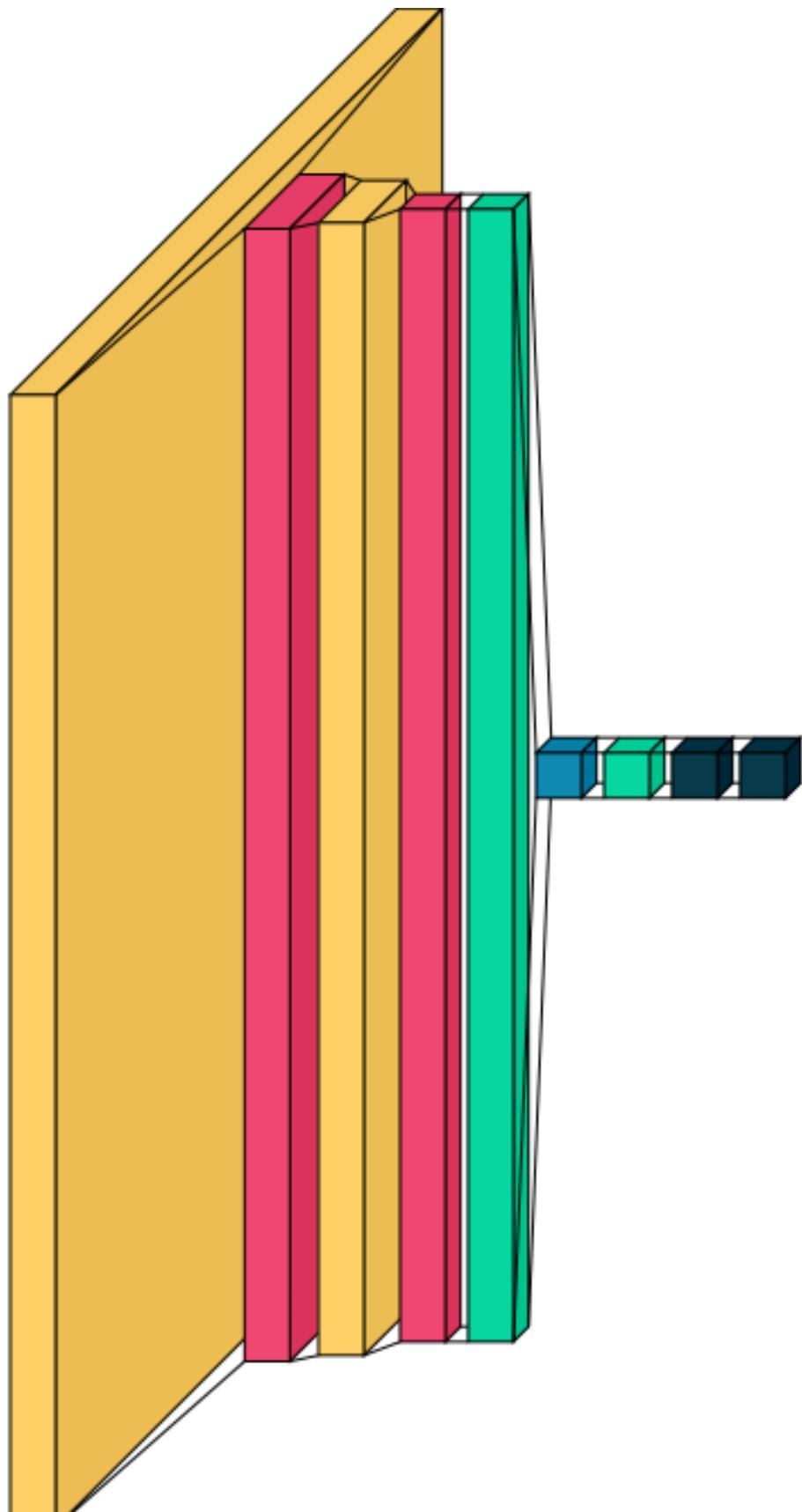
```
[128]: plot_model(best_model, show_shapes=True, show_layer_names=False)
```

```
[128]:
```



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

```
[129]:
```



Yellow Box: Conv1D    Pink Box: MaxPooling1D  
1052    Green Box: Dropout    Blue Box: LSTM  
Dark Blue Box: Dense

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

```
Results summary
Results in /media/kristian/HDD/ASL_Citizen/CSPNext/hyperband/2_1D_CNN+1_LSTM
Showing 10 best trials
Objective(name="val_f1_score", direction="max")

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: 0666
Score: 0.7170855700969696

Trial 0666 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: 0653
Score: 0.7117784321308136
```

```
Trial 0426 summary
Hyperparameters:
dense_activation: gelu
filters_1: 125
kernel_1: 5
pool_1: 8
kernel_2: 4
pool_2: 2
dropout_1: 0.4
units_1: 100
regularizer: 0.0019004375238737127
dropout_2: 0.0
units_2: 90
learning_rate: 0.0003497444477863496
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 5
tuner/round: 5
tuner/trial_id: 0423
Score: 0.6981795430183411
```

```
Trial 0427 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: 0424
Score: 0.6935070157051086
```

```
Trial 0423 summary
Hyperparameters:
```

```
dense_activation: gelu
filters_1: 125
kernel_1: 5
pool_1: 8
kernel_2: 4
pool_2: 2
dropout_1: 0.4
units_1: 100
regularizer: 0.0019004375238737127
dropout_2: 0.0
units_2: 90
learning_rate: 0.0003497444477863496
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0416
Score: 0.6906689405441284
```

```
Trial 0598 summary
Hyperparameters:
dense_activation: mish
filters_1: 100
kernel_1: 4
pool_1: 8
kernel_2: 4
pool_2: 1
dropout_1: 0.35000000000000003
units_1: 175
regularizer: 0.0024425646182466847
dropout_2: 0.55
units_2: 100
learning_rate: 0.0006552199268517461
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 4
tuner/round: 4
tuner/trial_id: 0593
Score: 0.6782307326793671
```

```
Trial 0714 summary
Hyperparameters:
dense_activation: gelu
filters_1: 100
kernel_1: 9
pool_1: 5
kernel_2: 5
pool_2: 1
```

```
dropout_1: 0.65
units_1: 125
regularizer: 0.0005788602293070543
dropout_2: 0.1
units_2: 120
learning_rate: 0.00022898349409130705
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 1
tuner/round: 1
tuner/trial_id: 0709
Score: 0.6738197207450867
```

```
Trial 0424 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: 0.3000000000000004
units_2: 100
learning_rate: 0.0004250525730906734
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 5
tuner/round: 4
tuner/trial_id: 0419
Score: 0.6735332608222961
```

```
Trial 0700 summary
Hyperparameters:
dense_activation: elu
filters_1: 200
kernel_1: 3
pool_1: 9
kernel_2: 3
pool_2: 3
dropout_1: 0.45
units_1: 100
regularizer: 0.0019317722218304056
dropout_2: 0.5
units_2: 80
learning_rate: 0.0007775212063831087
```

```
tuner/epochs: 300
tuner/initial_epoch: 100
tuner/bracket: 2
tuner/round: 2
tuner/trial_id: 0696
Score: 0.6728320419788361
```

```
Trial 0593 summary
Hyperparameters:
dense_activation: mish
filters_1: 100
kernel_1: 4
pool_1: 8
kernel_2: 4
pool_2: 1
dropout_1: 0.35000000000000003
units_1: 175
regularizer: 0.0024425646182466847
dropout_2: 0.55
units_2: 100
learning_rate: 0.0006552199268517461
tuner/epochs: 100
tuner/initial_epoch: 34
tuner/bracket: 4
tuner/round: 3
tuner/trial_id: 0584
Score: 0.6707352995872498
```

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

```
11/11 [=====] - 1s 13ms/step - loss: 1.4066 - f1_score: 0.7179
```

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

```
84/84 [=====] - 1s 10ms/step - loss: 0.0779 - 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 7ms/step
      precision    recall  f1-score   support
      AXE       1.000     1.000     1.000        8
    BACKPACK    0.750     1.000     0.857        6
```

BASKETBALL	0.769	1.000	0.870	10
BEE	0.714	0.500	0.588	10
BELT	1.000	1.000	1.000	4
BITE	0.714	0.625	0.667	8
BREAKFAST	0.667	0.333	0.444	6
CANCER	0.800	1.000	0.889	8
CHRISTMAS	0.833	0.833	0.833	6
CONFUSED	0.667	0.667	0.667	6
DARK	1.000	1.000	1.000	4
DEAF	0.667	0.333	0.444	6
DECIDE	1.000	1.000	1.000	6
DEMAND	1.000	0.500	0.667	8
DEVELOP	0.667	0.667	0.667	6
DINNER	1.000	0.750	0.857	8
DOG	0.111	0.167	0.133	6
DOWNSIZE	1.000	1.000	1.000	8
DRAG	1.000	0.500	0.667	4
EAT	0.455	0.833	0.588	6
EDIT	0.545	1.000	0.706	6
ELEVATOR	0.500	0.625	0.556	8
FINE	0.667	0.500	0.571	4
FLOAT	1.000	0.250	0.400	4
FOREIGNER	0.625	0.833	0.714	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	0.000	0.000	0.000	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.500	0.625	0.556	8
LUNCH	0.800	0.500	0.615	8
MAPLE	0.500	1.000	0.667	4
MEAT	0.750	1.000	0.857	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	1.000	0.875	0.933	8
MOVIE	0.600	0.750	0.667	8
NOON	1.000	1.000	1.000	8
PARTY	0.714	0.625	0.667	8
PATIENT	0.400	0.333	0.364	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	0.800	0.800	0.800	10
SINK	1.000	0.833	0.909	6
SQUEEZE	0.667	0.500	0.571	4
THEY	0.500	0.500	0.500	4
TWINS	0.778	0.875	0.824	8
WHATFOR	0.700	0.700	0.700	10

accuracy			0.738	324
macro avg	0.768	0.718	0.718	324
weighted avg	0.772	0.738	0.734	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 [=====] - 7s 78ms/step - loss: 3.9809 - f1\_score: 0.0137 - val\_loss: 3.9679 - val\_f1\_score: 0.0011

Epoch 2/500  
28/28 [=====] - 1s 44ms/step - loss: 3.9669 - f1\_score: 0.0120 - val\_loss: 3.9486 - val\_f1\_score: 9.7859e-04

Epoch 3/500  
28/28 [=====] - 1s 44ms/step - loss: 3.9469 - f1\_score: 0.0133 - val\_loss: 3.9275 - val\_f1\_score: 0.0037

Epoch 4/500  
28/28 [=====] - 1s 45ms/step - loss: 3.8871 - f1\_score: 0.0173 - val\_loss: 3.7740 - val\_f1\_score: 0.0160

Epoch 5/500  
28/28 [=====] - 1s 45ms/step - loss: 3.7029 - f1\_score: 0.0230 - val\_loss: 3.5648 - val\_f1\_score: 0.0218

Epoch 6/500  
28/28 [=====] - 1s 44ms/step - loss: 3.4790 - f1\_score: 0.0423 - val\_loss: 3.4204 - val\_f1\_score: 0.0237

Epoch 7/500  
28/28 [=====] - 1s 44ms/step - loss: 3.2767 - f1\_score: 0.0639 - val\_loss: 3.2489 - val\_f1\_score: 0.0625

Epoch 8/500  
28/28 [=====] - 1s 45ms/step - loss: 3.1481 - f1\_score:

```
0.0826 - val_loss: 3.0110 - val_f1_score: 0.0824
Epoch 9/500
28/28 [=====] - 1s 44ms/step - loss: 3.0082 - f1_score: 0.1035 - val_loss: 2.9013 - val_f1_score: 0.0901
Epoch 10/500
28/28 [=====] - 1s 44ms/step - loss: 2.8803 - f1_score: 0.1290 - val_loss: 2.7671 - val_f1_score: 0.1429
Epoch 11/500
28/28 [=====] - 1s 44ms/step - loss: 2.7462 - f1_score: 0.1790 - val_loss: 2.7377 - val_f1_score: 0.1523
Epoch 12/500
28/28 [=====] - 1s 45ms/step - loss: 2.6026 - f1_score: 0.1847 - val_loss: 2.5356 - val_f1_score: 0.1973
Epoch 13/500
28/28 [=====] - 1s 44ms/step - loss: 2.5459 - f1_score: 0.2144 - val_loss: 2.4244 - val_f1_score: 0.2600
Epoch 14/500
28/28 [=====] - 1s 45ms/step - loss: 2.4103 - f1_score: 0.2579 - val_loss: 2.4421 - val_f1_score: 0.1945
Epoch 15/500
28/28 [=====] - 1s 44ms/step - loss: 2.3280 - f1_score: 0.2783 - val_loss: 2.2879 - val_f1_score: 0.2959
Epoch 16/500
28/28 [=====] - 1s 48ms/step - loss: 2.2513 - f1_score: 0.2962 - val_loss: 2.2091 - val_f1_score: 0.3130
Epoch 17/500
28/28 [=====] - 1s 46ms/step - loss: 2.1574 - f1_score: 0.3142 - val_loss: 2.1543 - val_f1_score: 0.2865
Epoch 18/500
28/28 [=====] - 1s 47ms/step - loss: 2.0908 - f1_score: 0.3566 - val_loss: 2.1809 - val_f1_score: 0.2899
Epoch 19/500
28/28 [=====] - 1s 46ms/step - loss: 2.0171 - f1_score: 0.3584 - val_loss: 2.0779 - val_f1_score: 0.3356
Epoch 20/500
28/28 [=====] - 1s 46ms/step - loss: 1.9616 - f1_score: 0.3999 - val_loss: 2.0142 - val_f1_score: 0.3633
Epoch 21/500
28/28 [=====] - 1s 44ms/step - loss: 1.8850 - f1_score: 0.4188 - val_loss: 1.9375 - val_f1_score: 0.3874
Epoch 22/500
28/28 [=====] - 1s 44ms/step - loss: 1.7957 - f1_score: 0.4289 - val_loss: 1.9169 - val_f1_score: 0.3970
Epoch 23/500
28/28 [=====] - 1s 44ms/step - loss: 1.7431 - f1_score: 0.4465 - val_loss: 1.9656 - val_f1_score: 0.3770
Epoch 24/500
28/28 [=====] - 1s 44ms/step - loss: 1.6933 - f1_score:
```

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0.4621 - val_loss: 1.8147 - val_f1_score: 0.4402
Epoch 25/500
28/28 [=====] - 1s 44ms/step - loss: 1.6197 - f1_score: 0.4925 - val_loss: 1.7244 - val_f1_score: 0.4743
Epoch 26/500
28/28 [=====] - 1s 44ms/step - loss: 1.5766 - f1_score: 0.5131 - val_loss: 1.7093 - val_f1_score: 0.5095
Epoch 27/500
28/28 [=====] - 1s 45ms/step - loss: 1.5271 - f1_score: 0.5303 - val_loss: 1.7744 - val_f1_score: 0.4648
Epoch 28/500
28/28 [=====] - 1s 45ms/step - loss: 1.4838 - f1_score: 0.5323 - val_loss: 1.6376 - val_f1_score: 0.5033
Epoch 29/500
28/28 [=====] - 1s 47ms/step - loss: 1.4267 - f1_score: 0.5418 - val_loss: 1.6061 - val_f1_score: 0.5229
Epoch 30/500
28/28 [=====] - 1s 46ms/step - loss: 1.3823 - f1_score: 0.5558 - val_loss: 1.5637 - val_f1_score: 0.5385
Epoch 31/500
28/28 [=====] - 1s 47ms/step - loss: 1.3587 - f1_score: 0.5742 - val_loss: 1.7152 - val_f1_score: 0.4797
Epoch 32/500
28/28 [=====] - 1s 47ms/step - loss: 1.3114 - f1_score: 0.5898 - val_loss: 1.7081 - val_f1_score: 0.5167
Epoch 33/500
28/28 [=====] - 1s 45ms/step - loss: 1.2618 - f1_score: 0.5990 - val_loss: 1.5500 - val_f1_score: 0.5582
Epoch 34/500
28/28 [=====] - 1s 48ms/step - loss: 1.2654 - f1_score: 0.5993 - val_loss: 1.5608 - val_f1_score: 0.5623
Epoch 35/500
28/28 [=====] - 2s 54ms/step - loss: 1.2077 - f1_score: 0.6275 - val_loss: 1.5547 - val_f1_score: 0.5266
Epoch 36/500
28/28 [=====] - 2s 60ms/step - loss: 1.1332 - f1_score: 0.6606 - val_loss: 1.5575 - val_f1_score: 0.5611
Epoch 37/500
28/28 [=====] - 1s 47ms/step - loss: 1.1569 - f1_score: 0.6352 - val_loss: 1.4680 - val_f1_score: 0.5806
Epoch 38/500
28/28 [=====] - 1s 45ms/step - loss: 1.0838 - f1_score: 0.6742 - val_loss: 1.4484 - val_f1_score: 0.6183
Epoch 39/500
28/28 [=====] - 1s 44ms/step - loss: 1.0686 - f1_score: 0.6672 - val_loss: 1.4183 - val_f1_score: 0.6009
Epoch 40/500
28/28 [=====] - 1s 45ms/step - loss: 1.0300 - f1_score:
```

```
0.6851 - val_loss: 1.4186 - val_f1_score: 0.6031
Epoch 41/500
28/28 [=====] - 1s 45ms/step - loss: 0.9855 - f1_score:
0.6941 - val_loss: 1.4523 - val_f1_score: 0.6129
Epoch 42/500
28/28 [=====] - 1s 46ms/step - loss: 0.9977 - f1_score:
0.6869 - val_loss: 1.4370 - val_f1_score: 0.6092
Epoch 43/500
28/28 [=====] - 1s 45ms/step - loss: 0.9530 - f1_score:
0.6998 - val_loss: 1.4157 - val_f1_score: 0.6139
Epoch 44/500
28/28 [=====] - 1s 49ms/step - loss: 0.9397 - f1_score:
0.7145 - val_loss: 1.4423 - val_f1_score: 0.6238
Epoch 45/500
28/28 [=====] - 1s 49ms/step - loss: 0.9151 - f1_score:
0.7227 - val_loss: 1.4679 - val_f1_score: 0.6043
Epoch 46/500
28/28 [=====] - 1s 45ms/step - loss: 0.8797 - f1_score:
0.7298 - val_loss: 1.4755 - val_f1_score: 0.6473
Epoch 47/500
28/28 [=====] - 1s 44ms/step - loss: 0.8883 - f1_score:
0.7314 - val_loss: 1.3938 - val_f1_score: 0.6585
Epoch 48/500
28/28 [=====] - 1s 44ms/step - loss: 0.8573 - f1_score:
0.7369 - val_loss: 1.3762 - val_f1_score: 0.6413
Epoch 49/500
28/28 [=====] - 1s 49ms/step - loss: 0.8179 - f1_score:
0.7411 - val_loss: 1.3767 - val_f1_score: 0.6325
Epoch 50/500
28/28 [=====] - 1s 45ms/step - loss: 0.8058 - f1_score:
0.7505 - val_loss: 1.4658 - val_f1_score: 0.5856
Epoch 51/500
28/28 [=====] - 1s 45ms/step - loss: 0.7789 - f1_score:
0.7626 - val_loss: 1.4410 - val_f1_score: 0.6040
Epoch 52/500
28/28 [=====] - 1s 48ms/step - loss: 0.7516 - f1_score:
0.7699 - val_loss: 1.4280 - val_f1_score: 0.6534
Epoch 53/500
28/28 [=====] - 1s 45ms/step - loss: 0.7513 - f1_score:
0.7708 - val_loss: 1.3589 - val_f1_score: 0.6491
Epoch 54/500
28/28 [=====] - 1s 45ms/step - loss: 0.7301 - f1_score:
0.7721 - val_loss: 1.3378 - val_f1_score: 0.6704
Epoch 55/500
28/28 [=====] - 1s 45ms/step - loss: 0.6992 - f1_score:
0.7814 - val_loss: 1.4166 - val_f1_score: 0.6375
Epoch 56/500
27/28 [=====>..] - ETA: 0s - loss: 0.6691 - f1_score:
```

0.8047

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 450ms/step - loss: 0.6737 - f1\_score: 0.8015 - val\_loss: 1.3422 - val\_f1\_score: 0.6897  
Epoch 57/500

28/28 [=====] - 1s 44ms/step - loss: 0.6888 - f1\_score: 0.7971 - val\_loss: 1.4094 - val\_f1\_score: 0.6478  
Epoch 58/500

27/28 [=====>..] - ETA: 0s - loss: 0.6551 - f1\_score: 0.7986

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 [=====] - 9s 347ms/step - loss: 0.6575 - f1\_score: 0.7975 - val\_loss: 1.3844 - val\_f1\_score: 0.6907  
Epoch 59/500

28/28 [=====] - 1s 44ms/step - loss: 0.6356 - f1\_score: 0.8100 - val\_loss: 1.3858 - val\_f1\_score: 0.6580  
Epoch 60/500

28/28 [=====] - 1s 44ms/step - loss: 0.5998 - f1\_score: 0.8285 - val\_loss: 1.4325 - val\_f1\_score: 0.6193  
Epoch 61/500

28/28 [=====] - 1s 45ms/step - loss: 0.6222 - f1\_score: 0.8151 - val\_loss: 1.3884 - val\_f1\_score: 0.6629  
Epoch 62/500

28/28 [=====] - 1s 44ms/step - loss: 0.5943 - f1\_score: 0.8197 - val\_loss: 1.3109 - val\_f1\_score: 0.6868  
Epoch 63/500

28/28 [=====] - 1s 44ms/step - loss: 0.6005 - f1\_score: 0.8270 - val\_loss: 1.4039 - val\_f1\_score: 0.6248  
Epoch 64/500

27/28 [=====>..] - ETA: 0s - loss: 0.5786 - f1\_score: 0.8259

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 [=====] - 10s 364ms/step - loss: 0.5775 -
f1_score: 0.8267 - val_loss: 1.2824 - val_f1_score: 0.6912
Epoch 65/500
28/28 [=====] - 1s 44ms/step - loss: 0.5603 - f1_score:
0.8341 - val_loss: 1.3403 - val_f1_score: 0.6640
Epoch 66/500
28/28 [=====] - 1s 44ms/step - loss: 0.5347 - f1_score:
0.8409 - val_loss: 1.4247 - val_f1_score: 0.6415
Epoch 67/500
27/28 [=====>..] - ETA: 0s - loss: 0.5292 - f1_score:
0.8468

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 [=====] - 10s 373ms/step - loss: 0.5286 -
f1_score: 0.8483 - val_loss: 1.3040 - val_f1_score: 0.7020
Epoch 68/500
28/28 [=====] - 1s 44ms/step - loss: 0.5221 - f1_score:
0.8457 - val_loss: 1.3631 - val_f1_score: 0.6742
Epoch 69/500
28/28 [=====] - 1s 44ms/step - loss: 0.5376 - f1_score:
0.8395 - val_loss: 1.3264 - val_f1_score: 0.6920
Epoch 70/500
28/28 [=====] - 1s 44ms/step - loss: 0.4961 - f1_score:
0.8564 - val_loss: 1.3551 - val_f1_score: 0.6463
Epoch 71/500
28/28 [=====] - 1s 46ms/step - loss: 0.4736 - f1_score:
0.8608 - val_loss: 1.3778 - val_f1_score: 0.6766
Epoch 72/500
28/28 [=====] - 1s 44ms/step - loss: 0.4934 - f1_score:
0.8508 - val_loss: 1.4823 - val_f1_score: 0.6551
Epoch 73/500
28/28 [=====] - 1s 44ms/step - loss: 0.4904 - f1_score:
0.8619 - val_loss: 1.3914 - val_f1_score: 0.6519
Epoch 74/500
28/28 [=====] - 1s 43ms/step - loss: 0.4572 - f1_score:
0.8683 - val_loss: 1.3774 - val_f1_score: 0.6877
```

```
Epoch 75/500
28/28 [=====] - 1s 44ms/step - loss: 0.4429 - f1_score: 0.8769 - val_loss: 1.4028 - val_f1_score: 0.6877
Epoch 76/500
28/28 [=====] - 1s 44ms/step - loss: 0.4464 - f1_score: 0.8690 - val_loss: 1.4017 - val_f1_score: 0.6413
Epoch 77/500
28/28 [=====] - 1s 48ms/step - loss: 0.4253 - f1_score: 0.8814 - val_loss: 1.5266 - val_f1_score: 0.6429
Epoch 78/500
28/28 [=====] - 1s 44ms/step - loss: 0.4287 - f1_score: 0.8814 - val_loss: 1.4770 - val_f1_score: 0.6675
Epoch 79/500
28/28 [=====] - 1s 47ms/step - loss: 0.4166 - f1_score: 0.8839 - val_loss: 1.4105 - val_f1_score: 0.6596
Epoch 80/500
28/28 [=====] - 1s 45ms/step - loss: 0.4088 - f1_score: 0.8890 - val_loss: 1.3696 - val_f1_score: 0.6987
Epoch 81/500
28/28 [=====] - 1s 45ms/step - loss: 0.4005 - f1_score: 0.8902 - val_loss: 1.4299 - val_f1_score: 0.6697
Epoch 82/500
28/28 [=====] - 1s 46ms/step - loss: 0.4086 - f1_score: 0.8860 - val_loss: 1.3598 - val_f1_score: 0.6901
Epoch 83/500
27/28 [=====>..] - ETA: 0s - loss: 0.3940 - f1_score: 0.8913
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 [=====] - 10s 380ms/step - loss: 0.3931 - f1_score: 0.8912 - val_loss: 1.3462 - val_f1_score: 0.7203
Epoch 84/500
28/28 [=====] - 1s 43ms/step - loss: 0.3831 - f1_score: 0.8936 - val_loss: 1.5060 - val_f1_score: 0.6345
Epoch 85/500
28/28 [=====] - 1s 44ms/step - loss: 0.3834 - f1_score: 0.8997 - val_loss: 1.4220 - val_f1_score: 0.6624
Epoch 86/500
28/28 [=====] - 1s 44ms/step - loss: 0.3781 - f1_score: 0.8958 - val_loss: 1.5307 - val_f1_score: 0.6368
Epoch 87/500
28/28 [=====] - 1s 45ms/step - loss: 0.3571 - f1_score:
```

```
0.9069 - val_loss: 1.5358 - val_f1_score: 0.6360
Epoch 88/500
28/28 [=====] - 1s 44ms/step - loss: 0.3651 - f1_score: 0.8988 - val_loss: 1.5857 - val_f1_score: 0.6333
Epoch 89/500
28/28 [=====] - 1s 44ms/step - loss: 0.3529 - f1_score: 0.9062 - val_loss: 1.5619 - val_f1_score: 0.6540
Epoch 90/500
28/28 [=====] - 1s 44ms/step - loss: 0.3450 - f1_score: 0.9121 - val_loss: 1.4363 - val_f1_score: 0.6564
Epoch 91/500
28/28 [=====] - 1s 47ms/step - loss: 0.3385 - f1_score: 0.9060 - val_loss: 1.3911 - val_f1_score: 0.6970
Epoch 92/500
28/28 [=====] - 1s 44ms/step - loss: 0.3405 - f1_score: 0.9121 - val_loss: 1.4353 - val_f1_score: 0.6741
Epoch 93/500
28/28 [=====] - 1s 44ms/step - loss: 0.3596 - f1_score: 0.8988 - val_loss: 1.5096 - val_f1_score: 0.6692
Epoch 94/500
28/28 [=====] - 1s 44ms/step - loss: 0.3294 - f1_score: 0.9163 - val_loss: 1.4765 - val_f1_score: 0.6526
Epoch 95/500
28/28 [=====] - 1s 44ms/step - loss: 0.3110 - f1_score: 0.9179 - val_loss: 1.5401 - val_f1_score: 0.6435
Epoch 96/500
28/28 [=====] - 1s 45ms/step - loss: 0.3180 - f1_score: 0.9160 - val_loss: 1.4789 - val_f1_score: 0.6370
Epoch 97/500
28/28 [=====] - 1s 46ms/step - loss: 0.3264 - f1_score: 0.9084 - val_loss: 1.5772 - val_f1_score: 0.6669
Epoch 98/500
28/28 [=====] - 1s 44ms/step - loss: 0.3257 - f1_score: 0.9149 - val_loss: 1.4905 - val_f1_score: 0.6481
Epoch 99/500
28/28 [=====] - 1s 47ms/step - loss: 0.2899 - f1_score: 0.9301 - val_loss: 1.4403 - val_f1_score: 0.6763
Epoch 100/500
28/28 [=====] - 1s 43ms/step - loss: 0.2944 - f1_score: 0.9219 - val_loss: 1.4113 - val_f1_score: 0.6864
Epoch 101/500
28/28 [=====] - 1s 44ms/step - loss: 0.2962 - f1_score: 0.9266 - val_loss: 1.4973 - val_f1_score: 0.6711
Epoch 102/500
28/28 [=====] - 1s 46ms/step - loss: 0.2991 - f1_score: 0.9219 - val_loss: 1.4904 - val_f1_score: 0.6614
Epoch 103/500
28/28 [=====] - 1s 44ms/step - loss: 0.2748 - f1_score:
```

```
0.9310 - val_loss: 1.4185 - val_f1_score: 0.6727
Epoch 104/500
28/28 [=====] - 1s 45ms/step - loss: 0.2902 - f1_score: 0.9277 - val_loss: 1.4426 - val_f1_score: 0.6885
Epoch 105/500
28/28 [=====] - 1s 44ms/step - loss: 0.2957 - f1_score: 0.9199 - val_loss: 1.3949 - val_f1_score: 0.7042
Epoch 106/500
28/28 [=====] - 1s 49ms/step - loss: 0.2780 - f1_score: 0.9313 - val_loss: 1.5665 - val_f1_score: 0.6371
Epoch 107/500
28/28 [=====] - 1s 54ms/step - loss: 0.2713 - f1_score: 0.9277 - val_loss: 1.4447 - val_f1_score: 0.6743
Epoch 108/500
28/28 [=====] - 2s 59ms/step - loss: 0.2799 - f1_score: 0.9258 - val_loss: 1.4371 - val_f1_score: 0.6719
Epoch 109/500
28/28 [=====] - 1s 53ms/step - loss: 0.2513 - f1_score: 0.9408 - val_loss: 1.6047 - val_f1_score: 0.6518
Epoch 110/500
28/28 [=====] - 1s 48ms/step - loss: 0.2422 - f1_score: 0.9445 - val_loss: 1.4542 - val_f1_score: 0.6774
Epoch 111/500
28/28 [=====] - 1s 44ms/step - loss: 0.2562 - f1_score: 0.9358 - val_loss: 1.4338 - val_f1_score: 0.6722
Epoch 112/500
28/28 [=====] - 1s 45ms/step - loss: 0.2573 - f1_score: 0.9338 - val_loss: 1.4912 - val_f1_score: 0.6746
Epoch 113/500
28/28 [=====] - 1s 47ms/step - loss: 0.2432 - f1_score: 0.9428 - val_loss: 1.5380 - val_f1_score: 0.6396
Epoch 114/500
28/28 [=====] - 1s 49ms/step - loss: 0.2614 - f1_score: 0.9349 - val_loss: 1.4660 - val_f1_score: 0.6862
Epoch 115/500
28/28 [=====] - 1s 46ms/step - loss: 0.2536 - f1_score: 0.9424 - val_loss: 1.4464 - val_f1_score: 0.6984
Epoch 116/500
28/28 [=====] - 1s 46ms/step - loss: 0.2449 - f1_score: 0.9345 - val_loss: 1.4922 - val_f1_score: 0.6899
Epoch 117/500
28/28 [=====] - 1s 45ms/step - loss: 0.2404 - f1_score: 0.9410 - val_loss: 1.4874 - val_f1_score: 0.6497
Epoch 118/500
28/28 [=====] - 1s 45ms/step - loss: 0.2318 - f1_score: 0.9464 - val_loss: 1.5209 - val_f1_score: 0.6458
Epoch 119/500
28/28 [=====] - 1s 44ms/step - loss: 0.2486 - f1_score:
```

```
0.9397 - val_loss: 1.5914 - val_f1_score: 0.6727
Epoch 120/500
28/28 [=====] - 1s 48ms/step - loss: 0.2254 - f1_score: 0.9429 - val_loss: 1.5191 - val_f1_score: 0.6724
Epoch 121/500
28/28 [=====] - 1s 44ms/step - loss: 0.2258 - f1_score: 0.9466 - val_loss: 1.5062 - val_f1_score: 0.6576
Epoch 122/500
28/28 [=====] - 1s 49ms/step - loss: 0.2465 - f1_score: 0.9366 - val_loss: 1.4212 - val_f1_score: 0.6951
Epoch 123/500
28/28 [=====] - 1s 45ms/step - loss: 0.2367 - f1_score: 0.9404 - val_loss: 1.4874 - val_f1_score: 0.6818
Epoch 124/500
28/28 [=====] - 1s 45ms/step - loss: 0.2204 - f1_score: 0.9432 - val_loss: 1.4684 - val_f1_score: 0.6630
Epoch 125/500
28/28 [=====] - 1s 45ms/step - loss: 0.2327 - f1_score: 0.9406 - val_loss: 1.5956 - val_f1_score: 0.6732
Epoch 126/500
28/28 [=====] - 1s 45ms/step - loss: 0.2059 - f1_score: 0.9567 - val_loss: 1.5847 - val_f1_score: 0.6638
Epoch 127/500
28/28 [=====] - 1s 45ms/step - loss: 0.2508 - f1_score: 0.9309 - val_loss: 1.4347 - val_f1_score: 0.7014
Epoch 128/500
28/28 [=====] - 1s 45ms/step - loss: 0.2215 - f1_score: 0.9502 - val_loss: 1.4828 - val_f1_score: 0.6838
Epoch 129/500
28/28 [=====] - 1s 45ms/step - loss: 0.2145 - f1_score: 0.9487 - val_loss: 1.5375 - val_f1_score: 0.6708
Epoch 130/500
28/28 [=====] - 1s 47ms/step - loss: 0.2298 - f1_score: 0.9425 - val_loss: 1.5623 - val_f1_score: 0.6462
Epoch 131/500
28/28 [=====] - 1s 45ms/step - loss: 0.2210 - f1_score: 0.9453 - val_loss: 1.4927 - val_f1_score: 0.6885
Epoch 132/500
28/28 [=====] - 1s 44ms/step - loss: 0.2064 - f1_score: 0.9487 - val_loss: 1.6026 - val_f1_score: 0.6731
Epoch 133/500
28/28 [=====] - 1s 44ms/step - loss: 0.1980 - f1_score: 0.9607 - val_loss: 1.5549 - val_f1_score: 0.6709
Epoch 134/500
28/28 [=====] - 1s 45ms/step - loss: 0.1806 - f1_score: 0.9640 - val_loss: 1.7265 - val_f1_score: 0.6376
Epoch 135/500
28/28 [=====] - 1s 45ms/step - loss: 0.2174 - f1_score:
```

```
0.9459 - val_loss: 1.5944 - val_f1_score: 0.6705
Epoch 136/500
28/28 [=====] - 1s 45ms/step - loss: 0.2104 - f1_score:
0.9468 - val_loss: 1.6434 - val_f1_score: 0.6405
Epoch 137/500
28/28 [=====] - 1s 45ms/step - loss: 0.1899 - f1_score:
0.9560 - val_loss: 1.7363 - val_f1_score: 0.6245
Epoch 138/500
28/28 [=====] - 1s 49ms/step - loss: 0.2003 - f1_score:
0.9506 - val_loss: 1.5370 - val_f1_score: 0.6773
Epoch 139/500
28/28 [=====] - 1s 46ms/step - loss: 0.2060 - f1_score:
0.9513 - val_loss: 1.5952 - val_f1_score: 0.6577
Epoch 140/500
28/28 [=====] - 1s 45ms/step - loss: 0.1859 - f1_score:
0.9606 - val_loss: 1.6252 - val_f1_score: 0.6656
Epoch 141/500
28/28 [=====] - 1s 45ms/step - loss: 0.1916 - f1_score:
0.9547 - val_loss: 1.5401 - val_f1_score: 0.6833
Epoch 142/500
28/28 [=====] - 1s 45ms/step - loss: 0.1903 - f1_score:
0.9585 - val_loss: 1.6200 - val_f1_score: 0.6596
Epoch 143/500
28/28 [=====] - 1s 45ms/step - loss: 0.1942 - f1_score:
0.9537 - val_loss: 1.6841 - val_f1_score: 0.6516
Epoch 144/500
28/28 [=====] - 1s 44ms/step - loss: 0.1880 - f1_score:
0.9572 - val_loss: 1.5128 - val_f1_score: 0.6820
Epoch 145/500
28/28 [=====] - 1s 45ms/step - loss: 0.2129 - f1_score:
0.9425 - val_loss: 1.6529 - val_f1_score: 0.6613
Epoch 146/500
28/28 [=====] - 1s 45ms/step - loss: 0.2395 - f1_score:
0.9361 - val_loss: 1.5059 - val_f1_score: 0.6809
Epoch 147/500
28/28 [=====] - 1s 45ms/step - loss: 0.1767 - f1_score:
0.9640 - val_loss: 1.5048 - val_f1_score: 0.6629
Epoch 148/500
28/28 [=====] - 1s 45ms/step - loss: 0.1693 - f1_score:
0.9654 - val_loss: 1.4665 - val_f1_score: 0.6840
Epoch 149/500
28/28 [=====] - 1s 48ms/step - loss: 0.1830 - f1_score:
0.9617 - val_loss: 1.5578 - val_f1_score: 0.6698
Epoch 150/500
28/28 [=====] - 1s 45ms/step - loss: 0.1887 - f1_score:
0.9582 - val_loss: 1.6914 - val_f1_score: 0.6375
Epoch 151/500
28/28 [=====] - 1s 46ms/step - loss: 0.2026 - f1_score:
```

```
0.9467 - val_loss: 1.6112 - val_f1_score: 0.6664
Epoch 152/500
28/28 [=====] - 1s 46ms/step - loss: 0.1722 - f1_score: 0.9635 - val_loss: 1.7693 - val_f1_score: 0.6421
Epoch 153/500
28/28 [=====] - 1s 46ms/step - loss: 0.1629 - f1_score: 0.9636 - val_loss: 1.6222 - val_f1_score: 0.6963
Epoch 154/500
28/28 [=====] - 1s 49ms/step - loss: 0.1562 - f1_score: 0.9645 - val_loss: 1.5185 - val_f1_score: 0.6823
Epoch 155/500
28/28 [=====] - 1s 46ms/step - loss: 0.1600 - f1_score: 0.9695 - val_loss: 1.6822 - val_f1_score: 0.6523
Epoch 156/500
28/28 [=====] - 1s 46ms/step - loss: 0.1941 - f1_score: 0.9512 - val_loss: 1.6294 - val_f1_score: 0.6796
Epoch 157/500
28/28 [=====] - 1s 47ms/step - loss: 0.1958 - f1_score: 0.9492 - val_loss: 1.5270 - val_f1_score: 0.6967
Epoch 158/500
28/28 [=====] - 1s 49ms/step - loss: 0.1670 - f1_score: 0.9640 - val_loss: 1.5706 - val_f1_score: 0.7036
Epoch 159/500
28/28 [=====] - 1s 46ms/step - loss: 0.1724 - f1_score: 0.9615 - val_loss: 1.7325 - val_f1_score: 0.6234
Epoch 160/500
28/28 [=====] - 1s 49ms/step - loss: 0.1724 - f1_score: 0.9648 - val_loss: 1.6376 - val_f1_score: 0.6953
Epoch 161/500
28/28 [=====] - 1s 45ms/step - loss: 0.1501 - f1_score: 0.9715 - val_loss: 1.5991 - val_f1_score: 0.6794
Epoch 162/500
28/28 [=====] - 1s 46ms/step - loss: 0.1587 - f1_score: 0.9631 - val_loss: 1.6070 - val_f1_score: 0.6935
Epoch 163/500
28/28 [=====] - 1s 53ms/step - loss: 0.1713 - f1_score: 0.9650 - val_loss: 1.5933 - val_f1_score: 0.7039
Epoch 164/500
28/28 [=====] - 1s 46ms/step - loss: 0.1554 - f1_score: 0.9661 - val_loss: 1.6701 - val_f1_score: 0.6520
Epoch 165/500
28/28 [=====] - 1s 54ms/step - loss: 0.1605 - f1_score: 0.9667 - val_loss: 1.7129 - val_f1_score: 0.6670
Epoch 166/500
28/28 [=====] - 1s 47ms/step - loss: 0.1602 - f1_score: 0.9633 - val_loss: 1.7579 - val_f1_score: 0.6677
Epoch 167/500
28/28 [=====] - 1s 45ms/step - loss: 0.1658 - f1_score:
```

```
0.9664 - val_loss: 1.7600 - val_f1_score: 0.6757
Epoch 168/500
28/28 [=====] - 1s 46ms/step - loss: 0.1602 - f1_score:
0.9681 - val_loss: 1.7100 - val_f1_score: 0.6342
Epoch 169/500
28/28 [=====] - 1s 49ms/step - loss: 0.1920 - f1_score:
0.9551 - val_loss: 1.7229 - val_f1_score: 0.6494
Epoch 170/500
28/28 [=====] - 2s 54ms/step - loss: 0.1762 - f1_score:
0.9531 - val_loss: 1.6217 - val_f1_score: 0.6758
Epoch 171/500
28/28 [=====] - 2s 63ms/step - loss: 0.1594 - f1_score:
0.9636 - val_loss: 1.5972 - val_f1_score: 0.6918
Epoch 172/500
28/28 [=====] - 2s 68ms/step - loss: 0.1412 - f1_score:
0.9717 - val_loss: 1.6395 - val_f1_score: 0.6763
Epoch 173/500
28/28 [=====] - 2s 57ms/step - loss: 0.1557 - f1_score:
0.9634 - val_loss: 1.6101 - val_f1_score: 0.7089
Epoch 174/500
28/28 [=====] - 1s 47ms/step - loss: 0.1654 - f1_score:
0.9609 - val_loss: 1.5566 - val_f1_score: 0.6936
Epoch 175/500
28/28 [=====] - 1s 46ms/step - loss: 0.1618 - f1_score:
0.9604 - val_loss: 1.6700 - val_f1_score: 0.6810
Epoch 176/500
28/28 [=====] - 1s 45ms/step - loss: 0.1508 - f1_score:
0.9678 - val_loss: 1.6575 - val_f1_score: 0.6712
Epoch 177/500
28/28 [=====] - 1s 45ms/step - loss: 0.1594 - f1_score:
0.9634 - val_loss: 1.8399 - val_f1_score: 0.6337
Epoch 178/500
28/28 [=====] - 1s 44ms/step - loss: 0.1627 - f1_score:
0.9633 - val_loss: 1.6499 - val_f1_score: 0.6734
Epoch 179/500
28/28 [=====] - 1s 48ms/step - loss: 0.1658 - f1_score:
0.9624 - val_loss: 1.8111 - val_f1_score: 0.6747
Epoch 180/500
28/28 [=====] - 1s 44ms/step - loss: 0.1542 - f1_score:
0.9660 - val_loss: 1.7826 - val_f1_score: 0.6658
Epoch 181/500
28/28 [=====] - 1s 44ms/step - loss: 0.1485 - f1_score:
0.9655 - val_loss: 1.6976 - val_f1_score: 0.6806
Epoch 182/500
28/28 [=====] - 1s 44ms/step - loss: 0.1530 - f1_score:
0.9651 - val_loss: 1.7116 - val_f1_score: 0.6768
Epoch 183/500
28/28 [=====] - 1s 44ms/step - loss: 0.1597 - f1_score:
```

```
0.9633 - val_loss: 1.6494 - val_f1_score: 0.6673
Epoch 184/500
28/28 [=====] - 1s 44ms/step - loss: 0.1473 - f1_score: 0.9669 - val_loss: 1.6769 - val_f1_score: 0.6784
Epoch 185/500
28/28 [=====] - 1s 44ms/step - loss: 0.1532 - f1_score: 0.9660 - val_loss: 1.6860 - val_f1_score: 0.6585
Epoch 186/500
28/28 [=====] - 1s 48ms/step - loss: 0.1355 - f1_score: 0.9692 - val_loss: 1.6590 - val_f1_score: 0.6878
Epoch 187/500
28/28 [=====] - 1s 48ms/step - loss: 0.1460 - f1_score: 0.9669 - val_loss: 1.7003 - val_f1_score: 0.7092
Epoch 188/500
28/28 [=====] - 1s 45ms/step - loss: 0.1441 - f1_score: 0.9655 - val_loss: 1.7916 - val_f1_score: 0.6740
Epoch 189/500
28/28 [=====] - 1s 44ms/step - loss: 0.1420 - f1_score: 0.9647 - val_loss: 1.7716 - val_f1_score: 0.6637
Epoch 190/500
28/28 [=====] - 1s 44ms/step - loss: 0.1498 - f1_score: 0.9648 - val_loss: 1.6608 - val_f1_score: 0.6693
Epoch 191/500
28/28 [=====] - 1s 45ms/step - loss: 0.1498 - f1_score: 0.9690 - val_loss: 1.7277 - val_f1_score: 0.6631
Epoch 192/500
28/28 [=====] - 1s 44ms/step - loss: 0.1390 - f1_score: 0.9714 - val_loss: 1.6708 - val_f1_score: 0.6710
Epoch 193/500
28/28 [=====] - 1s 44ms/step - loss: 0.1429 - f1_score: 0.9697 - val_loss: 1.8267 - val_f1_score: 0.6577
Epoch 194/500
28/28 [=====] - 1s 44ms/step - loss: 0.1386 - f1_score: 0.9695 - val_loss: 1.6987 - val_f1_score: 0.6798
Epoch 195/500
28/28 [=====] - 1s 47ms/step - loss: 0.1260 - f1_score: 0.9737 - val_loss: 1.7012 - val_f1_score: 0.6907
Epoch 196/500
28/28 [=====] - 1s 44ms/step - loss: 0.1282 - f1_score: 0.9738 - val_loss: 1.6642 - val_f1_score: 0.6847
Epoch 197/500
28/28 [=====] - 1s 45ms/step - loss: 0.1329 - f1_score: 0.9720 - val_loss: 1.6496 - val_f1_score: 0.6594
Epoch 198/500
28/28 [=====] - 1s 45ms/step - loss: 0.1264 - f1_score: 0.9745 - val_loss: 1.7966 - val_f1_score: 0.6607
Epoch 199/500
28/28 [=====] - 1s 46ms/step - loss: 0.1308 - f1_score:
```

```
0.9677 - val_loss: 1.8132 - val_f1_score: 0.6765
Epoch 200/500
28/28 [=====] - 2s 54ms/step - loss: 0.1603 - f1_score: 0.9606 - val_loss: 1.6273 - val_f1_score: 0.6785
Epoch 201/500
28/28 [=====] - 1s 52ms/step - loss: 0.1520 - f1_score: 0.9664 - val_loss: 1.8385 - val_f1_score: 0.6467
Epoch 202/500
28/28 [=====] - 2s 57ms/step - loss: 0.1588 - f1_score: 0.9630 - val_loss: 1.8703 - val_f1_score: 0.6413
Epoch 203/500
28/28 [=====] - 2s 56ms/step - loss: 0.1550 - f1_score: 0.9668 - val_loss: 1.8251 - val_f1_score: 0.6647
Epoch 204/500
28/28 [=====] - 1s 51ms/step - loss: 0.1333 - f1_score: 0.9699 - val_loss: 1.7013 - val_f1_score: 0.6957
Epoch 205/500
28/28 [=====] - 2s 57ms/step - loss: 0.1442 - f1_score: 0.9673 - val_loss: 1.8029 - val_f1_score: 0.6773
Epoch 206/500
28/28 [=====] - 1s 46ms/step - loss: 0.1424 - f1_score: 0.9688 - val_loss: 1.9020 - val_f1_score: 0.6334
Epoch 207/500
28/28 [=====] - 1s 44ms/step - loss: 0.1364 - f1_score: 0.9696 - val_loss: 1.7135 - val_f1_score: 0.6772
Epoch 208/500
28/28 [=====] - 1s 44ms/step - loss: 0.1292 - f1_score: 0.9714 - val_loss: 1.8069 - val_f1_score: 0.6613
Epoch 209/500
28/28 [=====] - 1s 46ms/step - loss: 0.1235 - f1_score: 0.9747 - val_loss: 1.7807 - val_f1_score: 0.6815
Epoch 210/500
28/28 [=====] - 1s 46ms/step - loss: 0.1417 - f1_score: 0.9691 - val_loss: 1.7561 - val_f1_score: 0.6877
Epoch 211/500
28/28 [=====] - 1s 45ms/step - loss: 0.1413 - f1_score: 0.9679 - val_loss: 1.8616 - val_f1_score: 0.6536
Epoch 212/500
28/28 [=====] - 1s 44ms/step - loss: 0.1343 - f1_score: 0.9731 - val_loss: 1.7524 - val_f1_score: 0.6555
Epoch 213/500
28/28 [=====] - 1s 45ms/step - loss: 0.1537 - f1_score: 0.9620 - val_loss: 1.6873 - val_f1_score: 0.6673
Epoch 214/500
28/28 [=====] - 1s 44ms/step - loss: 0.1235 - f1_score: 0.9779 - val_loss: 1.7325 - val_f1_score: 0.6911
Epoch 215/500
28/28 [=====] - 1s 47ms/step - loss: 0.1169 - f1_score:
```

```
0.9741 - val_loss: 1.9051 - val_f1_score: 0.6503
Epoch 216/500
28/28 [=====] - 1s 45ms/step - loss: 0.1401 - f1_score: 0.9678 - val_loss: 1.7395 - val_f1_score: 0.6617
Epoch 217/500
28/28 [=====] - 1s 51ms/step - loss: 0.1292 - f1_score: 0.9733 - val_loss: 1.7578 - val_f1_score: 0.7038
Epoch 218/500
28/28 [=====] - 1s 45ms/step - loss: 0.1290 - f1_score: 0.9734 - val_loss: 1.7166 - val_f1_score: 0.6865
Epoch 219/500
28/28 [=====] - 1s 44ms/step - loss: 0.1051 - f1_score: 0.9810 - val_loss: 1.7155 - val_f1_score: 0.6891
Epoch 220/500
27/28 [=====>..] - ETA: 0s - loss: 0.1284 - f1_score: 0.9701

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 441ms/step - loss: 0.1271 - f1_score: 0.9702 - val_loss: 1.7001 - val_f1_score: 0.7232
Epoch 221/500
28/28 [=====] - 1s 44ms/step - loss: 0.1319 - f1_score: 0.9698 - val_loss: 1.9265 - val_f1_score: 0.6663
Epoch 222/500
28/28 [=====] - 1s 45ms/step - loss: 0.1248 - f1_score: 0.9755 - val_loss: 2.1418 - val_f1_score: 0.6429
Epoch 223/500
28/28 [=====] - 1s 44ms/step - loss: 0.1646 - f1_score: 0.9601 - val_loss: 2.0957 - val_f1_score: 0.6511
Epoch 224/500
28/28 [=====] - 1s 47ms/step - loss: 0.1506 - f1_score: 0.9617 - val_loss: 1.7578 - val_f1_score: 0.6885
Epoch 225/500
28/28 [=====] - 1s 47ms/step - loss: 0.1342 - f1_score: 0.9710 - val_loss: 1.8540 - val_f1_score: 0.6587
Epoch 226/500
28/28 [=====] - 1s 46ms/step - loss: 0.1196 - f1_score: 0.9752 - val_loss: 1.8548 - val_f1_score: 0.6699
Epoch 227/500
28/28 [=====] - 1s 44ms/step - loss: 0.1146 - f1_score: 0.9767 - val_loss: 1.7706 - val_f1_score: 0.7099
Epoch 228/500
```

```
28/28 [=====] - 1s 44ms/step - loss: 0.1173 - f1_score: 0.9740 - val_loss: 2.1084 - val_f1_score: 0.6384
Epoch 229/500
28/28 [=====] - 1s 46ms/step - loss: 0.1333 - f1_score: 0.9725 - val_loss: 1.8116 - val_f1_score: 0.6944
Epoch 230/500
28/28 [=====] - 1s 45ms/step - loss: 0.1121 - f1_score: 0.9782 - val_loss: 1.7770 - val_f1_score: 0.6909
Epoch 231/500
28/28 [=====] - 1s 45ms/step - loss: 0.1207 - f1_score: 0.9744 - val_loss: 1.7854 - val_f1_score: 0.6813
Epoch 232/500
28/28 [=====] - 1s 44ms/step - loss: 0.1259 - f1_score: 0.9751 - val_loss: 1.8663 - val_f1_score: 0.6428
Epoch 233/500
28/28 [=====] - 1s 47ms/step - loss: 0.1204 - f1_score: 0.9734 - val_loss: 1.9359 - val_f1_score: 0.6440
Epoch 234/500
28/28 [=====] - 1s 47ms/step - loss: 0.1184 - f1_score: 0.9728 - val_loss: 1.8422 - val_f1_score: 0.6508
Epoch 235/500
28/28 [=====] - 1s 44ms/step - loss: 0.1155 - f1_score: 0.9736 - val_loss: 1.6912 - val_f1_score: 0.6885
Epoch 236/500
28/28 [=====] - 1s 44ms/step - loss: 0.1187 - f1_score: 0.9774 - val_loss: 1.7903 - val_f1_score: 0.6927
Epoch 237/500
28/28 [=====] - 1s 45ms/step - loss: 0.1060 - f1_score: 0.9791 - val_loss: 1.9230 - val_f1_score: 0.6500
Epoch 238/500
28/28 [=====] - 1s 45ms/step - loss: 0.1076 - f1_score: 0.9787 - val_loss: 1.9008 - val_f1_score: 0.6837
Epoch 239/500
28/28 [=====] - 1s 46ms/step - loss: 0.1140 - f1_score: 0.9708 - val_loss: 1.7551 - val_f1_score: 0.6750
Epoch 240/500
28/28 [=====] - 1s 46ms/step - loss: 0.1856 - f1_score: 0.9587 - val_loss: 1.9553 - val_f1_score: 0.6793
Epoch 241/500
28/28 [=====] - 1s 44ms/step - loss: 0.1381 - f1_score: 0.9668 - val_loss: 1.6550 - val_f1_score: 0.6855
Epoch 242/500
28/28 [=====] - 1s 44ms/step - loss: 0.1304 - f1_score: 0.9721 - val_loss: 1.6846 - val_f1_score: 0.7012
Epoch 243/500
28/28 [=====] - 1s 45ms/step - loss: 0.1107 - f1_score: 0.9777 - val_loss: 1.7682 - val_f1_score: 0.6841
Epoch 244/500
```

```
28/28 [=====] - 1s 44ms/step - loss: 0.1370 - f1_score: 0.9695 - val_loss: 1.9371 - val_f1_score: 0.6535
Epoch 245/500
28/28 [=====] - 1s 45ms/step - loss: 0.1365 - f1_score: 0.9710 - val_loss: 1.8493 - val_f1_score: 0.6961
Epoch 246/500
28/28 [=====] - 1s 44ms/step - loss: 0.1056 - f1_score: 0.9793 - val_loss: 1.9660 - val_f1_score: 0.6732
Epoch 247/500
28/28 [=====] - 1s 45ms/step - loss: 0.1090 - f1_score: 0.9768 - val_loss: 1.9821 - val_f1_score: 0.6644
Epoch 248/500
28/28 [=====] - 1s 47ms/step - loss: 0.1289 - f1_score: 0.9702 - val_loss: 1.7513 - val_f1_score: 0.6785
Epoch 249/500
28/28 [=====] - 1s 44ms/step - loss: 0.1002 - f1_score: 0.9800 - val_loss: 1.8162 - val_f1_score: 0.6646
Epoch 250/500
28/28 [=====] - 1s 45ms/step - loss: 0.0998 - f1_score: 0.9802 - val_loss: 1.7288 - val_f1_score: 0.6908
Epoch 251/500
28/28 [=====] - 1s 45ms/step - loss: 0.1134 - f1_score: 0.9756 - val_loss: 1.8485 - val_f1_score: 0.6907
Epoch 252/500
28/28 [=====] - 1s 45ms/step - loss: 0.1355 - f1_score: 0.9653 - val_loss: 1.7901 - val_f1_score: 0.6975
Epoch 253/500
28/28 [=====] - 1s 44ms/step - loss: 0.1211 - f1_score: 0.9716 - val_loss: 1.7888 - val_f1_score: 0.7006
Epoch 254/500
28/28 [=====] - 1s 48ms/step - loss: 0.1563 - f1_score: 0.9663 - val_loss: 1.8896 - val_f1_score: 0.6764
Epoch 255/500
28/28 [=====] - 1s 45ms/step - loss: 0.1208 - f1_score: 0.9743 - val_loss: 1.7008 - val_f1_score: 0.6822
Epoch 256/500
28/28 [=====] - 1s 48ms/step - loss: 0.1095 - f1_score: 0.9711 - val_loss: 1.8305 - val_f1_score: 0.6772
Epoch 257/500
28/28 [=====] - 1s 45ms/step - loss: 0.0984 - f1_score: 0.9831 - val_loss: 1.9583 - val_f1_score: 0.6646
Epoch 258/500
28/28 [=====] - 1s 44ms/step - loss: 0.1144 - f1_score: 0.9778 - val_loss: 2.1226 - val_f1_score: 0.6789
Epoch 259/500
28/28 [=====] - 1s 45ms/step - loss: 0.1116 - f1_score: 0.9779 - val_loss: 1.8753 - val_f1_score: 0.6639
Epoch 260/500
```

```
28/28 [=====] - 1s 49ms/step - loss: 0.1094 - f1_score: 0.9780 - val_loss: 1.8376 - val_f1_score: 0.6784
Epoch 261/500
28/28 [=====] - 1s 50ms/step - loss: 0.1160 - f1_score: 0.9736 - val_loss: 1.8163 - val_f1_score: 0.6860
Epoch 262/500
28/28 [=====] - 1s 50ms/step - loss: 0.1094 - f1_score: 0.9774 - val_loss: 1.9392 - val_f1_score: 0.6789
Epoch 263/500
28/28 [=====] - 1s 46ms/step - loss: 0.1196 - f1_score: 0.9773 - val_loss: 1.7172 - val_f1_score: 0.6840
Epoch 264/500
28/28 [=====] - 2s 55ms/step - loss: 0.0991 - f1_score: 0.9770 - val_loss: 1.8210 - val_f1_score: 0.6718
Epoch 265/500
28/28 [=====] - 1s 45ms/step - loss: 0.1153 - f1_score: 0.9782 - val_loss: 1.7894 - val_f1_score: 0.6919
Epoch 266/500
28/28 [=====] - 1s 46ms/step - loss: 0.0968 - f1_score: 0.9826 - val_loss: 1.8241 - val_f1_score: 0.6739
Epoch 267/500
28/28 [=====] - 1s 47ms/step - loss: 0.1170 - f1_score: 0.9765 - val_loss: 1.9059 - val_f1_score: 0.6706
Epoch 268/500
28/28 [=====] - 1s 47ms/step - loss: 0.1321 - f1_score: 0.9686 - val_loss: 1.8923 - val_f1_score: 0.6617
Epoch 269/500
28/28 [=====] - 1s 49ms/step - loss: 0.1053 - f1_score: 0.9785 - val_loss: 1.6956 - val_f1_score: 0.6886
Epoch 270/500
28/28 [=====] - 1s 46ms/step - loss: 0.1013 - f1_score: 0.9801 - val_loss: 1.8244 - val_f1_score: 0.6692
Epoch 271/500
28/28 [=====] - 1s 50ms/step - loss: 0.1042 - f1_score: 0.9778 - val_loss: 1.8732 - val_f1_score: 0.6849
Epoch 272/500
28/28 [=====] - 1s 46ms/step - loss: 0.1002 - f1_score: 0.9781 - val_loss: 1.8106 - val_f1_score: 0.6739
Epoch 273/500
28/28 [=====] - 1s 46ms/step - loss: 0.1310 - f1_score: 0.9683 - val_loss: 1.8324 - val_f1_score: 0.6926
Epoch 274/500
28/28 [=====] - 1s 45ms/step - loss: 0.1289 - f1_score: 0.9703 - val_loss: 1.9116 - val_f1_score: 0.6602
Epoch 275/500
28/28 [=====] - 1s 45ms/step - loss: 0.0991 - f1_score: 0.9794 - val_loss: 1.7834 - val_f1_score: 0.6781
Epoch 276/500
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28/28 [=====] - 1s 45ms/step - loss: 0.1173 - f1_score: 0.9733 - val_loss: 1.8767 - val_f1_score: 0.6772
Epoch 277/500
28/28 [=====] - 1s 46ms/step - loss: 0.0983 - f1_score: 0.9823 - val_loss: 1.8973 - val_f1_score: 0.6681
Epoch 278/500
28/28 [=====] - 1s 46ms/step - loss: 0.0917 - f1_score: 0.9818 - val_loss: 1.8696 - val_f1_score: 0.6739
Epoch 279/500
28/28 [=====] - 1s 51ms/step - loss: 0.1134 - f1_score: 0.9745 - val_loss: 2.0174 - val_f1_score: 0.6826
Epoch 280/500
28/28 [=====] - 1s 50ms/step - loss: 0.1078 - f1_score: 0.9782 - val_loss: 1.8406 - val_f1_score: 0.6771
Epoch 281/500
28/28 [=====] - 1s 47ms/step - loss: 0.1133 - f1_score: 0.9780 - val_loss: 1.8213 - val_f1_score: 0.6626
Epoch 282/500
28/28 [=====] - 1s 47ms/step - loss: 0.1038 - f1_score: 0.9776 - val_loss: 2.0671 - val_f1_score: 0.6387
Epoch 283/500
28/28 [=====] - 1s 52ms/step - loss: 0.0904 - f1_score: 0.9861 - val_loss: 1.9008 - val_f1_score: 0.6800
Epoch 284/500
28/28 [=====] - 1s 45ms/step - loss: 0.0834 - f1_score: 0.9881 - val_loss: 1.7421 - val_f1_score: 0.6946
Epoch 285/500
28/28 [=====] - 1s 44ms/step - loss: 0.0855 - f1_score: 0.9854 - val_loss: 2.0158 - val_f1_score: 0.6515
Epoch 286/500
28/28 [=====] - 1s 45ms/step - loss: 0.0820 - f1_score: 0.9858 - val_loss: 1.9123 - val_f1_score: 0.6715
Epoch 287/500
28/28 [=====] - 1s 52ms/step - loss: 0.0936 - f1_score: 0.9805 - val_loss: 1.9858 - val_f1_score: 0.6493
Epoch 288/500
28/28 [=====] - 1s 45ms/step - loss: 0.1212 - f1_score: 0.9715 - val_loss: 1.9608 - val_f1_score: 0.6588
Epoch 289/500
28/28 [=====] - 1s 47ms/step - loss: 0.1070 - f1_score: 0.9762 - val_loss: 2.0442 - val_f1_score: 0.6588
Epoch 290/500
28/28 [=====] - 1s 47ms/step - loss: 0.1061 - f1_score: 0.9776 - val_loss: 1.9430 - val_f1_score: 0.6825
Epoch 291/500
28/28 [=====] - 1s 48ms/step - loss: 0.0987 - f1_score: 0.9768 - val_loss: 1.9543 - val_f1_score: 0.6746
Epoch 292/500
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28/28 [=====] - 1s 47ms/step - loss: 0.1244 - f1_score: 0.9690 - val_loss: 1.7419 - val_f1_score: 0.6823
Epoch 293/500
28/28 [=====] - 1s 46ms/step - loss: 0.1065 - f1_score: 0.9747 - val_loss: 1.9257 - val_f1_score: 0.6639
Epoch 294/500
28/28 [=====] - 1s 54ms/step - loss: 0.1009 - f1_score: 0.9806 - val_loss: 2.0358 - val_f1_score: 0.6692
Epoch 295/500
28/28 [=====] - 1s 45ms/step - loss: 0.1273 - f1_score: 0.9690 - val_loss: 1.9452 - val_f1_score: 0.6910
Epoch 296/500
28/28 [=====] - 1s 45ms/step - loss: 0.1361 - f1_score: 0.9692 - val_loss: 1.9885 - val_f1_score: 0.6741
Epoch 297/500
28/28 [=====] - 1s 47ms/step - loss: 0.1431 - f1_score: 0.9646 - val_loss: 2.0165 - val_f1_score: 0.6410
Epoch 298/500
28/28 [=====] - 1s 48ms/step - loss: 0.1326 - f1_score: 0.9697 - val_loss: 1.8387 - val_f1_score: 0.6800
Epoch 299/500
28/28 [=====] - 1s 50ms/step - loss: 0.0996 - f1_score: 0.9816 - val_loss: 1.9036 - val_f1_score: 0.6708
Epoch 300/500
28/28 [=====] - 1s 51ms/step - loss: 0.1039 - f1_score: 0.9802 - val_loss: 1.8466 - val_f1_score: 0.6753
Epoch 301/500
28/28 [=====] - 1s 49ms/step - loss: 0.1037 - f1_score: 0.9794 - val_loss: 1.9182 - val_f1_score: 0.6723
Epoch 302/500
28/28 [=====] - 1s 49ms/step - loss: 0.0949 - f1_score: 0.9826 - val_loss: 1.8543 - val_f1_score: 0.7047
Epoch 303/500
28/28 [=====] - 1s 46ms/step - loss: 0.0928 - f1_score: 0.9828 - val_loss: 1.8126 - val_f1_score: 0.6947
Epoch 304/500
28/28 [=====] - 1s 48ms/step - loss: 0.0952 - f1_score: 0.9828 - val_loss: 1.9297 - val_f1_score: 0.6968
Epoch 305/500
28/28 [=====] - 1s 45ms/step - loss: 0.0934 - f1_score: 0.9797 - val_loss: 1.9370 - val_f1_score: 0.6897
Epoch 306/500
28/28 [=====] - 1s 46ms/step - loss: 0.0844 - f1_score: 0.9875 - val_loss: 1.7588 - val_f1_score: 0.7031
Epoch 307/500
28/28 [=====] - 1s 53ms/step - loss: 0.0851 - f1_score: 0.9846 - val_loss: 1.7846 - val_f1_score: 0.6828
Epoch 308/500
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28/28 [=====] - 1s 51ms/step - loss: 0.1061 - f1_score: 0.9788 - val_loss: 1.9912 - val_f1_score: 0.6564
Epoch 309/500
28/28 [=====] - 2s 56ms/step - loss: 0.0897 - f1_score: 0.9824 - val_loss: 1.9582 - val_f1_score: 0.6561
Epoch 310/500
28/28 [=====] - 1s 45ms/step - loss: 0.0991 - f1_score: 0.9790 - val_loss: 2.0530 - val_f1_score: 0.6688
Epoch 311/500
28/28 [=====] - 1s 51ms/step - loss: 0.1049 - f1_score: 0.9755 - val_loss: 1.7914 - val_f1_score: 0.7038
Epoch 312/500
28/28 [=====] - 2s 59ms/step - loss: 0.1100 - f1_score: 0.9748 - val_loss: 1.8453 - val_f1_score: 0.6920
Epoch 313/500
28/28 [=====] - 1s 49ms/step - loss: 0.1031 - f1_score: 0.9757 - val_loss: 2.0107 - val_f1_score: 0.6409
Epoch 314/500
28/28 [=====] - 1s 49ms/step - loss: 0.0993 - f1_score: 0.9781 - val_loss: 1.9273 - val_f1_score: 0.6723
Epoch 315/500
28/28 [=====] - 1s 50ms/step - loss: 0.0936 - f1_score: 0.9825 - val_loss: 1.7635 - val_f1_score: 0.6477
Epoch 316/500
28/28 [=====] - 1s 51ms/step - loss: 0.1099 - f1_score: 0.9754 - val_loss: 2.0669 - val_f1_score: 0.6619
Epoch 317/500
28/28 [=====] - 1s 51ms/step - loss: 0.1032 - f1_score: 0.9803 - val_loss: 1.9528 - val_f1_score: 0.6505
Epoch 318/500
28/28 [=====] - 1s 45ms/step - loss: 0.0804 - f1_score: 0.9875 - val_loss: 1.8061 - val_f1_score: 0.6849
Epoch 319/500
28/28 [=====] - 1s 46ms/step - loss: 0.1002 - f1_score: 0.9776 - val_loss: 1.9417 - val_f1_score: 0.6457
Epoch 320/500
28/28 [=====] - 1s 46ms/step - loss: 0.0935 - f1_score: 0.9831 - val_loss: 1.8940 - val_f1_score: 0.6868
Epoch 321/500
28/28 [=====] - 1s 46ms/step - loss: 0.1042 - f1_score: 0.9759 - val_loss: 1.7977 - val_f1_score: 0.6768
Epoch 322/500
28/28 [=====] - 1s 45ms/step - loss: 0.0855 - f1_score: 0.9863 - val_loss: 1.7615 - val_f1_score: 0.7105
Epoch 323/500
28/28 [=====] - 2s 59ms/step - loss: 0.0960 - f1_score: 0.9786 - val_loss: 1.8360 - val_f1_score: 0.7129
Epoch 324/500
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28/28 [=====] - 1s 53ms/step - loss: 0.1032 - f1_score: 0.9793 - val_loss: 1.7495 - val_f1_score: 0.7164
Epoch 325/500
28/28 [=====] - 1s 50ms/step - loss: 0.0941 - f1_score: 0.9753 - val_loss: 2.0716 - val_f1_score: 0.6451
Epoch 326/500
28/28 [=====] - 1s 48ms/step - loss: 0.1100 - f1_score: 0.9722 - val_loss: 1.8309 - val_f1_score: 0.6862
Epoch 327/500
28/28 [=====] - 1s 48ms/step - loss: 0.1109 - f1_score: 0.9758 - val_loss: 1.8107 - val_f1_score: 0.7007
Epoch 328/500
28/28 [=====] - 1s 46ms/step - loss: 0.0934 - f1_score: 0.9789 - val_loss: 1.9327 - val_f1_score: 0.6425
Epoch 329/500
28/28 [=====] - 1s 47ms/step - loss: 0.0851 - f1_score: 0.9813 - val_loss: 1.8271 - val_f1_score: 0.6886
Epoch 330/500
28/28 [=====] - 1s 49ms/step - loss: 0.1055 - f1_score: 0.9758 - val_loss: 1.9114 - val_f1_score: 0.6771
Epoch 331/500
28/28 [=====] - 1s 46ms/step - loss: 0.1046 - f1_score: 0.9774 - val_loss: 1.9353 - val_f1_score: 0.6854
Epoch 332/500
28/28 [=====] - 1s 45ms/step - loss: 0.0943 - f1_score: 0.9791 - val_loss: 1.7734 - val_f1_score: 0.7021
Epoch 333/500
28/28 [=====] - 1s 45ms/step - loss: 0.0990 - f1_score: 0.9802 - val_loss: 1.9219 - val_f1_score: 0.6764
Epoch 334/500
28/28 [=====] - 1s 45ms/step - loss: 0.1068 - f1_score: 0.9779 - val_loss: 1.8440 - val_f1_score: 0.7096
Epoch 335/500
28/28 [=====] - 1s 46ms/step - loss: 0.1109 - f1_score: 0.9763 - val_loss: 1.9484 - val_f1_score: 0.7108
Epoch 336/500
28/28 [=====] - 1s 45ms/step - loss: 0.1115 - f1_score: 0.9729 - val_loss: 1.7687 - val_f1_score: 0.7058
Epoch 337/500
28/28 [=====] - 1s 46ms/step - loss: 0.0858 - f1_score: 0.9840 - val_loss: 1.8176 - val_f1_score: 0.7005
Epoch 338/500
28/28 [=====] - 1s 50ms/step - loss: 0.0817 - f1_score: 0.9880 - val_loss: 1.8456 - val_f1_score: 0.7101
Epoch 339/500
28/28 [=====] - 1s 45ms/step - loss: 0.1017 - f1_score: 0.9789 - val_loss: 2.0383 - val_f1_score: 0.6705
Epoch 340/500
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28/28 [=====] - 1s 46ms/step - loss: 0.0981 - f1_score: 0.9793 - val_loss: 1.9608 - val_f1_score: 0.6949
Epoch 341/500
28/28 [=====] - 1s 45ms/step - loss: 0.0750 - f1_score: 0.9861 - val_loss: 2.0231 - val_f1_score: 0.6700
Epoch 342/500
28/28 [=====] - 1s 45ms/step - loss: 0.0832 - f1_score: 0.9827 - val_loss: 1.8688 - val_f1_score: 0.6850
Epoch 343/500
28/28 [=====] - 1s 46ms/step - loss: 0.0914 - f1_score: 0.9826 - val_loss: 1.8641 - val_f1_score: 0.7010
Epoch 344/500
28/28 [=====] - 1s 46ms/step - loss: 0.0846 - f1_score: 0.9851 - val_loss: 2.0028 - val_f1_score: 0.6817
Epoch 345/500
28/28 [=====] - 1s 45ms/step - loss: 0.1114 - f1_score: 0.9759 - val_loss: 1.9164 - val_f1_score: 0.6795
Epoch 346/500
28/28 [=====] - 1s 50ms/step - loss: 0.0975 - f1_score: 0.9800 - val_loss: 2.0188 - val_f1_score: 0.6882
Epoch 347/500
28/28 [=====] - 1s 45ms/step - loss: 0.1198 - f1_score: 0.9718 - val_loss: 2.0010 - val_f1_score: 0.6912
Epoch 348/500
28/28 [=====] - 1s 45ms/step - loss: 0.0969 - f1_score: 0.9818 - val_loss: 1.8087 - val_f1_score: 0.7016
Epoch 349/500
28/28 [=====] - 1s 46ms/step - loss: 0.0829 - f1_score: 0.9858 - val_loss: 1.8414 - val_f1_score: 0.6807
Epoch 350/500
28/28 [=====] - 1s 47ms/step - loss: 0.0843 - f1_score: 0.9836 - val_loss: 1.7711 - val_f1_score: 0.7177
Epoch 351/500
28/28 [=====] - 1s 46ms/step - loss: 0.0922 - f1_score: 0.9828 - val_loss: 1.8381 - val_f1_score: 0.6786
Epoch 352/500
28/28 [=====] - 1s 45ms/step - loss: 0.0977 - f1_score: 0.9788 - val_loss: 1.9419 - val_f1_score: 0.6699
Epoch 353/500
28/28 [=====] - 1s 45ms/step - loss: 0.0911 - f1_score: 0.9843 - val_loss: 2.0265 - val_f1_score: 0.6817
Epoch 354/500
28/28 [=====] - 1s 51ms/step - loss: 0.1070 - f1_score: 0.9747 - val_loss: 1.9116 - val_f1_score: 0.6997
Epoch 355/500
28/28 [=====] - 1s 46ms/step - loss: 0.1103 - f1_score: 0.9737 - val_loss: 2.0300 - val_f1_score: 0.6539
Epoch 356/500
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28/28 [=====] - 1s 46ms/step - loss: 0.0999 - f1_score: 0.9772 - val_loss: 1.9794 - val_f1_score: 0.7012
Epoch 357/500
28/28 [=====] - 1s 45ms/step - loss: 0.1040 - f1_score: 0.9778 - val_loss: 1.7748 - val_f1_score: 0.6831
Epoch 358/500
28/28 [=====] - 1s 46ms/step - loss: 0.0879 - f1_score: 0.9838 - val_loss: 1.8661 - val_f1_score: 0.7002
Epoch 359/500
28/28 [=====] - 1s 45ms/step - loss: 0.0795 - f1_score: 0.9861 - val_loss: 2.0513 - val_f1_score: 0.6531
Epoch 360/500
28/28 [=====] - 1s 46ms/step - loss: 0.1002 - f1_score: 0.9774 - val_loss: 1.9596 - val_f1_score: 0.6806
Epoch 361/500
28/28 [=====] - 1s 51ms/step - loss: 0.0984 - f1_score: 0.9809 - val_loss: 2.0153 - val_f1_score: 0.6661
Epoch 362/500
28/28 [=====] - 1s 46ms/step - loss: 0.0876 - f1_score: 0.9791 - val_loss: 1.8703 - val_f1_score: 0.6970
Epoch 363/500
28/28 [=====] - 1s 46ms/step - loss: 0.0772 - f1_score: 0.9864 - val_loss: 2.0111 - val_f1_score: 0.6860
Epoch 364/500
28/28 [=====] - 1s 46ms/step - loss: 0.0625 - f1_score: 0.9908 - val_loss: 1.8989 - val_f1_score: 0.7106
Epoch 365/500
28/28 [=====] - 1s 46ms/step - loss: 0.0863 - f1_score: 0.9820 - val_loss: 1.8546 - val_f1_score: 0.6858
Epoch 366/500
28/28 [=====] - 1s 46ms/step - loss: 0.0917 - f1_score: 0.9814 - val_loss: 1.9818 - val_f1_score: 0.7051
Epoch 367/500
28/28 [=====] - 1s 46ms/step - loss: 0.0913 - f1_score: 0.9839 - val_loss: 1.9677 - val_f1_score: 0.6720
Epoch 368/500
28/28 [=====] - 1s 46ms/step - loss: 0.0991 - f1_score: 0.9798 - val_loss: 2.1255 - val_f1_score: 0.6430
Epoch 369/500
28/28 [=====] - 2s 55ms/step - loss: 0.0928 - f1_score: 0.9831 - val_loss: 1.9645 - val_f1_score: 0.6707
Epoch 370/500
28/28 [=====] - 1s 46ms/step - loss: 0.1054 - f1_score: 0.9772 - val_loss: 1.9791 - val_f1_score: 0.6426
Epoch 371/500
28/28 [=====] - 1s 46ms/step - loss: 0.1018 - f1_score: 0.9796 - val_loss: 2.1525 - val_f1_score: 0.6624
Epoch 372/500
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28/28 [=====] - 1s 46ms/step - loss: 0.1087 - f1_score: 0.9789 - val_loss: 1.8522 - val_f1_score: 0.7103
Epoch 373/500
28/28 [=====] - 1s 52ms/step - loss: 0.1176 - f1_score: 0.9710 - val_loss: 1.9737 - val_f1_score: 0.6892
Epoch 374/500
28/28 [=====] - 1s 46ms/step - loss: 0.0751 - f1_score: 0.9852 - val_loss: 2.0787 - val_f1_score: 0.6903
Epoch 375/500
28/28 [=====] - 1s 46ms/step - loss: 0.0813 - f1_score: 0.9813 - val_loss: 2.3257 - val_f1_score: 0.6276
Epoch 376/500
28/28 [=====] - 2s 56ms/step - loss: 0.0998 - f1_score: 0.9763 - val_loss: 1.9273 - val_f1_score: 0.6748
Epoch 377/500
28/28 [=====] - 1s 50ms/step - loss: 0.0951 - f1_score: 0.9787 - val_loss: 2.1570 - val_f1_score: 0.6468
Epoch 378/500
28/28 [=====] - 1s 47ms/step - loss: 0.0925 - f1_score: 0.9786 - val_loss: 1.8661 - val_f1_score: 0.6859
Epoch 379/500
28/28 [=====] - 1s 45ms/step - loss: 0.0887 - f1_score: 0.9818 - val_loss: 2.0133 - val_f1_score: 0.6703
Epoch 380/500
28/28 [=====] - 1s 46ms/step - loss: 0.0806 - f1_score: 0.9847 - val_loss: 1.9916 - val_f1_score: 0.6693
Epoch 381/500
28/28 [=====] - 1s 46ms/step - loss: 0.0815 - f1_score: 0.9837 - val_loss: 2.1462 - val_f1_score: 0.6794
Epoch 382/500
28/28 [=====] - 1s 45ms/step - loss: 0.0859 - f1_score: 0.9848 - val_loss: 2.1279 - val_f1_score: 0.6642
Epoch 383/500
28/28 [=====] - 1s 49ms/step - loss: 0.0652 - f1_score: 0.9883 - val_loss: 1.9697 - val_f1_score: 0.6797
Epoch 384/500
28/28 [=====] - 1s 50ms/step - loss: 0.0628 - f1_score: 0.9911 - val_loss: 2.1606 - val_f1_score: 0.7041
Epoch 385/500
28/28 [=====] - 1s 46ms/step - loss: 0.0755 - f1_score: 0.9889 - val_loss: 1.9244 - val_f1_score: 0.7190
Epoch 386/500
28/28 [=====] - 1s 45ms/step - loss: 0.0942 - f1_score: 0.9794 - val_loss: 2.2866 - val_f1_score: 0.6167
Epoch 387/500
28/28 [=====] - 1s 46ms/step - loss: 0.0851 - f1_score: 0.9818 - val_loss: 1.9891 - val_f1_score: 0.6959
Epoch 388/500
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28/28 [=====] - 1s 46ms/step - loss: 0.0952 - f1_score: 0.9769 - val_loss: 1.8783 - val_f1_score: 0.7049
Epoch 389/500
28/28 [=====] - 1s 45ms/step - loss: 0.0774 - f1_score: 0.9868 - val_loss: 2.0878 - val_f1_score: 0.6809
Epoch 390/500
28/28 [=====] - 1s 46ms/step - loss: 0.0888 - f1_score: 0.9814 - val_loss: 1.8962 - val_f1_score: 0.7080
Epoch 391/500
28/28 [=====] - 1s 45ms/step - loss: 0.0705 - f1_score: 0.9884 - val_loss: 2.0024 - val_f1_score: 0.6957
Epoch 392/500
28/28 [=====] - 1s 51ms/step - loss: 0.0898 - f1_score: 0.9791 - val_loss: 2.0331 - val_f1_score: 0.6722
Epoch 393/500
28/28 [=====] - 1s 45ms/step - loss: 0.0835 - f1_score: 0.9803 - val_loss: 2.1148 - val_f1_score: 0.6939
Epoch 394/500
28/28 [=====] - 1s 50ms/step - loss: 0.0889 - f1_score: 0.9800 - val_loss: 2.1409 - val_f1_score: 0.6483
Epoch 395/500
28/28 [=====] - 1s 47ms/step - loss: 0.0709 - f1_score: 0.9894 - val_loss: 1.9806 - val_f1_score: 0.6966
Epoch 396/500
28/28 [=====] - 1s 46ms/step - loss: 0.1002 - f1_score: 0.9735 - val_loss: 2.0693 - val_f1_score: 0.6888
Epoch 397/500
28/28 [=====] - 1s 45ms/step - loss: 0.1093 - f1_score: 0.9735 - val_loss: 2.0000 - val_f1_score: 0.6869
Epoch 398/500
28/28 [=====] - 1s 45ms/step - loss: 0.1051 - f1_score: 0.9793 - val_loss: 2.1429 - val_f1_score: 0.6640
Epoch 399/500
28/28 [=====] - 1s 52ms/step - loss: 0.0960 - f1_score: 0.9767 - val_loss: 2.2930 - val_f1_score: 0.6868
Epoch 400/500
28/28 [=====] - 1s 45ms/step - loss: 0.0895 - f1_score: 0.9803 - val_loss: 2.1634 - val_f1_score: 0.6824
Epoch 401/500
28/28 [=====] - 1s 48ms/step - loss: 0.0981 - f1_score: 0.9786 - val_loss: 2.0693 - val_f1_score: 0.6997
Epoch 402/500
28/28 [=====] - 1s 45ms/step - loss: 0.0814 - f1_score: 0.9841 - val_loss: 2.0576 - val_f1_score: 0.6961
Epoch 403/500
28/28 [=====] - 2s 59ms/step - loss: 0.0869 - f1_score: 0.9841 - val_loss: 1.9947 - val_f1_score: 0.6981
Epoch 404/500
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28/28 [=====] - 1s 46ms/step - loss: 0.0917 - f1_score: 0.9784 - val_loss: 2.1419 - val_f1_score: 0.6797
Epoch 405/500
28/28 [=====] - 1s 46ms/step - loss: 0.0859 - f1_score: 0.9817 - val_loss: 2.0304 - val_f1_score: 0.7026
Epoch 406/500
28/28 [=====] - 1s 48ms/step - loss: 0.0772 - f1_score: 0.9853 - val_loss: 2.1938 - val_f1_score: 0.6949
Epoch 407/500
28/28 [=====] - 2s 61ms/step - loss: 0.1036 - f1_score: 0.9762 - val_loss: 1.9864 - val_f1_score: 0.6718
Epoch 408/500
28/28 [=====] - 1s 47ms/step - loss: 0.0864 - f1_score: 0.9808 - val_loss: 2.0436 - val_f1_score: 0.6902
Epoch 409/500
28/28 [=====] - 1s 46ms/step - loss: 0.0915 - f1_score: 0.9801 - val_loss: 2.0409 - val_f1_score: 0.6838
Epoch 410/500
28/28 [=====] - 1s 53ms/step - loss: 0.0779 - f1_score: 0.9854 - val_loss: 2.0519 - val_f1_score: 0.6919
Epoch 411/500
28/28 [=====] - 1s 47ms/step - loss: 0.0629 - f1_score: 0.9902 - val_loss: 2.2405 - val_f1_score: 0.6513
Epoch 412/500
28/28 [=====] - 2s 56ms/step - loss: 0.1096 - f1_score: 0.9738 - val_loss: 2.0627 - val_f1_score: 0.7009
Epoch 413/500
28/28 [=====] - 1s 46ms/step - loss: 0.0775 - f1_score: 0.9852 - val_loss: 2.0526 - val_f1_score: 0.6733
Epoch 414/500
28/28 [=====] - 1s 51ms/step - loss: 0.0892 - f1_score: 0.9797 - val_loss: 1.9637 - val_f1_score: 0.6656
Epoch 415/500
28/28 [=====] - 1s 46ms/step - loss: 0.0903 - f1_score: 0.9795 - val_loss: 2.0156 - val_f1_score: 0.7017
Epoch 416/500
28/28 [=====] - 1s 47ms/step - loss: 0.1018 - f1_score: 0.9783 - val_loss: 2.1808 - val_f1_score: 0.6554
Epoch 417/500
28/28 [=====] - 1s 46ms/step - loss: 0.0912 - f1_score: 0.9818 - val_loss: 2.1507 - val_f1_score: 0.6719
Epoch 418/500
28/28 [=====] - 1s 49ms/step - loss: 0.1016 - f1_score: 0.9764 - val_loss: 2.3880 - val_f1_score: 0.6183
Epoch 419/500
28/28 [=====] - 1s 46ms/step - loss: 0.0853 - f1_score: 0.9837 - val_loss: 2.0558 - val_f1_score: 0.6696
Epoch 420/500
```

```
28/28 [=====] - 1s 49ms/step - loss: 0.1027 - f1_score: 0.9772 - val_loss: 2.3029 - val_f1_score: 0.6614
Epoch 421/500
28/28 [=====] - 1s 51ms/step - loss: 0.1031 - f1_score: 0.9783 - val_loss: 2.0725 - val_f1_score: 0.6535
Epoch 422/500
28/28 [=====] - 1s 46ms/step - loss: 0.0821 - f1_score: 0.9821 - val_loss: 1.9337 - val_f1_score: 0.6670
Epoch 423/500
28/28 [=====] - 1s 48ms/step - loss: 0.0806 - f1_score: 0.9829 - val_loss: 1.9700 - val_f1_score: 0.6853
Epoch 424/500
28/28 [=====] - 1s 47ms/step - loss: 0.0662 - f1_score: 0.9896 - val_loss: 1.9581 - val_f1_score: 0.7009
Epoch 425/500
28/28 [=====] - 1s 49ms/step - loss: 0.0773 - f1_score: 0.9852 - val_loss: 2.0878 - val_f1_score: 0.6966
Epoch 426/500
28/28 [=====] - 1s 47ms/step - loss: 0.0753 - f1_score: 0.9866 - val_loss: 1.9509 - val_f1_score: 0.6868
Epoch 427/500
28/28 [=====] - 1s 50ms/step - loss: 0.0993 - f1_score: 0.9786 - val_loss: 1.9646 - val_f1_score: 0.6920
Epoch 428/500
28/28 [=====] - 1s 51ms/step - loss: 0.0979 - f1_score: 0.9766 - val_loss: 1.9800 - val_f1_score: 0.7074
Epoch 429/500
28/28 [=====] - 1s 51ms/step - loss: 0.0700 - f1_score: 0.9885 - val_loss: 1.9946 - val_f1_score: 0.6556
Epoch 430/500
28/28 [=====] - 1s 50ms/step - loss: 0.0719 - f1_score: 0.9875 - val_loss: 2.1980 - val_f1_score: 0.6497
Epoch 431/500
28/28 [=====] - 2s 56ms/step - loss: 0.0868 - f1_score: 0.9792 - val_loss: 2.0240 - val_f1_score: 0.7043
Epoch 432/500
28/28 [=====] - 1s 52ms/step - loss: 0.0742 - f1_score: 0.9837 - val_loss: 2.1562 - val_f1_score: 0.6757
Epoch 433/500
28/28 [=====] - 1s 50ms/step - loss: 0.0837 - f1_score: 0.9836 - val_loss: 1.8946 - val_f1_score: 0.6998
Epoch 434/500
28/28 [=====] - 1s 50ms/step - loss: 0.0771 - f1_score: 0.9816 - val_loss: 1.8030 - val_f1_score: 0.7051
Epoch 435/500
28/28 [=====] - 2s 63ms/step - loss: 0.0627 - f1_score: 0.9891 - val_loss: 2.3627 - val_f1_score: 0.6480
Epoch 436/500
```

```
28/28 [=====] - 1s 53ms/step - loss: 0.0728 - f1_score: 0.9848 - val_loss: 2.0672 - val_f1_score: 0.7181
Epoch 437/500
28/28 [=====] - 1s 52ms/step - loss: 0.0840 - f1_score: 0.9838 - val_loss: 1.9471 - val_f1_score: 0.6854
Epoch 438/500
28/28 [=====] - 1s 46ms/step - loss: 0.0876 - f1_score: 0.9778 - val_loss: 2.0855 - val_f1_score: 0.6893
Epoch 439/500
28/28 [=====] - 1s 48ms/step - loss: 0.0789 - f1_score: 0.9833 - val_loss: 1.9170 - val_f1_score: 0.7051
Epoch 440/500
28/28 [=====] - 1s 50ms/step - loss: 0.0779 - f1_score: 0.9839 - val_loss: 2.0735 - val_f1_score: 0.6895
Epoch 441/500
28/28 [=====] - 1s 48ms/step - loss: 0.0749 - f1_score: 0.9841 - val_loss: 2.0118 - val_f1_score: 0.6725
Epoch 442/500
28/28 [=====] - 1s 53ms/step - loss: 0.0635 - f1_score: 0.9890 - val_loss: 2.2210 - val_f1_score: 0.6751
Epoch 443/500
28/28 [=====] - 1s 50ms/step - loss: 0.0904 - f1_score: 0.9815 - val_loss: 2.3064 - val_f1_score: 0.6430
Epoch 444/500
28/28 [=====] - 1s 50ms/step - loss: 0.1221 - f1_score: 0.9692 - val_loss: 2.0893 - val_f1_score: 0.6554
Epoch 445/500
28/28 [=====] - 1s 53ms/step - loss: 0.0870 - f1_score: 0.9839 - val_loss: 2.0694 - val_f1_score: 0.7165
Epoch 446/500
28/28 [=====] - 2s 71ms/step - loss: 0.0898 - f1_score: 0.9802 - val_loss: 2.0898 - val_f1_score: 0.6870
Epoch 447/500
28/28 [=====] - 2s 56ms/step - loss: 0.0752 - f1_score: 0.9867 - val_loss: 2.0065 - val_f1_score: 0.6654
Epoch 448/500
28/28 [=====] - 2s 56ms/step - loss: 0.0965 - f1_score: 0.9774 - val_loss: 2.1836 - val_f1_score: 0.6733
Epoch 449/500
28/28 [=====] - 3s 96ms/step - loss: 0.0968 - f1_score: 0.9791 - val_loss: 2.0155 - val_f1_score: 0.6937
Epoch 450/500
28/28 [=====] - 2s 74ms/step - loss: 0.0856 - f1_score: 0.9771 - val_loss: 1.9881 - val_f1_score: 0.6755
Epoch 451/500
28/28 [=====] - 2s 64ms/step - loss: 0.0768 - f1_score: 0.9843 - val_loss: 1.9516 - val_f1_score: 0.6791
Epoch 452/500
```

```
28/28 [=====] - 2s 60ms/step - loss: 0.0776 - f1_score: 0.9827 - val_loss: 2.0388 - val_f1_score: 0.7035
Epoch 453/500
28/28 [=====] - 1s 53ms/step - loss: 0.0828 - f1_score: 0.9792 - val_loss: 2.0324 - val_f1_score: 0.6759
Epoch 454/500
28/28 [=====] - 2s 55ms/step - loss: 0.1020 - f1_score: 0.9774 - val_loss: 2.2051 - val_f1_score: 0.6360
Epoch 455/500
28/28 [=====] - 2s 57ms/step - loss: 0.0761 - f1_score: 0.9834 - val_loss: 2.2875 - val_f1_score: 0.6904
Epoch 456/500
28/28 [=====] - 2s 54ms/step - loss: 0.0964 - f1_score: 0.9747 - val_loss: 1.9200 - val_f1_score: 0.7013
Epoch 457/500
28/28 [=====] - 2s 56ms/step - loss: 0.0917 - f1_score: 0.9774 - val_loss: 1.9331 - val_f1_score: 0.6861
Epoch 458/500
28/28 [=====] - 2s 54ms/step - loss: 0.1064 - f1_score: 0.9716 - val_loss: 2.0125 - val_f1_score: 0.6901
Epoch 459/500
28/28 [=====] - 1s 52ms/step - loss: 0.0635 - f1_score: 0.9894 - val_loss: 1.8444 - val_f1_score: 0.7046
Epoch 460/500
28/28 [=====] - 2s 58ms/step - loss: 0.0580 - f1_score: 0.9927 - val_loss: 1.9606 - val_f1_score: 0.6820
Epoch 461/500
28/28 [=====] - 1s 46ms/step - loss: 0.0690 - f1_score: 0.9864 - val_loss: 1.8414 - val_f1_score: 0.7168
Epoch 462/500
28/28 [=====] - 1s 46ms/step - loss: 0.0768 - f1_score: 0.9830 - val_loss: 1.9672 - val_f1_score: 0.7027
Epoch 463/500
28/28 [=====] - 1s 45ms/step - loss: 0.0675 - f1_score: 0.9873 - val_loss: 1.9113 - val_f1_score: 0.6894
Epoch 464/500
28/28 [=====] - 1s 45ms/step - loss: 0.0694 - f1_score: 0.9862 - val_loss: 1.9510 - val_f1_score: 0.7030
Epoch 465/500
28/28 [=====] - 1s 45ms/step - loss: 0.0721 - f1_score: 0.9884 - val_loss: 1.8554 - val_f1_score: 0.6996
Epoch 466/500
27/28 [=====>..] - ETA: 0s - loss: 0.0708 - f1_score: 0.9868
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 487ms/step - loss: 0.0723 - f1_score: 0.9864 - val_loss: 1.7508 - val_f1_score: 0.7237
Epoch 467/500
28/28 [=====] - 1s 45ms/step - loss: 0.0664 - f1_score: 0.9884 - val_loss: 2.1435 - val_f1_score: 0.7025
Epoch 468/500
28/28 [=====] - 1s 48ms/step - loss: 0.0603 - f1_score: 0.9894 - val_loss: 1.8909 - val_f1_score: 0.7096
Epoch 469/500
28/28 [=====] - 1s 46ms/step - loss: 0.0520 - f1_score: 0.9922 - val_loss: 2.0262 - val_f1_score: 0.6963
Epoch 470/500
28/28 [=====] - 1s 45ms/step - loss: 0.0648 - f1_score: 0.9873 - val_loss: 2.1175 - val_f1_score: 0.6814
Epoch 471/500
28/28 [=====] - 1s 45ms/step - loss: 0.0750 - f1_score: 0.9864 - val_loss: 1.8964 - val_f1_score: 0.7171
Epoch 472/500
28/28 [=====] - 1s 47ms/step - loss: 0.0707 - f1_score: 0.9864 - val_loss: 2.0560 - val_f1_score: 0.6959
Epoch 473/500
28/28 [=====] - 1s 50ms/step - loss: 0.0844 - f1_score: 0.9807 - val_loss: 1.9081 - val_f1_score: 0.7029
Epoch 474/500
28/28 [=====] - 1s 48ms/step - loss: 0.0778 - f1_score: 0.9852 - val_loss: 1.9529 - val_f1_score: 0.7112
Epoch 475/500
28/28 [=====] - 1s 44ms/step - loss: 0.0928 - f1_score: 0.9807 - val_loss: 1.9902 - val_f1_score: 0.6801
Epoch 476/500
28/28 [=====] - 1s 45ms/step - loss: 0.0600 - f1_score: 0.9881 - val_loss: 2.0084 - val_f1_score: 0.6943
Epoch 477/500
28/28 [=====] - 1s 44ms/step - loss: 0.0839 - f1_score: 0.9780 - val_loss: 1.9006 - val_f1_score: 0.6769
Epoch 478/500
28/28 [=====] - 1s 44ms/step - loss: 0.0746 - f1_score: 0.9845 - val_loss: 2.1463 - val_f1_score: 0.6532
Epoch 479/500
28/28 [=====] - 1s 46ms/step - loss: 0.0693 - f1_score: 0.9846 - val_loss: 2.0125 - val_f1_score: 0.6723
Epoch 480/500
27/28 [=====>..] - ETA: 0s - loss: 0.0840 - f1_score:
```

0.9826

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 [=====] - 1s 397ms/step - loss: 0.0846 -  
f1\_score: 0.9828 - val\_loss: 1.8662 - val\_f1\_score: 0.7381  
Epoch 481/500

28/28 [=====] - 1s 44ms/step - loss: 0.0732 - f1\_score:  
0.9843 - val\_loss: 1.9357 - val\_f1\_score: 0.6882  
Epoch 482/500

28/28 [=====] - 1s 44ms/step - loss: 0.0705 - f1\_score:  
0.9899 - val\_loss: 2.0426 - val\_f1\_score: 0.6763  
Epoch 483/500

28/28 [=====] - 1s 45ms/step - loss: 0.0588 - f1\_score:  
0.9923 - val\_loss: 2.1107 - val\_f1\_score: 0.6805  
Epoch 484/500

28/28 [=====] - 1s 46ms/step - loss: 0.0686 - f1\_score:  
0.9857 - val\_loss: 2.1499 - val\_f1\_score: 0.6887  
Epoch 485/500

28/28 [=====] - 1s 46ms/step - loss: 0.0732 - f1\_score:  
0.9834 - val\_loss: 2.0775 - val\_f1\_score: 0.7069  
Epoch 486/500

28/28 [=====] - 1s 44ms/step - loss: 0.0605 - f1\_score:  
0.9888 - val\_loss: 1.9203 - val\_f1\_score: 0.7226  
Epoch 487/500

28/28 [=====] - 1s 46ms/step - loss: 0.0923 - f1\_score:  
0.9762 - val\_loss: 1.9504 - val\_f1\_score: 0.7002  
Epoch 488/500

28/28 [=====] - 1s 45ms/step - loss: 0.0756 - f1\_score:  
0.9841 - val\_loss: 1.9930 - val\_f1\_score: 0.7309  
Epoch 489/500

28/28 [=====] - 1s 50ms/step - loss: 0.0737 - f1\_score:  
0.9854 - val\_loss: 2.1295 - val\_f1\_score: 0.6767  
Epoch 490/500

28/28 [=====] - 1s 47ms/step - loss: 0.0936 - f1\_score:  
0.9797 - val\_loss: 2.0578 - val\_f1\_score: 0.6972  
Epoch 491/500

28/28 [=====] - 1s 44ms/step - loss: 0.0961 - f1\_score:  
0.9782 - val\_loss: 1.8869 - val\_f1\_score: 0.6911  
Epoch 492/500

28/28 [=====] - 1s 45ms/step - loss: 0.0865 - f1\_score:  
0.9780 - val\_loss: 1.9830 - val\_f1\_score: 0.6876  
Epoch 493/500

```

28/28 [=====] - 1s 45ms/step - loss: 0.0823 - f1_score: 0.9823 - val_loss: 1.9164 - val_f1_score: 0.7010
Epoch 494/500
28/28 [=====] - 1s 44ms/step - loss: 0.0713 - f1_score: 0.9866 - val_loss: 1.9268 - val_f1_score: 0.7079
Epoch 495/500
28/28 [=====] - 1s 45ms/step - loss: 0.0647 - f1_score: 0.9881 - val_loss: 1.9315 - val_f1_score: 0.6991
Epoch 496/500
28/28 [=====] - 1s 47ms/step - loss: 0.0659 - f1_score: 0.9865 - val_loss: 1.9292 - val_f1_score: 0.7159
Epoch 497/500
28/28 [=====] - 1s 45ms/step - loss: 0.0615 - f1_score: 0.9895 - val_loss: 2.0967 - val_f1_score: 0.7043
Epoch 498/500
28/28 [=====] - 1s 49ms/step - loss: 0.0714 - f1_score: 0.9871 - val_loss: 2.1792 - val_f1_score: 0.6707
Epoch 499/500
28/28 [=====] - 1s 51ms/step - loss: 0.0861 - f1_score: 0.9779 - val_loss: 2.0363 - val_f1_score: 0.6441
Epoch 500/500
28/28 [=====] - 1s 44ms/step - loss: 0.0820 - f1_score: 0.9817 - val_loss: 2.3933 - val_f1_score: 0.6431

```

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

	precision	recall	f1-score	support
AXE	1.000	1.000	1.000	8
BACKPACK	0.429	0.500	0.462	6
BASKETBALL	0.909	1.000	0.952	10
BEE	0.667	0.200	0.308	10
BELT	0.571	1.000	0.727	4
BITE	0.500	0.375	0.429	8
BREAKFAST	0.385	0.833	0.526	6
CANCER	1.000	0.750	0.857	8
CHRISTMAS	1.000	1.000	1.000	6
CONFUSED	0.600	0.500	0.545	6
DARK	1.000	1.000	1.000	4
DEAF	0.200	0.167	0.182	6
DECIDE	1.000	0.333	0.500	6
DEMAND	1.000	0.625	0.769	8
DEVELOP	0.571	0.667	0.615	6

DINNER	0.857	0.750	0.800	8
DOG	0.500	0.333	0.400	6
DOWNSIZE	0.800	1.000	0.889	8
DRAG	0.400	0.500	0.444	4
EAT	1.000	0.667	0.800	6
EDIT	1.000	1.000	1.000	6
ELEVATOR	0.444	0.500	0.471	8
FINE	0.182	0.500	0.267	4
FLOAT	0.333	0.250	0.286	4
FOREIGNER	0.500	0.833	0.625	6
GUESS	1.000	0.875	0.933	8
HALLOWEEN	0.889	1.000	0.941	8
HOSPITAL	0.667	0.667	0.667	6
HURDLE/TRIP	0.333	0.500	0.400	4
JEWELRY	0.667	0.500	0.571	4
KNIGHT	1.000	0.500	0.667	4
LOCK	0.600	0.375	0.462	8
LUNCH	1.000	0.500	0.667	8
MAPLE	1.000	0.750	0.857	4
MEAT	0.400	0.333	0.364	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	0.800	1.000	0.889	8
MOVIE	0.444	1.000	0.615	8
NOON	1.000	1.000	1.000	8
PARTY	0.667	0.750	0.706	8
PATIENT	0.143	0.167	0.154	6
RAZOR	1.000	0.250	0.400	4
RIVER	0.833	0.833	0.833	6
ROCKINGCHAIR	1.000	0.750	0.857	8
SHAVE	0.818	0.900	0.857	10
SINK	1.000	0.333	0.500	6
SQUEEZE	0.000	0.000	0.000	4
THEY	0.500	1.000	0.667	4
TWINS	0.429	0.750	0.545	8
WHATFOR	1.000	0.600	0.750	10
accuracy			0.670	324
macro avg	0.701	0.652	0.643	324
weighted avg	0.724	0.670	0.665	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))
```

```
[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)
```

```
[140]: hist_df = pd.read_csv('2 1DCNN + 1 LSTM/history.csv', index_col=0)
hist_df.tail()
```

```
[140]:      loss  f1_score  val_loss  val_f1_score
495  0.065869  0.986549  1.929171      0.715875
496  0.061536  0.989471  2.096670      0.704284
497  0.071398  0.987126  2.179244      0.670726
498  0.086115  0.977866  2.036255      0.644118
499  0.081999  0.981726  2.393304      0.643122
```

```
[141]: # 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]
```

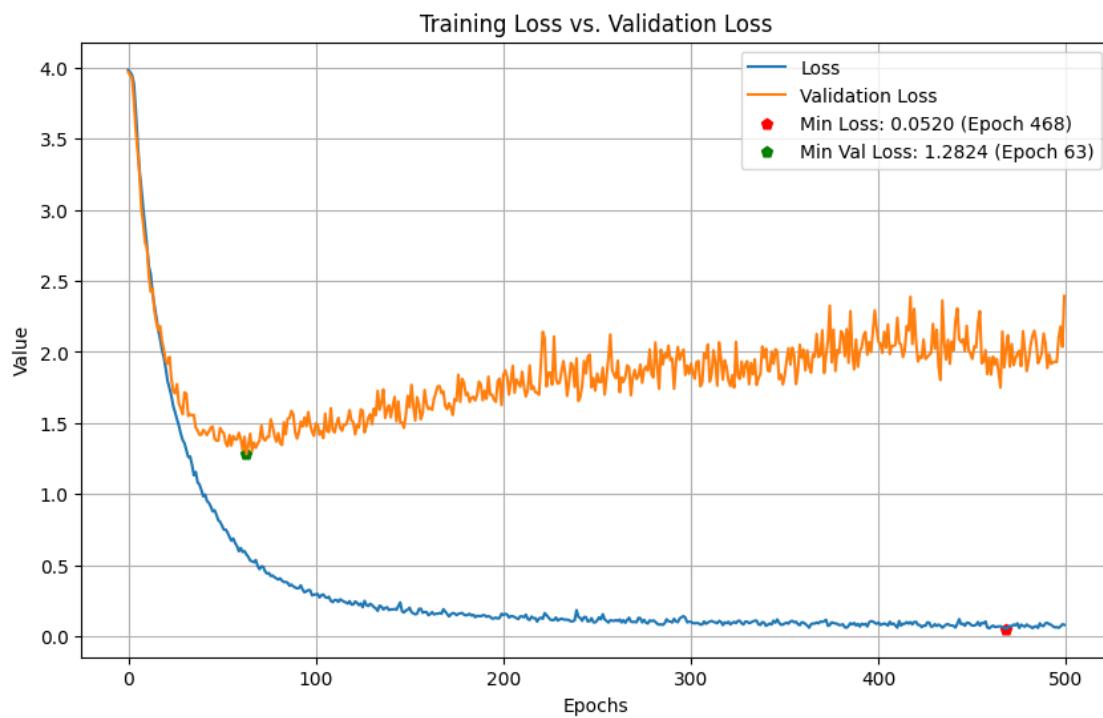
```
# Plotting
epochs = range(0, 500)
plt.figure(figsize=(10, 6))
plt.plot(epochs, hist_df.loss, label='Loss')
plt.plot(epochs, hist_df.val_loss, label='Validation Loss')
plt.scatter(min_loss_epoch,
            min_loss,
            c='red',
            marker='p',
            label=f'Min Loss: {min_loss:.4f} (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()

```



```

[142]: # 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,

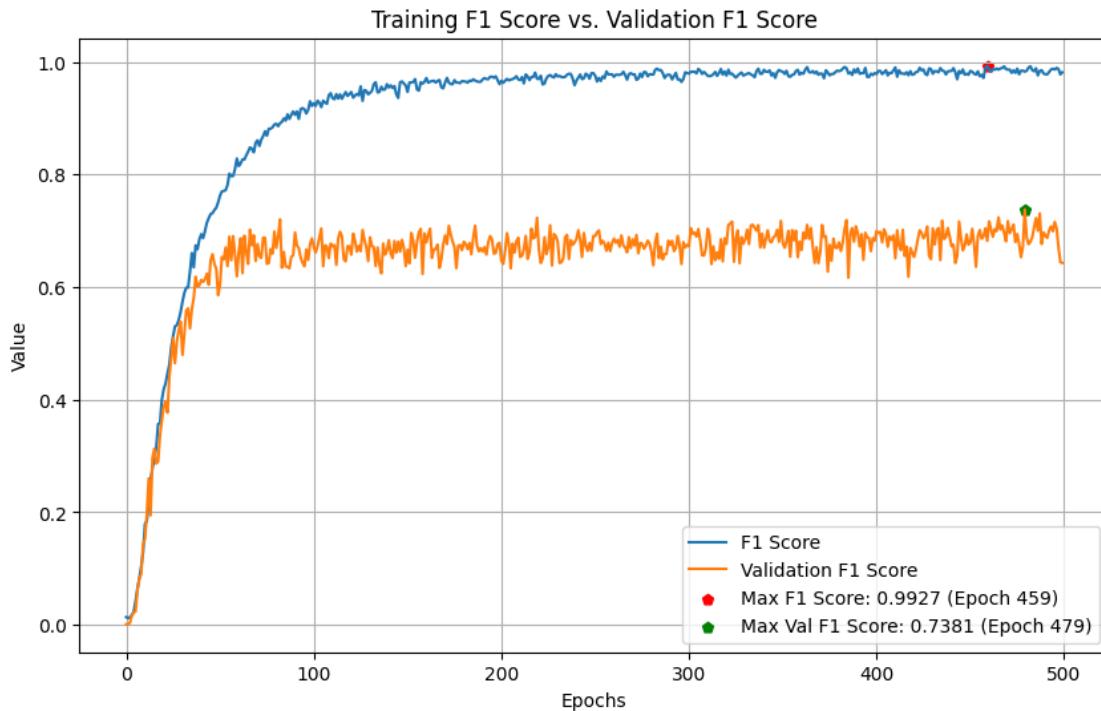
```

```

        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 LSTM")

[139]: reconstructed\_model.summary()

Model: "sequential\_2"

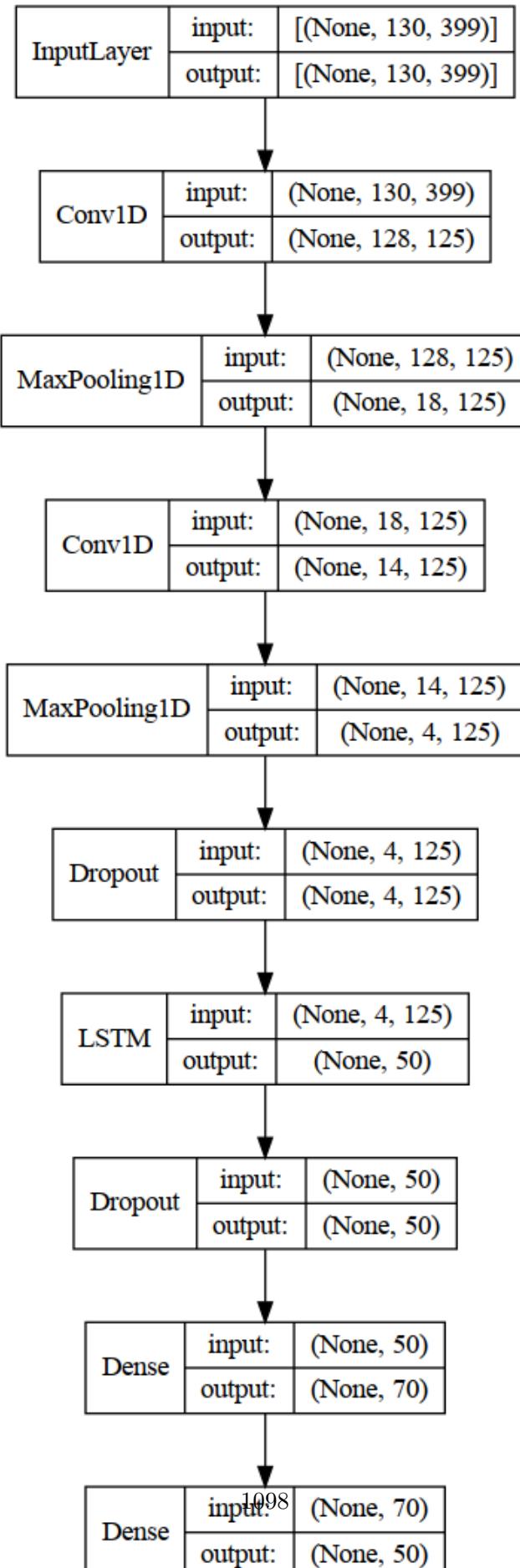
Layer (type)	Output Shape	Param #
		1096

```
=====
conv1d_4 (Conv1D)           (None, 128, 125)      149750
max_pooling1d_4 (MaxPooling 1D) (None, 18, 125)    0
conv1d_5 (Conv1D)           (None, 14, 125)       78250
max_pooling1d_5 (MaxPooling 1D) (None, 4, 125)     0
dropout_4 (Dropout)         (None, 4, 125)        0
lstm_2 (LSTM)               (None, 50)            35200
dropout_5 (Dropout)         (None, 50)            0
dense_4 (Dense)             (None, 70)            3570
dense_5 (Dense)             (None, 50)            3550
=====

Total params: 270,320
Trainable params: 270,320
Non-trainable params: 0
```

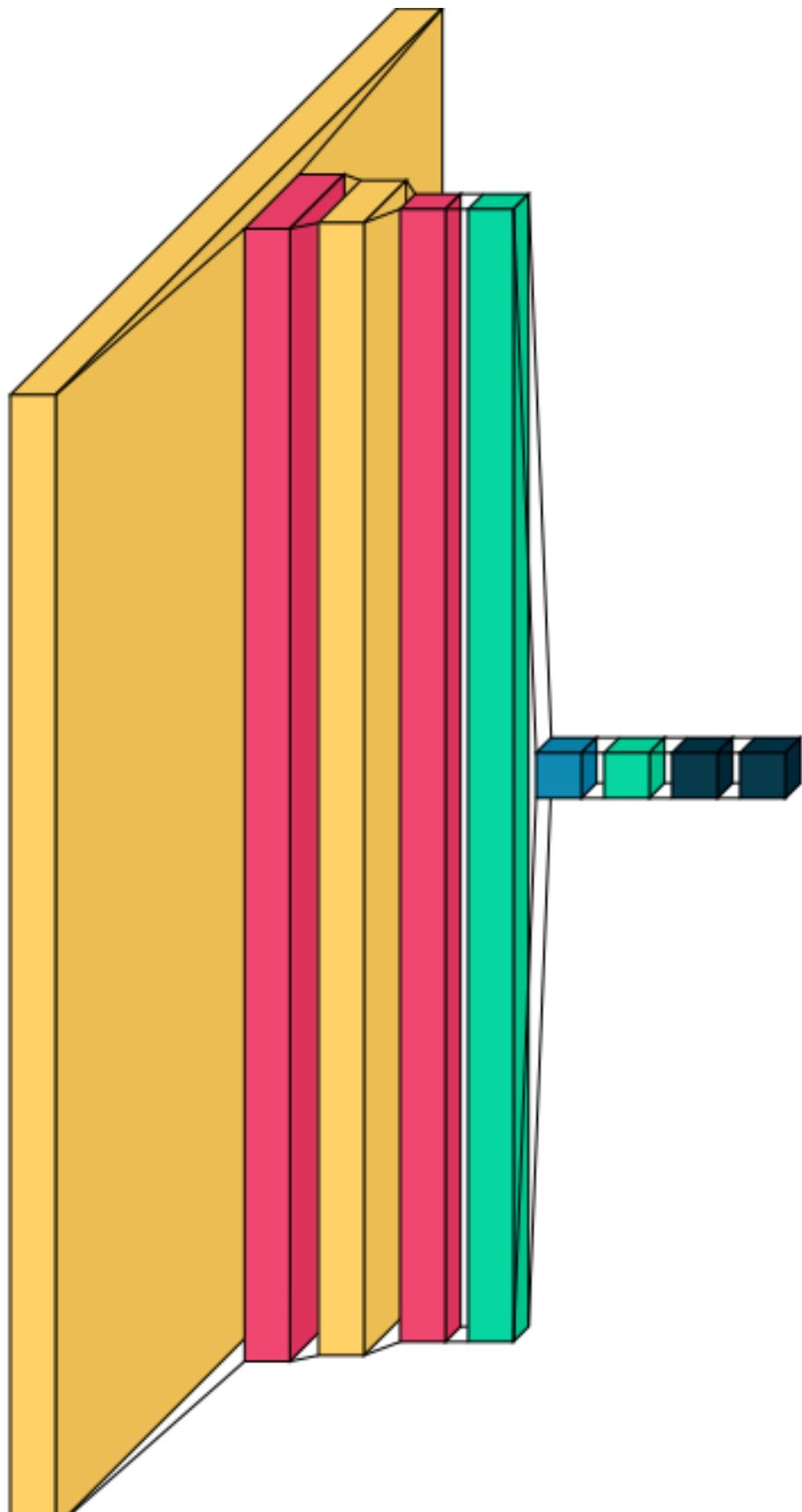
```
[140]: plot_model(reconstructed_model, show_shapes=True, show_layer_names=False)
```

```
[140]:
```



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

```
[141]:
```



Yellow Box: Conv1D   Pink Box: MaxPooling1D  
Green Box: Dropout   Blue Box: LSTM

Dark Blue Box: Dense

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

11/11 [=====] - 1s 12ms/step - loss: 1.8662 - f1_score: 0.7381
```

[142]: [1.8662282228469849, 0.7380902171134949]

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

2023-09-23 17:48:32.684997: W tensorflow/core/framework/cpu\_allocator\_impl.cc:82] Allocation of 555216480 exceeds 10% of free system memory.

```
84/84 [=====] - 1s 10ms/step - loss: 0.0281 - f1_score: 1.0000
```

[143]: [0.028070375323295593, 1.0]

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

	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	0.625	0.500	0.556	10
BELT	1.000	1.000	1.000	4
BITE	0.857	0.750	0.800	8
BREAKFAST	0.750	0.500	0.600	6
CANCER	1.000	0.875	0.933	8
CHRISTMAS	1.000	0.833	0.909	6
CONFUSED	0.667	1.000	0.800	6
DARK	1.000	1.000	1.000	4
DEAF	0.571	0.667	0.615	6
DECIDE	1.000	0.667	0.800	6
DEMAND	0.800	0.500	0.615	8
DEVELOP	0.750	0.500	0.600	6
DINNER	1.000	0.875	0.933	8
DOG	0.333	0.167	0.222	6
DOWNSIZE	0.800	1.000	0.889	8
DRAG	0.667	0.500	0.571	4
EAT	0.625	0.833	0.714	6

EDIT	1.000	1.000	1.000	6
ELEVATOR	0.571	0.500	0.533	8
FINE	0.667	0.500	0.571	4
FLOAT	0.667	0.500	0.571	4
FOREIGNER	0.714	0.833	0.769	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	0.333	0.500	0.400	4
JEWELRY	1.000	0.500	0.667	4
KNIGHT	0.667	0.500	0.571	4
LOCK	0.444	0.500	0.471	8
LUNCH	0.857	0.750	0.800	8
MAPLE	1.000	0.750	0.857	4
MEAT	1.000	0.833	0.909	6
MECHANIC	1.000	1.000	1.000	4
MICROSCOPE	0.889	1.000	0.941	8
MOVIE	0.600	0.750	0.667	8
NOON	1.000	1.000	1.000	8
PARTY	0.750	0.750	0.750	8
PATIENT	0.333	0.333	0.333	6
RAZOR	0.333	0.500	0.400	4
RIVER	0.857	1.000	0.923	6
ROCKINGCHAIR	0.571	1.000	0.727	8
SHAVE	0.750	0.600	0.667	10
SINK	0.400	0.333	0.364	6
SQUEEZE	1.000	0.500	0.667	4
THEY	0.667	1.000	0.800	4
TWINS	0.636	0.875	0.737	8
WHATFOR	0.750	0.900	0.818	10
accuracy			0.753	324
macro avg	0.767	0.738	0.738	324
weighted avg	0.770	0.753	0.748	324

## 5 Test in Custom Dataset

```
[124]: 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

from sklearn.preprocessing import OrdinalEncoder
from keras.utils import to_categorical

import matplotlib.pyplot as plt
import numpy as np

```

```

[146]: 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)

```

```

[147]: 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)
```

```
[125]: inferencer = Pose2DIInferencer(  
        device='cuda',  
        model='cspnext-m_udp_8xb64-210e_coco-wholebody-256x192',  
        det_model='yolox_tiny_8x8_300e_coco',  
        det_cat_ids=[0], # the category id of 'human' class  
)
```

09/23 17:59:39 - 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/cspnext-m\\_udp-coco-wholebody\\_pt-in1k\\_210e-256x192-320fa258\\_20230123.pth](https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/cspnext-m_udp-coco-wholebody_pt-in1k_210e-256x192-320fa258_20230123.pth)

09/23 17:59:40 - 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/mmdetection/v2.0/yolox/yolox\\_tiny\\_8x8\\_300e\\_coco/yolox\\_tiny\\_8x8\\_300e\\_coco\\_20211124\\_171234-b4047906.pth](https://download.openmmlab.com/mmdetection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171234-b4047906.pth)

```
[126]: 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'  
]
```

```
[127]: label_map = {label: num for num, label in enumerate(words)}
```

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

```
[141]: label_map
```

```
[141]: {'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}
```

```
[142]: signs_df = pd.read_csv('/home/kristian/cct_gdrive/DAP/Signs_DF.csv')
```

```
[143]: signs_df.head()
```

```
[143]:                                     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
```

```
[144]: signs_df.tail()
```

```
[144]:                                     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
```

```
[145]: signs_df.describe()
```

```
[145]:      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
```

```
[146]: 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()

```

[147]: signs\_df.path[1]

[147]: '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]

[63]: sign\_keypoints = np.load(
 "/home/kristian/Capstone/keypoints/Custom\_Dataset/CspNetNext/
→sign\_videos\_keypoints.npy",
 allow\_pickle=True)
sign\_keypoints\_flip = np.load(
 "/home/kristian/Capstone/keypoints/Custom\_Dataset/CspNetNext/
→sign\_videos\_keypoints\_flip.npy",

```

    allow_pickle=True)

print('Sign Keypoints Shape:', sign_keypoints.shape)
print('Sign_FLIP Keypoints Shape:', sign_keypoints_flip.shape)

Sign Keypoints Shape: (250,)
Sign_FLIP Keypoints Shape: (250,)

[64]: max_len = 130

[65]: # 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)

[66]: # 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)

[153]: signs_df['Cat_label'] = signs_df['Gloss'].map(label_map)

[154]: signs_df.tail(20)

[154]:
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
```

```
[155]: sign_labels = signs_df['Cat_label'].to_numpy()
```

```
[156]: sign_labels
```

```
[156]: array([ 0,  0,  0,  0,  0,  1,  1,  1,  1,  1,  2,  2,  2,  2,  2,  2,  3,  3,
   3,  3,  4,  4,  4,  4,  4,  5,  5,  5,  5,  5,  5,  6,  6,  6,  6,  6,
   6,  7,  7,  7,  7,  7,  8,  8,  8,  8,  8,  8,  9,  9,  9,  9,  9,  9,  9,  10,
  10, 10, 10, 10, 11, 11, 11, 11, 11, 11, 12, 12, 12, 12, 12, 12, 13, 13, 13,
  13, 13, 14, 14, 14, 14, 14, 14, 15, 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, 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, 25, 26, 26, 26, 26, 26, 27,
  27, 27, 27, 27, 28, 28, 28, 28, 28, 29, 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, 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])
```

```
[157]: #np.save("/home/kristian/Capstone/keypoints/Custom_Dataset/Mediapipe/
    ↪sign_videos_labels.npy", sign_labels)
```

```
[68]: sign_labels = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/CspNetNext/
    ↪sign_videos_labels.npy"
)
sign_labels_flip = np.load(
    "/home/kristian/Capstone/keypoints/Custom_Dataset/CspNetNext/
    ↪sign_videos_labels.npy"
)
```

```
[69]: 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)

```

```

[70]: 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)

```

```
[85]: reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU")
```

```
[83]: reconstructed_model.evaluate(sign_keypoints, to_categorical(sign_labels, 50))
```

```
8/8 [=====] - 0s 9ms/step - loss: 2.2993 - f1_score: 0.4926
```

```
[83]: [2.2993221282958984, 0.49258917570114136]
```

```

[84]: print(
    classification_report(sign_labels,
                          np.argmax(
                              reconstructed_model.predict(sign_keypoints),
                              axis=1),
                          digits=3,
                          target_names=label_map))

```

	precision	recall	f1-score	support
AXE	0.800	0.800	0.800	5
BACKPACK	0.083	0.200	0.118	5
BASKETBALL	0.667	0.400	0.500	5
BEE	0.625	1.000	0.769	5

BELT	1.000	0.800	0.889	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	0.714	1.000	0.833	5
CONFUSED	0.500	0.400	0.444	5
DARK	0.833	1.000	0.909	5
DEAF	1.000	1.000	1.000	5
DECIDE	0.714	1.000	0.833	5
DEMAND	0.000	0.000	0.000	5
DEVELOP	0.000	0.000	0.000	5
DINNER	0.833	1.000	0.909	5
DOG	0.833	1.000	0.909	5
DOWNSIZE	0.000	0.000	0.000	5
DRAG	0.000	0.000	0.000	5
EAT	1.000	0.800	0.889	5
EDIT	0.500	0.600	0.545	5
ELEVATOR	0.667	0.400	0.500	5
FINE	0.000	0.000	0.000	5
FLOAT	0.833	1.000	0.909	5
FOREIGNER	0.714	1.000	0.833	5
GUESS	1.000	0.800	0.889	5
HALLOWEEN	0.444	0.800	0.571	5
HOSPITAL	0.500	0.800	0.615	5
HURDLE/TRIP	1.000	0.600	0.750	5
JEWELRY	1.000	0.600	0.750	5
KNIGHT	0.286	0.400	0.333	5
LOCK	0.000	0.000	0.000	5
LUNCH	0.750	0.600	0.667	5
MAPLE	0.500	0.400	0.444	5
MEAT	1.000	0.800	0.889	5
MECHANIC	0.500	0.600	0.545	5
MICROSCOPE	0.167	1.000	0.286	5
MOVIE	0.000	0.000	0.000	5
NOON	0.571	0.800	0.667	5
PARTY	0.250	0.200	0.222	5
PATIENT	0.833	1.000	0.909	5
RAZOR	0.200	0.200	0.200	5
RIVER	1.000	0.600	0.750	5
ROCKINGCHAIR	1.000	0.600	0.750	5
SHAVE	0.000	0.000	0.000	5
SINK	0.000	0.000	0.000	5
SQUEEZE	0.000	0.000	0.000	5
THEY	0.500	0.600	0.545	5
TWINS	0.500	1.000	0.667	5
WHATFOR	0.417	1.000	0.588	5
accuracy		0.536	250	

macro avg	0.495	0.536	0.493	250
weighted avg	0.495	0.536	0.493	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))
```

## 6 Realtime Implementation

```
[129]: 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
```

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

```
[131]: from pickle import load
import time

scaler = load(open('scaler.pkl', 'rb'))
reconstructed_model = tf.keras.models.load_model("2 1DCNN + 1 GRU")
#reconstructed_model = tf.keras.models.load_model("2 1D-CNN + 1 GRU Trial 698")
```

2023-09-23 18:00:10.237450: 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 18:00:10.239074: I tensorflow/core/common\_runtime/gpu/gpu\_device.cc:1616] Created device /job:localhost/replica:0/task:0/device:GPU:0 with 1557 MB memory: -> device: 0, name: NVIDIA GeForce MX250, pci bus id: 0000:01:00.0, compute capability: 6.1

```
[132]: inferencer = Pose2DIInferencer(
    device='cuda',
    model='cspnext-m_udp_8xb64-210e_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/cspnext-m\\_udp-coco-wholebody\\_pt-in1k\\_210e-256x192-320fa258\\_20230123.pth](https://download.openmmlab.com/mmpose/v1/projects/rtmposev1/cspnext-m_udp-coco-wholebody_pt-in1k_210e-256x192-320fa258_20230123.pth)  
Loads checkpoint by http backend from path: [https://download.openmmlab.com/mmdetection/v2.0/yolox/yolox\\_tiny\\_8x8\\_300e\\_coco/yolox\\_tiny\\_8x8\\_300e\\_coco\\_20211124\\_171234-b4047906.pth](https://download.openmmlab.com/mmdetection/v2.0/yolox/yolox_tiny_8x8_300e_coco/yolox_tiny_8x8_300e_coco_20211124_171234-b4047906.pth)

```
[133]: 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'
]
```

```
[134]: label_map = {label: num for num, label in enumerate(words)}
```

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

```
[149]: tf.random.set_seed(5)
tf.keras.utils.set_random_seed(5)

[150]: 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.")

```

```

[151]: #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("CSPNext 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: 0.13 seconds

[ ]: cap.release()  
cv2.destroyAllWindows()

[66]: import matplotlib.pyplot as plt  
import numpy as np

```

time_intervals = [i / fps for i in range(len(inference_times))]

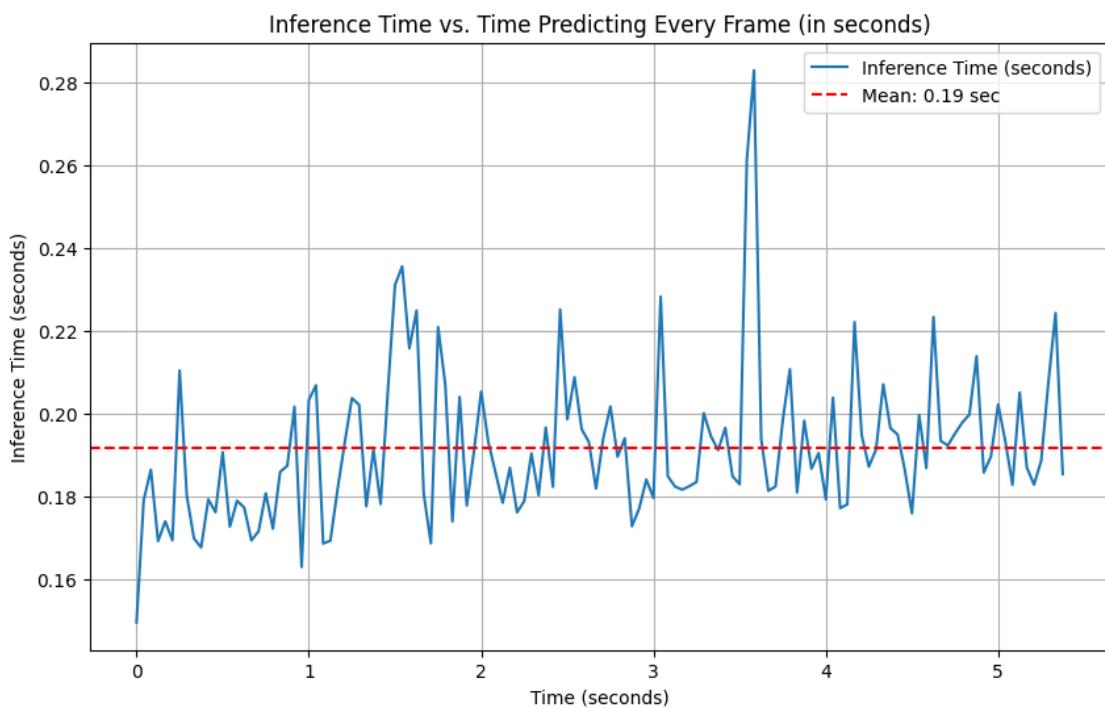
mean_inference_time = np.mean(inference_times)

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 Frame (in seconds)')
plt.grid()
plt.show()

```



```

[64]: import matplotlib.pyplot as plt
import numpy as np

time_intervals = [i / fps for i in range(len(inference_times))]

```

```

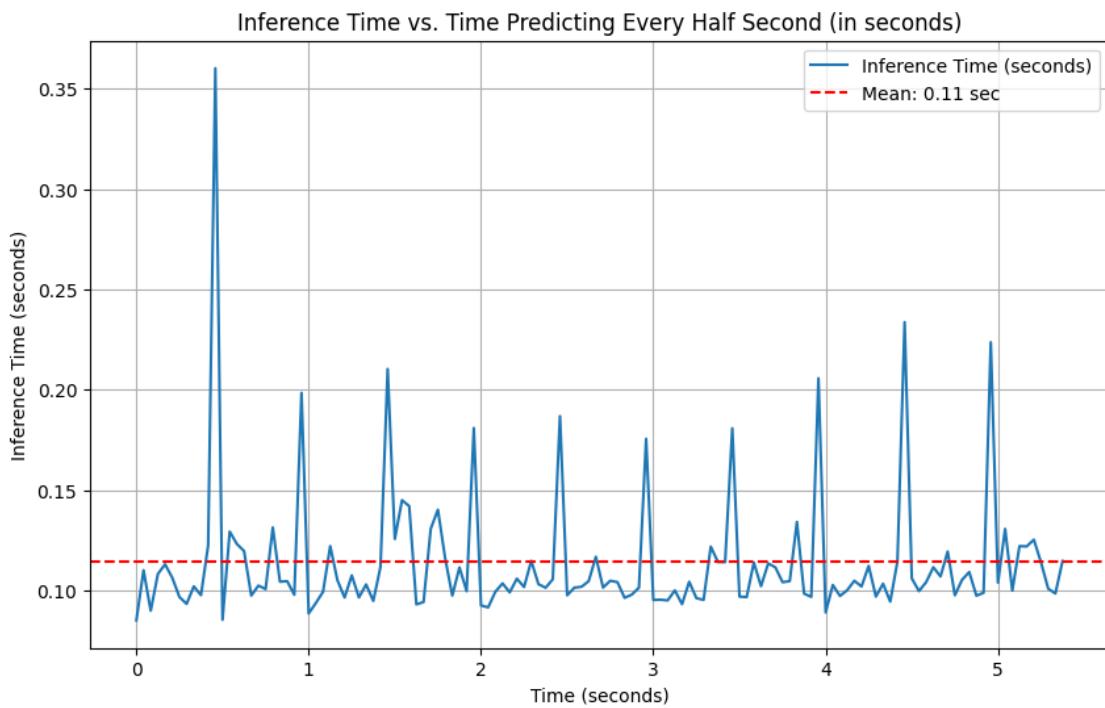
mean_inference_time = np.mean(inference_times)

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()

```



[ ]: