Assignment_3_Ahmad_Sayeb

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0.0.1 AIDI 1002 Assignment 3

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[167]:
```
# ---------------- Libraries-----------------
import pandas as pd
import numpy as np
# ---------------- Plotting-----------------
import matplotlib.pyplot as plt
import seaborn as sns
# ---------------- Sklearn libraries---------
from sklearn.model_selection import train_test_split
from sklearn.preprocessing import LabelEncoder
from sklearn.preprocessing import OneHotEncoder
from sklearn.preprocessing import MinMaxScaler
from sklearn.metrics import f1_score, accuracy_score, recall_score,␣
 ↪precision_score
from sklearn.metrics import roc_curve,roc_auc_score
from imblearn.over_sampling import SMOTE
# ---------------- Keras---------------------
from tensorflow import keras
from tensorflow.keras.models import Sequential
from tensorflow.keras.layers import Dense, Dropout
from tensorflow.keras.callbacks import EarlyStopping
from keras import regularizers
# ----------------Tensor-flow support--------
import tensorflow_addons as tfa
# -----------------Warnings-----------------
#removing cuda warnings for gpu
import warnings
warnings.filterwarnings('ignore')
```

0.0.3 All the Necessary Functions

[246]:
```
def load_csv(path: str) -> 'dataframe':
    '''
    Loads csv file into dataframe
    path: path to the file
```

```
    '''
    df = pd.read_csv(path)
    return df


def num_col_nan(df: 'dataframe'):
    '''
    replaces nan value in numerical columns with mode
    df: dataframe
    '''

    numerics = ['int16', 'int32', 'int64', 'float16', 'float32', 'float64']
    col_num = df.select_dtypes(include=numerics)

    for col in col_num:
        df[col].replace([np.nan], df[col].mode()[0], inplace=True)


def cat_col_nan(df: 'dataframe'):
    '''
    replace nan value in categorical column with None string
    df: dataframe
    '''

    categorical = ['object']
    cat_columns = df.select_dtypes(include=categorical)

    for col in cat_columns:
        df[col].replace([np.nan], 'None', inplace=True)


def encoder(df: 'dataframe', train=True, only_label=False) -> 'dataframe':
    '''
    label encoding categorical data that are indep variable
    and one hot encode target variables
    df: dataframe
    '''
    label = LabelEncoder()
    categorical = ['object']
    cat_col = df.select_dtypes(include=categorical)
    if train and only_label:
        target_only_label = cat_col[['Var_1']]
        cat_col.drop(columns=['Var_1'], inplace=True)
        for col in cat_col:
            df[col] = label.fit_transform(df[col])
        df.drop(columns=['Var_1'], inplace=True)
        return pd.concat([df, target_only_label], axis=1)
```

```
    if train  and not only_label:
        target = cat_col[['Var_1']]
        cat_col.drop(columns=['Var_1'], inplace=True)

    for col in cat_col:
        df[col] = label.fit_transform(df[col])

    if train and not only_label:
        target = pd.get_dummies(target)
        df.drop(columns=['Var_1'], inplace=True)
        return pd.concat([df, target], axis=1)
    if not train and not only_label:
        return df


def replacing_classes(row: 'object'):
    if row != 'Cat_4' and row != 'Cat_6':
        return 'Other'
    else:
        return row

def drop_cols(cols: list, df: 'dataframe'):
    '''
    drops specified columns
    col: list of columns
    df: dataframe
    '''
    print(f'dropping {cols}...')
    df.drop(columns=cols, inplace=True)


def pre_processing(df: 'dataframe', train=True, only_label=False):
    '''
    performs nan value replacement and encoding categorical values
    '''
    try:
        if train:
            print('dropping columns...')
            drop_cols(['ID', 'Segmentation','Age'], df)
        if not train:
            print('dropping ID column')
            drop_cols(['ID','Var_1','Age'], df)
        print('replacing numerical nans with mode...')
        num_col_nan(df)
        print('replacing categorical nans with None string...')
        cat_col_nan(df)
```

```
        if train:
            print('changing anything otehr than cat_6 and cat_4 to other...')
            df['Var_1'] = df['Var_1'].apply(replacing_classes)
        print('label encoding categorical data...')
        df = encoder(df, train, only_label)
        print('\033[1m' + 'SUCCESSFULLY PERFORMED PREPROCESSING' + '\033[0m')
        return df

    except Exception as e:
        print('error occurred in pre-processing')
        print(e)
        return False


def train_validation_split(val_size: float, df: 'dataframe'):
    '''
    splits dataframe into train and validation and SHUFFLES
    test_size: size of the validation
    df: dataframe
    '''
    # Shuffle is set to true
    # Stratify is set to true
    df_dep = df[['Var_1_Cat_4','Var_1_Cat_6', 'Var_1_Other']]
    df_indep = df.drop(columns=['Var_1_Cat_4','Var_1_Cat_6', 'Var_1_Other'])
    X_train, X_valid, y_train, y_valid = train_test_split(
                                                          df_indep,
                                                          df_dep,
                                                          test_size=val_size,
                                                          shuffle=True,

 ↪stratify=df_dep[['Var_1_Cat_4', 'Var_1_Cat_6', 'Var_1_Other']]
                                                          )

    return X_train, X_valid, y_train, y_valid


def min_max_scaler(df: 'dataframe'):
    '''
    normalize numerical data
    df: dataframe
    '''
    scaler = MinMaxScaler()
    col_num = ['Work_Experience', 'Family_Size']
    df[col_num] = scaler.fit_transform(df[col_num])


def fit_model(X_train: 'dataframe',
```

```
              y_train: 'dataframe',
              X_val: 'dataframe',
              y_val: 'dataframe'
             ):
    '''
    This builds and trains the model
    X_trian: training data
    '''
    model = Sequential()
    model.add(Dense(512, input_shape=(7,)))
    model.add(Dense(256, activation='relu'))
    model.add(Dense(128))
    # dropout for regularization
    model.add(Dropout(0.2))
    model.add(Dense(64, activation='relu'))
    model.add(Dropout(0.35))
    model.add(Dense(16, activation='relu'))
    model.add(Dropout(0.5))
    model.add(Dense(8, activation='relu'))
    model.add(Dense(3, activation='softmax'))
    # metric is accuracy and f1_score
    model.compile(loss='categorical_crossentropy', optimizer='adam',␣
 ↪metrics=[tfa.metrics.F1Score(average='micro', num_classes=3),'accuracy'])
    print(model.summary())

    X_train_array = X_train.values
    y_train_array = y_train.values
    X_val_array = X_val.values
    y_val_array = y_val.values
    # callback to stop training if reverse learning happens
    # Patience is set to 200, stop wont happen before 200 epochs
    callbacks = EarlyStopping(monitor='val_loss', mode='min', patience=200)
    history = model.fit(X_train_array,
                        y_train_array,
                        epochs=500,
                        verbose=1,
                        validation_data=(X_val_array, y_val_array),
                       callbacks=[callbacks])
    return history, model


# Link: https://github.com/vinyluis/Articles/blob/main/
 ↪ROC%20Curve%20and%20ROC%20AUC/ROC%20Curve%20-%20Multiclass.ipynb
def get_all_roc_coordinates(y_real, y_proba):
    '''
    Calculates all the ROC Curve coordinates (tpr and fpr) by considering each␣
 ↪point as a threshold for the predicion of the class.
```

```
    Args:
        y_real: The list or series with the real classes.
        y_proba: The array with the probabilities for each class, obtained by␣
 ↪using the `.predict_proba()` method.

    Returns:
        tpr_list: The list of TPRs representing each threshold.
        fpr_list: The list of FPRs representing each threshold.
    '''
    tpr_list = [0]
    fpr_list = [0]
    for i in range(len(y_proba)):
        threshold = y_proba[i]
        y_pred = y_proba >= threshold
        tpr, fpr = calculate_tpr_fpr(y_real, y_pred)
        tpr_list.append(tpr)
        fpr_list.append(fpr)
    return tpr_list, fpr_list


# Link: https://github.com/vinyluis/Articles/blob/main/
 ↪ROC%20Curve%20and%20ROC%20AUC/ROC%20Curve%20-%20Multiclass.ipynb
def plot_roc_curve(tpr, fpr, scatter = True, ax = None):
    '''
    Plots the ROC Curve by using the list of coordinates (tpr and fpr).

    Args:
        tpr: The list of TPRs representing each coordinate.
        fpr: The list of FPRs representing each coordinate.
        scatter: When True, the points used on the calculation will be plotted␣
 ↪with the line (default = True).
    '''
    if ax == None:
        plt.figure(figsize = (5, 5))
        ax = plt.axes()

    if scatter:
        sns.scatterplot(x = fpr, y = tpr, ax = ax)
    sns.lineplot(x = fpr, y = tpr, ax = ax)
    sns.lineplot(x = [0, 1], y = [0, 1], color = 'green', ax = ax)
    plt.xlim(-0.05, 1.05)
    plt.ylim(-0.05, 1.05)
    plt.xlabel("False Positive Rate")
    plt.ylabel("True Positive Rate")
```

```
# Link: https://github.com/vinyluis/Articles/blob/main/
 ↪ROC%20Curve%20and%20ROC%20AUC/ROC%20Curve%20-%20Multiclass.ipynb
def calculate_tpr_fpr(y_real, y_pred):
    '''
    Calculates the True Positive Rate (tpr) and the True Negative Rate (fpr)␣
 ↪based on real and predicted observations

    Args:
        y_real: The list or series with the real classes
        y_pred: The list or series with the predicted classes

    Returns:
        tpr: The True Positive Rate of the classifier
        fpr: The False Positive Rate of the classifier
    '''

    # Calculates the confusion matrix and recover each element
    cm = confusion_matrix(y_real, y_pred)
    TN = cm[0, 0]
    FP = cm[0, 1]
    FN = cm[1, 0]
    TP = cm[1, 1]

    # Calculates tpr and fpr
    tpr =  TP/(TP + FN) # sensitivity - true positive rate
    fpr = 1 - TN/(TN+FP) # 1-specificity - false positive rate

    return tpr, fpr

def apply_smote(df: 'dataframe') -> 'dataframe':
    '''
    This function applies SMOTE and return dataframe
    '''
    X = df.loc[:, df.columns != "Var_1"]
    y = df[['Var_1']]
    sm = SMOTE(sampling_strategy='auto', k_neighbors=1, random_state=100)
    X_res, y_res = sm.fit_resample(X, y)
    return pd.concat([X_res, y_res], axis=1)
```

0.0.4 All Steps without Dealing Minority with Minority Class

Applying the preprocessing function to the train data. Applying min_max_scaler brought no change to the accuracy, f1_score or recall.Since most of the columns are categorical, normalization only apply to work experience column and it will reduce it importance significantly as the other columsn are values betwen 0 to 4 because of label encoding. This is the reason that I avoided normalization. We also train the model with this pipeline. test_validation_split shuffles the data and uses stratify to include all types of classes in validation set.

[247]:
```
def train_pipeline():
    '''
    performs all the necessary functions for the training
    dataset
    '''
    df = load_csv('archive/train.csv')
    df = pre_processing(df)
    X_train, X_valid, y_train, y_valid = train_validation_split(0.10, df)
    # Removing normalization: Because most of the columns
    # Are categorical and if we normalize the effect of
    # Numerical data will be very low
    # min_max_scaler(X_train)
    # min_max_scaler(X_valid)
    history, model = fit_model(X_train, y_train, X_valid, y_valid)
    return history, model
```

[248]:
```
history, model = train_pipeline()
```

```
dropping columns…
dropping ['ID', 'Segmentation', 'Age']…
replacing numerical nans with mode…
replacing categorical nans with None string…
changing anything otehr than cat_6 and cat_4 to other…
label encoding categorical data…
SUCCESSFULLY PERFORMED PREPROCESSING
Model: "sequential_25"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_175 (Dense)           (None, 512)               4096

 dense_176 (Dense)           (None, 256)               131328

 dense_177 (Dense)           (None, 128)               32896

 dropout_75 (Dropout)        (None, 128)               0

 dense_178 (Dense)           (None, 64)                8256

 dropout_76 (Dropout)        (None, 64)                0

 dense_179 (Dense)           (None, 16)                1040

 dropout_77 (Dropout)        (None, 16)                0

 dense_180 (Dense)           (None, 8)                 136
```

```
 dense_181 (Dense)           (None, 3)                 27

=================================================================
Total params: 177,779
Trainable params: 177,779
Non-trainable params: 0
_________________________________________________________________
None
Epoch 1/500
227/227 [==============================] - 1s 2ms/step - loss: 0.9372 -
f1_score: 0.6356 - accuracy: 0.6354 - val_loss: 0.8709 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 2/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8805 -
f1_score: 0.6480 - accuracy: 0.6480 - val_loss: 0.8568 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 3/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8686 -
f1_score: 0.6488 - accuracy: 0.6488 - val_loss: 0.8576 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 4/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8664 -
f1_score: 0.6485 - accuracy: 0.6485 - val_loss: 0.8652 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 5/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8647 -
f1_score: 0.6494 - accuracy: 0.6494 - val_loss: 0.8515 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 6/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8605 -
f1_score: 0.6502 - accuracy: 0.6502 - val_loss: 0.8530 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 7/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8565 -
f1_score: 0.6502 - accuracy: 0.6502 - val_loss: 0.8519 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 8/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8591 -
f1_score: 0.6540 - accuracy: 0.6540 - val_loss: 0.8526 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 9/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8520 -
f1_score: 0.6528 - accuracy: 0.6528 - val_loss: 0.8510 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 10/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8520 -
f1_score: 0.6535 - accuracy: 0.6535 - val_loss: 0.8474 - val_f1_score: 0.6481 -
val_accuracy: 0.6481
```

```
Epoch 11/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8552 -
f1_score: 0.6529 - accuracy: 0.6529 - val_loss: 0.8539 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 12/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8546 -
f1_score: 0.6509 - accuracy: 0.6509 - val_loss: 0.8442 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 13/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8540 -
f1_score: 0.6513 - accuracy: 0.6513 - val_loss: 0.8442 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 14/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8521 -
f1_score: 0.6531 - accuracy: 0.6531 - val_loss: 0.8444 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 15/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8519 -
f1_score: 0.6543 - accuracy: 0.6543 - val_loss: 0.8474 - val_f1_score: 0.6468 -
val_accuracy: 0.6468
Epoch 16/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8466 -
f1_score: 0.6538 - accuracy: 0.6538 - val_loss: 0.8483 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 17/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8514 -
f1_score: 0.6513 - accuracy: 0.6513 - val_loss: 0.8522 - val_f1_score: 0.6481 -
val_accuracy: 0.6481
Epoch 18/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8530 -
f1_score: 0.6507 - accuracy: 0.6507 - val_loss: 0.8478 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 19/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8475 -
f1_score: 0.6551 - accuracy: 0.6551 - val_loss: 0.8524 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 20/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8493 -
f1_score: 0.6542 - accuracy: 0.6542 - val_loss: 0.8465 - val_f1_score: 0.6468 -
val_accuracy: 0.6468
Epoch 21/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8483 -
f1_score: 0.6547 - accuracy: 0.6547 - val_loss: 0.8571 - val_f1_score: 0.6468 -
val_accuracy: 0.6468
Epoch 22/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8467 -
f1_score: 0.6528 - accuracy: 0.6528 - val_loss: 0.8535 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
```

```
Epoch 23/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8466 -
f1_score: 0.6564 - accuracy: 0.6564 - val_loss: 0.8546 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 24/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8462 -
f1_score: 0.6547 - accuracy: 0.6547 - val_loss: 0.8570 - val_f1_score: 0.6468 -
val_accuracy: 0.6468
Epoch 25/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8466 -
f1_score: 0.6539 - accuracy: 0.6539 - val_loss: 0.8517 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 26/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8468 -
f1_score: 0.6550 - accuracy: 0.6550 - val_loss: 0.8492 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 27/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8476 -
f1_score: 0.6558 - accuracy: 0.6558 - val_loss: 0.8518 - val_f1_score: 0.6481 -
val_accuracy: 0.6481
Epoch 28/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8493 -
f1_score: 0.6540 - accuracy: 0.6540 - val_loss: 0.8480 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 29/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8460 -
f1_score: 0.6549 - accuracy: 0.6549 - val_loss: 0.8518 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 30/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8465 -
f1_score: 0.6539 - accuracy: 0.6539 - val_loss: 0.8476 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 31/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8448 -
f1_score: 0.6557 - accuracy: 0.6557 - val_loss: 0.8452 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 32/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8421 -
f1_score: 0.6543 - accuracy: 0.6543 - val_loss: 0.8437 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 33/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8421 -
f1_score: 0.6521 - accuracy: 0.6521 - val_loss: 0.8503 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 34/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8406 -
f1_score: 0.6557 - accuracy: 0.6557 - val_loss: 0.8499 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
```

```
Epoch 35/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8414 -
f1_score: 0.6562 - accuracy: 0.6562 - val_loss: 0.8517 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 36/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8455 -
f1_score: 0.6551 - accuracy: 0.6551 - val_loss: 0.8443 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 37/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8423 -
f1_score: 0.6576 - accuracy: 0.6576 - val_loss: 0.8467 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 38/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8406 -
f1_score: 0.6554 - accuracy: 0.6554 - val_loss: 0.8516 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 39/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8414 -
f1_score: 0.6550 - accuracy: 0.6550 - val_loss: 0.8455 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 40/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8440 -
f1_score: 0.6543 - accuracy: 0.6543 - val_loss: 0.8407 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 41/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8429 -
f1_score: 0.6551 - accuracy: 0.6551 - val_loss: 0.8398 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 42/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8389 -
f1_score: 0.6584 - accuracy: 0.6584 - val_loss: 0.8420 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 43/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8424 -
f1_score: 0.6561 - accuracy: 0.6561 - val_loss: 0.8459 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 44/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8422 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8460 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 45/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8401 -
f1_score: 0.6553 - accuracy: 0.6553 - val_loss: 0.8500 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 46/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8401 -
f1_score: 0.6558 - accuracy: 0.6558 - val_loss: 0.8480 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

```
Epoch 47/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8399 -
f1_score: 0.6562 - accuracy: 0.6562 - val_loss: 0.8446 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 48/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8400 -
f1_score: 0.6558 - accuracy: 0.6558 - val_loss: 0.8438 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 49/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8374 -
f1_score: 0.6565 - accuracy: 0.6565 - val_loss: 0.8459 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 50/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8380 -
f1_score: 0.6569 - accuracy: 0.6569 - val_loss: 0.8516 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 51/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8392 -
f1_score: 0.6560 - accuracy: 0.6560 - val_loss: 0.8508 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 52/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8394 -
f1_score: 0.6565 - accuracy: 0.6565 - val_loss: 0.8482 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 53/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8375 -
f1_score: 0.6558 - accuracy: 0.6558 - val_loss: 0.8436 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 54/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8377 -
f1_score: 0.6558 - accuracy: 0.6558 - val_loss: 0.8514 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 55/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8433 -
f1_score: 0.6560 - accuracy: 0.6560 - val_loss: 0.8529 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 56/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8428 -
f1_score: 0.6571 - accuracy: 0.6571 - val_loss: 0.8483 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 57/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8334 -
f1_score: 0.6579 - accuracy: 0.6579 - val_loss: 0.8499 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 58/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8400 -
f1_score: 0.6571 - accuracy: 0.6571 - val_loss: 0.8411 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 59/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8395 -
f1_score: 0.6565 - accuracy: 0.6565 - val_loss: 0.8463 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 60/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8430 -
f1_score: 0.6580 - accuracy: 0.6580 - val_loss: 0.8501 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 61/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8419 -
f1_score: 0.6560 - accuracy: 0.6560 - val_loss: 0.8472 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 62/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8408 -
f1_score: 0.6562 - accuracy: 0.6562 - val_loss: 0.8408 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 63/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8387 -
f1_score: 0.6567 - accuracy: 0.6567 - val_loss: 0.8480 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 64/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8414 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8399 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 65/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8366 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8440 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 66/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8352 -
f1_score: 0.6569 - accuracy: 0.6569 - val_loss: 0.8494 - val_f1_score: 0.6481 -
val_accuracy: 0.6481
Epoch 67/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8379 -
f1_score: 0.6575 - accuracy: 0.6575 - val_loss: 0.8502 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 68/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8373 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8426 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 69/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8346 -
f1_score: 0.6580 - accuracy: 0.6580 - val_loss: 0.8413 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 70/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8399 -
f1_score: 0.6569 - accuracy: 0.6569 - val_loss: 0.8496 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

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Epoch 71/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8329 -
f1_score: 0.6583 - accuracy: 0.6583 - val_loss: 0.8490 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 72/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8371 -
f1_score: 0.6582 - accuracy: 0.6582 - val_loss: 0.8475 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 73/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8340 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8409 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 74/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8358 -
f1_score: 0.6587 - accuracy: 0.6587 - val_loss: 0.8433 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 75/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8366 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8456 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 76/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8371 -
f1_score: 0.6578 - accuracy: 0.6578 - val_loss: 0.8475 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 77/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8380 -
f1_score: 0.6565 - accuracy: 0.6565 - val_loss: 0.8411 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 78/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8346 -
f1_score: 0.6582 - accuracy: 0.6582 - val_loss: 0.8425 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 79/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8335 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8399 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 80/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8324 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8399 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 81/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8324 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8448 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 82/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8363 -
f1_score: 0.6576 - accuracy: 0.6576 - val_loss: 0.8456 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

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Epoch 83/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8388 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8439 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 84/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8326 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8413 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 85/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8318 -
f1_score: 0.6578 - accuracy: 0.6578 - val_loss: 0.8461 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 86/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8339 -
f1_score: 0.6580 - accuracy: 0.6580 - val_loss: 0.8416 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 87/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8342 -
f1_score: 0.6569 - accuracy: 0.6569 - val_loss: 0.8424 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 88/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8310 -
f1_score: 0.6579 - accuracy: 0.6579 - val_loss: 0.8388 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 89/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8317 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8456 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 90/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8322 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8429 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 91/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8335 -
f1_score: 0.6579 - accuracy: 0.6579 - val_loss: 0.8454 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 92/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8326 -
f1_score: 0.6589 - accuracy: 0.6589 - val_loss: 0.8461 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 93/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8301 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8406 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 94/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8342 -
f1_score: 0.6572 - accuracy: 0.6572 - val_loss: 0.8372 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 95/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8343 -
f1_score: 0.6579 - accuracy: 0.6579 - val_loss: 0.8410 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 96/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8337 -
f1_score: 0.6582 - accuracy: 0.6582 - val_loss: 0.8463 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 97/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8306 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8410 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 98/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8327 -
f1_score: 0.6583 - accuracy: 0.6583 - val_loss: 0.8486 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 99/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8347 -
f1_score: 0.6578 - accuracy: 0.6578 - val_loss: 0.8519 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 100/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8329 -
f1_score: 0.6569 - accuracy: 0.6569 - val_loss: 0.8450 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 101/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8341 -
f1_score: 0.6590 - accuracy: 0.6590 - val_loss: 0.8360 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 102/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8320 -
f1_score: 0.6561 - accuracy: 0.6561 - val_loss: 0.8439 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 103/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8281 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8464 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 104/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8325 -
f1_score: 0.6582 - accuracy: 0.6582 - val_loss: 0.8433 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 105/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8292 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8368 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 106/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8291 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8462 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

```
Epoch 107/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8316 -
f1_score: 0.6580 - accuracy: 0.6580 - val_loss: 0.8410 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 108/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8314 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8437 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 109/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8300 -
f1_score: 0.6582 - accuracy: 0.6582 - val_loss: 0.8456 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 110/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8318 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8388 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 111/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8320 -
f1_score: 0.6587 - accuracy: 0.6587 - val_loss: 0.8420 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 112/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8268 -
f1_score: 0.6594 - accuracy: 0.6594 - val_loss: 0.8453 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 113/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8305 -
f1_score: 0.6573 - accuracy: 0.6573 - val_loss: 0.8440 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 114/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8297 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8396 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 115/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8288 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8374 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 116/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8300 -
f1_score: 0.6593 - accuracy: 0.6593 - val_loss: 0.8444 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 117/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8310 -
f1_score: 0.6593 - accuracy: 0.6593 - val_loss: 0.8464 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 118/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8274 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8412 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

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Epoch 119/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8291 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8461 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 120/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8272 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8405 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 121/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8307 -
f1_score: 0.6594 - accuracy: 0.6594 - val_loss: 0.8456 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 122/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8305 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8447 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 123/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8319 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8433 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 124/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8297 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8366 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 125/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8291 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8434 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 126/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8275 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8345 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 127/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8278 -
f1_score: 0.6584 - accuracy: 0.6584 - val_loss: 0.8369 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 128/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8278 -
f1_score: 0.6587 - accuracy: 0.6587 - val_loss: 0.8368 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 129/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8270 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8393 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 130/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8291 -
f1_score: 0.6593 - accuracy: 0.6593 - val_loss: 0.8386 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

```
Epoch 131/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8284 -
f1_score: 0.6589 - accuracy: 0.6589 - val_loss: 0.8404 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 132/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8277 -
f1_score: 0.6604 - accuracy: 0.6604 - val_loss: 0.8310 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 133/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8301 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8369 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 134/500
227/227 [==============================] - 1s 3ms/step - loss: 0.8267 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8377 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 135/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8295 -
f1_score: 0.6584 - accuracy: 0.6584 - val_loss: 0.8452 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 136/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8277 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8430 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 137/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8277 -
f1_score: 0.6590 - accuracy: 0.6590 - val_loss: 0.8391 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 138/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8232 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8450 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 139/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8287 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8504 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 140/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8277 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8457 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 141/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8254 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8464 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 142/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8266 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8487 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 143/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8277 -
f1_score: 0.6583 - accuracy: 0.6583 - val_loss: 0.8407 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 144/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8268 -
f1_score: 0.6593 - accuracy: 0.6593 - val_loss: 0.8459 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 145/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8290 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8435 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 146/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8272 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8424 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 147/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8270 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8431 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 148/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8247 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8528 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 149/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8282 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8510 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 150/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8273 -
f1_score: 0.6580 - accuracy: 0.6580 - val_loss: 0.8409 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 151/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8238 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8417 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 152/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8266 -
f1_score: 0.6604 - accuracy: 0.6604 - val_loss: 0.8422 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 153/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8276 -
f1_score: 0.6584 - accuracy: 0.6584 - val_loss: 0.8449 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 154/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8275 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8443 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
```

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Epoch 155/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8267 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8423 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 156/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8238 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8406 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 157/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8230 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8394 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 158/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8260 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8427 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 159/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8257 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8485 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 160/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8259 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8462 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 161/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8252 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8434 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 162/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8276 -
f1_score: 0.6587 - accuracy: 0.6587 - val_loss: 0.8410 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 163/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8249 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8401 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 164/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8227 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8415 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 165/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8261 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8334 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 166/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8279 -
f1_score: 0.6576 - accuracy: 0.6576 - val_loss: 0.8451 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 167/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8275 -
f1_score: 0.6589 - accuracy: 0.6589 - val_loss: 0.8384 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 168/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8235 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8400 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 169/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8236 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8377 - val_f1_score: 0.6617 -
val_accuracy: 0.6617
Epoch 170/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8230 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8390 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 171/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8230 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8428 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 172/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8238 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8385 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 173/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8265 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8411 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 174/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8234 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8398 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 175/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8237 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8433 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 176/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8255 -
f1_score: 0.6590 - accuracy: 0.6590 - val_loss: 0.8363 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 177/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8225 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8409 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 178/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8230 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8365 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
```

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Epoch 179/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8218 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8348 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 180/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8194 -
f1_score: 0.6624 - accuracy: 0.6624 - val_loss: 0.8369 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 181/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8227 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8388 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 182/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8220 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8353 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 183/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8175 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8356 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 184/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8211 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8447 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 185/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8194 -
f1_score: 0.6651 - accuracy: 0.6651 - val_loss: 0.8373 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 186/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8251 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8359 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 187/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8217 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8407 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 188/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8267 -
f1_score: 0.6594 - accuracy: 0.6594 - val_loss: 0.8404 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 189/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8255 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8367 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 190/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8187 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8364 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
```

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Epoch 191/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8216 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8369 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 192/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8210 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8336 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 193/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8214 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8382 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 194/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8212 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8371 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 195/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8194 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8436 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 196/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8231 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8477 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 197/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8283 -
f1_score: 0.6568 - accuracy: 0.6568 - val_loss: 0.8466 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 198/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8244 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8413 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 199/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8218 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8466 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 200/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8230 -
f1_score: 0.6634 - accuracy: 0.6634 - val_loss: 0.8462 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 201/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8236 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8418 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 202/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8246 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8461 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 203/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8214 -
f1_score: 0.6608 - accuracy: 0.6608 - val_loss: 0.8433 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 204/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8229 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8441 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 205/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8216 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8450 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 206/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8229 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8418 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 207/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8226 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8403 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 208/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8186 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8375 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 209/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8193 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8432 - val_f1_score: 0.6580 -
val_accuracy: 0.6580
Epoch 210/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8256 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8472 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 211/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8247 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8380 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 212/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8195 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8441 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 213/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8205 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8407 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 214/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8205 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8401 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

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Epoch 215/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8225 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8448 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 216/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8222 -
f1_score: 0.6602 - accuracy: 0.6602 - val_loss: 0.8406 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 217/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8221 -
f1_score: 0.6608 - accuracy: 0.6608 - val_loss: 0.8470 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 218/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8209 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8409 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 219/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8219 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8421 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 220/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8248 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8444 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 221/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8250 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8465 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 222/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8208 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8422 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 223/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8227 -
f1_score: 0.6601 - accuracy: 0.6601 - val_loss: 0.8406 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 224/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8206 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8421 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 225/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8216 -
f1_score: 0.6604 - accuracy: 0.6604 - val_loss: 0.8421 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 226/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8217 -
f1_score: 0.6600 - accuracy: 0.6600 - val_loss: 0.8392 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

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Epoch 227/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8219 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8432 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 228/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8160 -
f1_score: 0.6629 - accuracy: 0.6629 - val_loss: 0.8474 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 229/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8202 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8454 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 230/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8199 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8432 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 231/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8147 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8428 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 232/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8223 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8432 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 233/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8156 -
f1_score: 0.6629 - accuracy: 0.6629 - val_loss: 0.8474 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 234/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8204 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8395 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 235/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8208 -
f1_score: 0.6593 - accuracy: 0.6593 - val_loss: 0.8389 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 236/500
227/227 [==============================] - 0s 1ms/step - loss: 0.8209 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8443 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 237/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8200 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8464 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 238/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8207 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8407 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

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Epoch 239/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8156 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8381 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 240/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8210 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8391 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 241/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8239 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8449 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 242/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8178 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8451 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 243/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8161 -
f1_score: 0.6631 - accuracy: 0.6631 - val_loss: 0.8406 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 244/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8195 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8484 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 245/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8238 -
f1_score: 0.6629 - accuracy: 0.6629 - val_loss: 0.8413 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 246/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8196 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8476 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 247/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8221 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8395 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 248/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8219 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8450 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 249/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8190 -
f1_score: 0.6637 - accuracy: 0.6637 - val_loss: 0.8421 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 250/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8188 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8374 - val_f1_score: 0.6580 -
val_accuracy: 0.6580
```

```
Epoch 251/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8273 -
f1_score: 0.6583 - accuracy: 0.6583 - val_loss: 0.8421 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 252/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8283 -
f1_score: 0.6590 - accuracy: 0.6590 - val_loss: 0.8440 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 253/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8198 -
f1_score: 0.6608 - accuracy: 0.6608 - val_loss: 0.8415 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 254/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8190 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8446 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 255/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8183 -
f1_score: 0.6596 - accuracy: 0.6596 - val_loss: 0.8398 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 256/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8213 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8415 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 257/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8193 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8460 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 258/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8223 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8430 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 259/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8183 -
f1_score: 0.6586 - accuracy: 0.6586 - val_loss: 0.8382 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 260/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8212 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8329 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 261/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8203 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8421 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 262/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8183 -
f1_score: 0.6638 - accuracy: 0.6638 - val_loss: 0.8370 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
```

```
Epoch 263/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8205 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8377 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 264/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8204 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8398 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 265/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8198 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8433 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 266/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8188 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8365 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 267/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8227 -
f1_score: 0.6591 - accuracy: 0.6591 - val_loss: 0.8365 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 268/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8213 -
f1_score: 0.6609 - accuracy: 0.6609 - val_loss: 0.8363 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 269/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8237 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8370 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 270/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8186 -
f1_score: 0.6642 - accuracy: 0.6642 - val_loss: 0.8429 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 271/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8211 -
f1_score: 0.6624 - accuracy: 0.6624 - val_loss: 0.8450 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 272/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8201 -
f1_score: 0.6622 - accuracy: 0.6622 - val_loss: 0.8437 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 273/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8221 -
f1_score: 0.6633 - accuracy: 0.6633 - val_loss: 0.8394 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 274/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8191 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8441 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
```

```
Epoch 275/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8204 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8397 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 276/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8167 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8360 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 277/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8206 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8382 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 278/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8203 -
f1_score: 0.6637 - accuracy: 0.6637 - val_loss: 0.8356 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 279/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8202 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8469 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 280/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8194 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8461 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 281/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8176 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8386 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 282/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8182 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8376 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 283/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8207 -
f1_score: 0.6594 - accuracy: 0.6594 - val_loss: 0.8358 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 284/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8193 -
f1_score: 0.6622 - accuracy: 0.6622 - val_loss: 0.8402 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 285/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8194 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8383 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 286/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8204 -
f1_score: 0.6602 - accuracy: 0.6602 - val_loss: 0.8363 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

```
Epoch 287/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8185 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8447 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 288/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8226 -
f1_score: 0.6633 - accuracy: 0.6633 - val_loss: 0.8495 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 289/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8207 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8396 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 290/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8201 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8391 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 291/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8211 -
f1_score: 0.6604 - accuracy: 0.6604 - val_loss: 0.8362 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 292/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8142 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8353 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 293/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8224 -
f1_score: 0.6579 - accuracy: 0.6579 - val_loss: 0.8374 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 294/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8205 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8430 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 295/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8209 -
f1_score: 0.6618 - accuracy: 0.6618 - val_loss: 0.8374 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 296/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8216 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8353 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 297/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8193 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8371 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 298/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8215 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8340 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
```

```
Epoch 299/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8170 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8379 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 300/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8194 -
f1_score: 0.6597 - accuracy: 0.6597 - val_loss: 0.8369 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 301/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8183 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8328 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 302/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8194 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8392 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 303/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8160 -
f1_score: 0.6629 - accuracy: 0.6629 - val_loss: 0.8395 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 304/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8174 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8379 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 305/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8229 -
f1_score: 0.6623 - accuracy: 0.6623 - val_loss: 0.8435 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 306/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8192 -
f1_score: 0.6624 - accuracy: 0.6624 - val_loss: 0.8404 - val_f1_score: 0.6568 -
val_accuracy: 0.6568
Epoch 307/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8202 -
f1_score: 0.6615 - accuracy: 0.6615 - val_loss: 0.8392 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 308/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8194 -
f1_score: 0.6604 - accuracy: 0.6604 - val_loss: 0.8397 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 309/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8178 -
f1_score: 0.6611 - accuracy: 0.6611 - val_loss: 0.8447 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 310/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8149 -
f1_score: 0.6622 - accuracy: 0.6622 - val_loss: 0.8320 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
```

```
Epoch 311/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8210 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8464 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 312/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8177 -
f1_score: 0.6626 - accuracy: 0.6626 - val_loss: 0.8366 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 313/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8151 -
f1_score: 0.6631 - accuracy: 0.6631 - val_loss: 0.8438 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 314/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8178 -
f1_score: 0.6620 - accuracy: 0.6620 - val_loss: 0.8385 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 315/500
227/227 [==============================] - 1s 2ms/step - loss: 0.8222 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8398 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 316/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8172 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8348 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 317/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8169 -
f1_score: 0.6612 - accuracy: 0.6612 - val_loss: 0.8438 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 318/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8182 -
f1_score: 0.6613 - accuracy: 0.6613 - val_loss: 0.8326 - val_f1_score: 0.6555 -
val_accuracy: 0.6555
Epoch 319/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8210 -
f1_score: 0.6608 - accuracy: 0.6608 - val_loss: 0.8346 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 320/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8203 -
f1_score: 0.6605 - accuracy: 0.6605 - val_loss: 0.8397 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 321/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8193 -
f1_score: 0.6629 - accuracy: 0.6629 - val_loss: 0.8466 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 322/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8195 -
f1_score: 0.6616 - accuracy: 0.6616 - val_loss: 0.8385 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
```

```
Epoch 323/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8160 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8405 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 324/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8219 -
f1_score: 0.6594 - accuracy: 0.6594 - val_loss: 0.8414 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 325/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8151 -
f1_score: 0.6627 - accuracy: 0.6627 - val_loss: 0.8438 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 326/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8146 -
f1_score: 0.6648 - accuracy: 0.6648 - val_loss: 0.8458 - val_f1_score: 0.6493 -
val_accuracy: 0.6493
Epoch 327/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8212 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8417 - val_f1_score: 0.6506 -
val_accuracy: 0.6506
Epoch 328/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8170 -
f1_score: 0.6607 - accuracy: 0.6607 - val_loss: 0.8396 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
Epoch 329/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8179 -
f1_score: 0.6622 - accuracy: 0.6622 - val_loss: 0.8435 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 330/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8188 -
f1_score: 0.6619 - accuracy: 0.6619 - val_loss: 0.8513 - val_f1_score: 0.6518 -
val_accuracy: 0.6518
Epoch 331/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8273 -
f1_score: 0.6598 - accuracy: 0.6598 - val_loss: 0.8419 - val_f1_score: 0.6543 -
val_accuracy: 0.6543
Epoch 332/500
227/227 [==============================] - 0s 2ms/step - loss: 0.8175 -
f1_score: 0.6624 - accuracy: 0.6624 - val_loss: 0.8350 - val_f1_score: 0.6530 -
val_accuracy: 0.6530
```

[249]:
```python
def test_pipeline(model):
    '''performs all the necessary steps for the testing
    dataset
    '''
    df_test = load_csv('archive/test.csv')
    df_test = pre_processing(df_test, train=False)
```

```
    y_pred = model.predict(df_test.values)
    y_test = load_csv('archive/test.csv')[['Var_1']]
    y_test['Var_1'] = y_test['Var_1'].apply(replacing_classes)
    y_test = pd.get_dummies(y_test)
    # putting predictions in a list
    # as the index of max probability
    pred = list()
    for i in range(len(y_pred)):
        pred.append(np.argmax(y_pred[i]))
    # putting test target variables in a list
    test = list()
    y_test_arr = y_test.values
    for i in range(len(y_test_arr)):
         test.append(np.argmax(y_test_arr[i]))

    def num_to_class(x):
        if x == 0:
            return "Var_1_Cat_4"
        if x == 1:
            return "Var_1_Cat_6"
        if x == 2:
            return "Var_1_Other"

    return (list(map(lambda x: num_to_class(x), pred)),
            list(map(lambda x: num_to_class(x), test)),
            y_pred,
            y_test,
           df_test)
```

[250]:
```
pred, test, y_pred, y_test, X_test = test_pipeline(model)
```

```
dropping ID column
dropping ['ID', 'Var_1', 'Age']…
replacing numerical nans with mode…
replacing categorical nans with None string…
label encoding categorical data…
SUCCESSFULLY PERFORMED PREPROCESSING
83/83 [==============================] - 0s 547us/step
```

[251]:
```
X_test
```

[251]:

	Gender	Ever_Married	Graduated	Profession	Work_Experience	\
0	0	2	2	2	0.0	
1	1	2	2	5	8.0	
2	0	2	0	9	0.0	
3	1	2	0	4	11.0	
4	0	0	0	8	1.0	

```
…       …             …          …          …              …
2622       1             0          0          5              9.0
2623       0             0          2          1              1.0
2624       0             0          2          3              1.0
2625       1             2          2          4              1.0
2626       0             0          2          5              9.0

      Spending_Score  Family_Size
0                  2          1.0
1                  0          4.0
2                  2          1.0
3                  1          2.0
4                  2          4.0
…                …            …
2622               2          4.0
2623               2          1.0
2624               2          2.0
2625               1          5.0
2626               2          3.0

[2627 rows x 7 columns]
```

[252]:
```
# Classification metrics for Test
print(f'f1_score for the test data is:', f1_score(pred, test, average='macro'))
print(f'recall for the test data is:', recall_score(pred, test,␣
 ↪average='macro'))
print(f'precision score for the test data is:', precision_score(pred, test,␣
 ↪average='macro'))
print(f'accuracy for the test data is: {accuracy_score(pred, test)}')
```

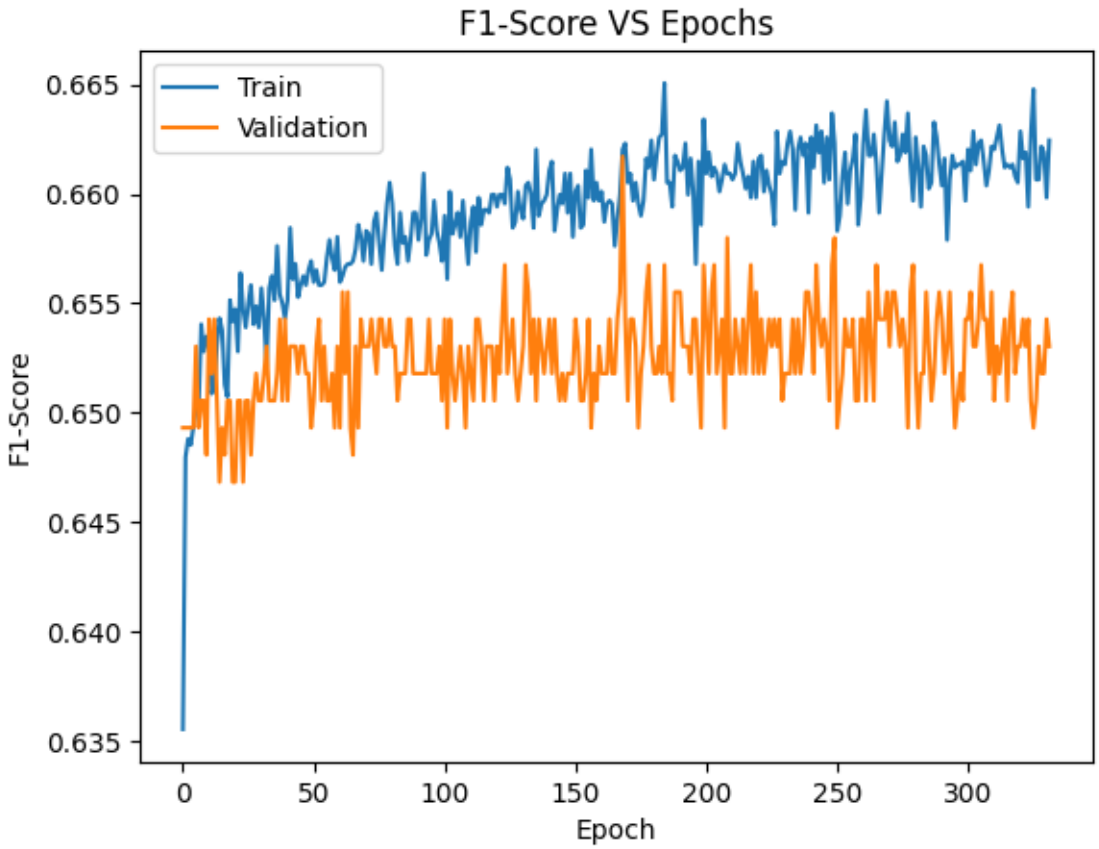
```
f1_score for the test data is: 0.2849736839965477
recall for the test data is: 0.5258282267330525
precision score for the test data is: 0.34608733916751366
accuracy for the test data is: 0.6417967263037686
```

recall: recall is the true positives over false negatives and true positives. In multi class the true positives mean all the value for the class A that was correctly identified. False negative means all the predictions that belonged to class A but incorrectly classified as B or C. the recall would be average recall of the recalls for all three classes.

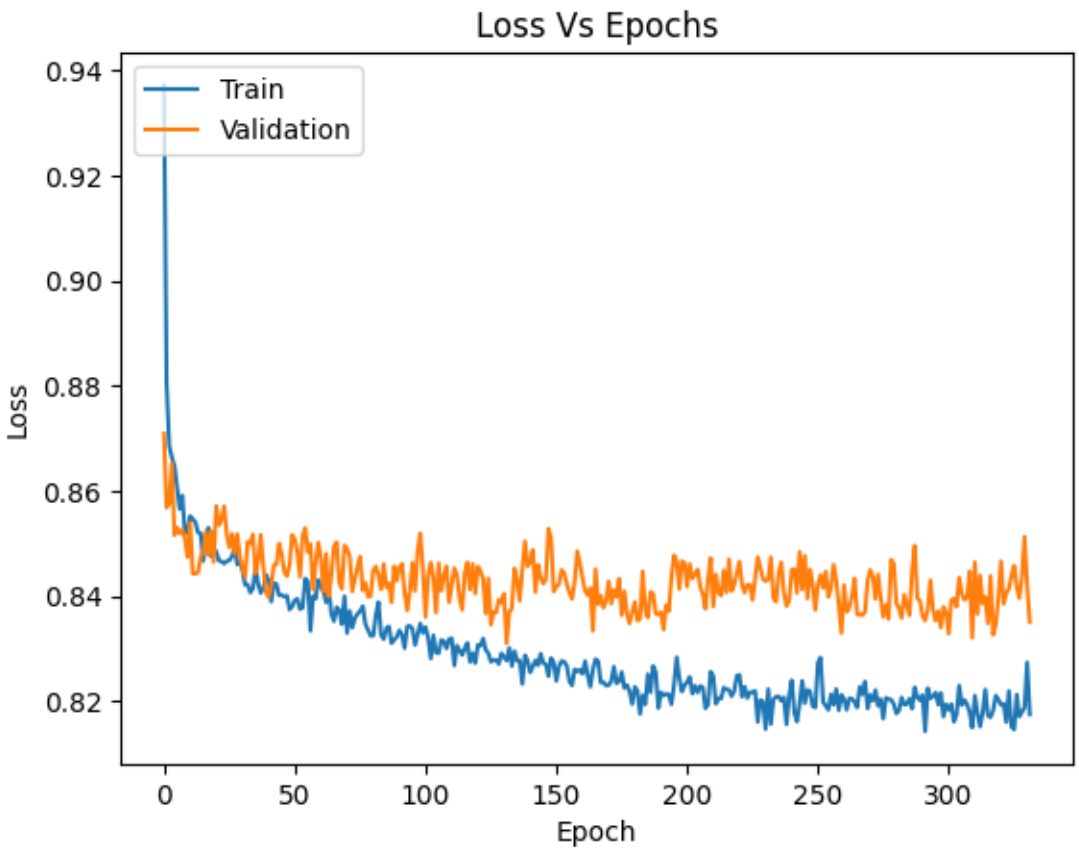
precision: precision is the true positives over true positives and false positives. false positive are the values that belong to class B or C but was predicted incorrectly as A. precision would be the average of the precision for the three classes.

f1_score: it is the harmonic mean that punishes the extreme values. it means that if recall is high then recall would be punished and the harmonic mean would be more in the side of precision. It is a good metric for imbalance data. it is 2 times average precision time average recall over average recall and average precision.

[253]:
```
plt.plot(history.history['f1_score'])
plt.plot(history.history['val_f1_score'])
plt.title('F1-Score VS Epochs')
plt.ylabel('F1-Score')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



[254]:
```
plt.plot(history.history['loss'])
plt.plot(history.history['val_loss'])
plt.title('Loss Vs Epochs')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



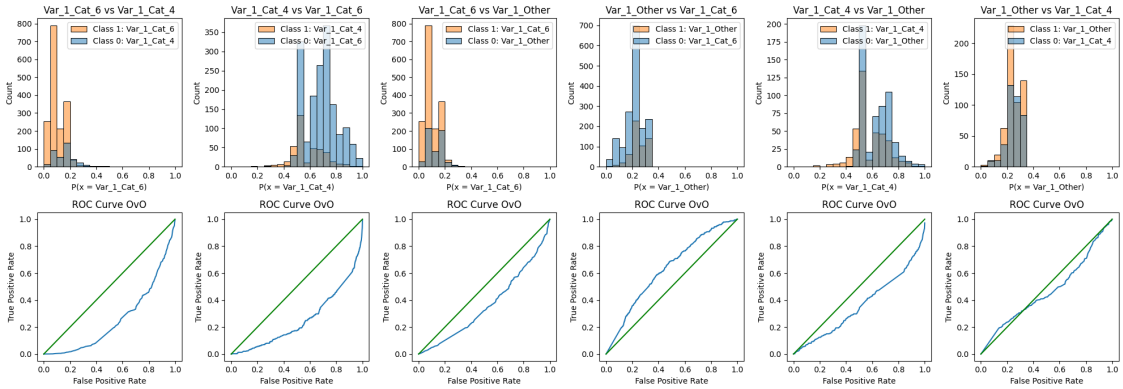
Model is definitely learning in training set. you can see that loss is decreasing and f1_score is increasing. However Because of small number of data (although it was shuffled and stratified) model doesn't reach its best form. The early stopage was applied and the model stopped after 332 epoch of 500 total epochs.

[255]:
```
# Reference: https://towardsdatascience.com/
↪multiclass-classification-evaluation-with-roc-curves-and-roc-auc-294fd4617e3a
def plot_roc_auc(test, y_pred):
    '''This plots the roc auc'''
    classes_combinations = []
    class_list = list(set(test))
    for i in range(len(class_list)):
        for j in range(i+1, len(class_list)):
            classes_combinations.append([class_list[i], class_list[j]])
            classes_combinations.append([class_list[j], class_list[i]])
    print(classes_combinations)
    plt.figure(figsize = (20, 7))
    bins = [i/20 for i in range(20)] + [1]
    roc_auc_ovo = {}
    for i in range(len(classes_combinations)):
```

```
        # Gets the class
        comb = classes_combinations[i]
        c1 = comb[0]
        c2 = comb[1]
        c1_index = class_list.index(c1)
        title = c1 + " vs " +c2

        # Prepares an auxiliar dataframe to help with the plots
        df_aux = df_test.copy()
        df_aux['class'] = test
        df_aux['prob'] = y_pred[:, c1_index]

        # Slices only the subset with both classes
        df_aux = df_aux[(df_aux['class'] == c1) | (df_aux['class'] == c2)]
        df_aux['class'] = [1 if y == c1 else 0 for y in df_aux['class']]
        df_aux = df_aux.reset_index(drop = True)

        # Plots the probability distribution for the class and the rest
        ax = plt.subplot(2, 6, i+1)
        sns.histplot(x = "prob", data = df_aux, hue = 'class', color = 'b', ax␣
↪= ax, bins = bins)
        ax.set_title(title)
        ax.legend([f"Class 1: {c1}", f"Class 0: {c2}"])
        ax.set_xlabel(f"P(x = {c1})")

        # Calculates the ROC Coordinates and plots the ROC Curves
        ax_bottom = plt.subplot(2, 6, i+7)
        tpr, fpr = get_all_roc_coordinates(df_aux['class'], df_aux['prob'])
        plot_roc_curve(tpr, fpr, scatter = False, ax = ax_bottom)
        ax_bottom.set_title("ROC Curve OvO")

        # Calculates the ROC AUC OvO
        roc_auc_ovo[title] = roc_auc_score(df_aux['class'], df_aux['prob'])
    plt.tight_layout()
```

[256]:
```
plot_roc_auc(test, y_pred)
```

```
[['Var_1_Cat_6', 'Var_1_Cat_4'], ['Var_1_Cat_4', 'Var_1_Cat_6'], ['Var_1_Cat_6',
'Var_1_Other'], ['Var_1_Other', 'Var_1_Cat_6'], ['Var_1_Cat_4', 'Var_1_Other'],
['Var_1_Other', 'Var_1_Cat_4']]
```



ROC curves are not very promising in this mode. You can see that for most of the classes, ROC curve is below the 0.5 probability which means that model is performing worse than a coin toss. This is most probably because of a small number of data that we have. For neural network, minimum of a few million data-sets are required. However, if we look at 4th ROC graph, we might say that a False Positive of around 0.5 and True Positive of around 0.6 are good thresholds since it maximises the area under the curve.

0.0.5 After Applying SMOTE for Over Sampling

[257]:
```
def smote_train_pipeline():
    '''
    performs all the necessary functions for the training
    dataset
    '''
    df = load_csv('archive/train.csv')
    df = pre_processing(df, train=True, only_label=True)
    df_smote = apply_smote(df)
    print("Var_1_Cat_4 after SMOTE", len(df_smote.loc[df_smote["Var_1"] ==␣
 ↪"Cat_4"]))
    print("Var_1_Cat_6 after SMOTE", len(df_smote.loc[df_smote["Var_1"] ==␣
 ↪"Cat_6"]))
    print("Other after SMOTE", len(df_smote.loc[df_smote["Var_1"] == "Other"]))
    target = df_smote[['Var_1']]
    target = pd.get_dummies(target)
    df_smote.drop(columns=['Var_1'], inplace=True)
    df_smote = pd.concat([df_smote, target], axis=1)
    X_train, X_valid, y_train, y_valid = train_validation_split(0.10, df_smote)
    # Removing normalization: Because most of the columns
    # Are categorical and if we normalize the effect of
    # Numerical data will be very low
    # min_max_scaler(X_train)
    # min_max_scaler(X_valid)
    history_smote, model_smote = fit_model(X_train, y_train, X_valid, y_valid)
```

```
    return history, model_smote
```

We applied SMOTE to increase the number minority classes. As you can see below all three classes have the same number of data points.

[258]:
```
history_smote, model_smote = smote_train_pipeline()
```

```
dropping columns…
dropping ['ID', 'Segmentation', 'Age']…
replacing numerical nans with mode…
replacing categorical nans with None string…
changing anything otehr than cat_6 and cat_4 to other…
label encoding categorical data…
SUCCESSFULLY PERFORMED PREPROCESSING
Var_1_Cat_4 after SMOTE 5238
Var_1_Cat_6 after SMOTE 5238
Other after SMOTE 5238
Model: "sequential_26"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 dense_182 (Dense)           (None, 512)               4096

 dense_183 (Dense)           (None, 256)               131328

 dense_184 (Dense)           (None, 128)               32896

 dropout_78 (Dropout)        (None, 128)               0

 dense_185 (Dense)           (None, 64)                8256

 dropout_79 (Dropout)        (None, 64)                0

 dense_186 (Dense)           (None, 16)                1040

 dropout_80 (Dropout)        (None, 16)                0

 dense_187 (Dense)           (None, 8)                 136

 dense_188 (Dense)           (None, 3)                 27

=================================================================
Total params: 177,779
Trainable params: 177,779
Non-trainable params: 0
_________________________________________________________________
None
Epoch 1/500
```

```
442/442 [==============================] - 2s 3ms/step - loss: 1.0919 -
f1_score: 0.3837 - accuracy: 0.3837 - val_loss: 1.0688 - val_f1_score: 0.4078 -
val_accuracy: 0.4078
Epoch 2/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0683 -
f1_score: 0.4190 - accuracy: 0.4190 - val_loss: 1.0668 - val_f1_score: 0.4281 -
val_accuracy: 0.4281
Epoch 3/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0665 -
f1_score: 0.4137 - accuracy: 0.4137 - val_loss: 1.0596 - val_f1_score: 0.4256 -
val_accuracy: 0.4256
Epoch 4/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0579 -
f1_score: 0.4314 - accuracy: 0.4314 - val_loss: 1.0549 - val_f1_score: 0.4567 -
val_accuracy: 0.4567
Epoch 5/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0554 -
f1_score: 0.4330 - accuracy: 0.4330 - val_loss: 1.0518 - val_f1_score: 0.4230 -
val_accuracy: 0.4230
Epoch 6/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0530 -
f1_score: 0.4314 - accuracy: 0.4314 - val_loss: 1.0571 - val_f1_score: 0.4358 -
val_accuracy: 0.4358
Epoch 7/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0562 -
f1_score: 0.4332 - accuracy: 0.4332 - val_loss: 1.0554 - val_f1_score: 0.4440 -
val_accuracy: 0.4440
Epoch 8/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0502 -
f1_score: 0.4447 - accuracy: 0.4447 - val_loss: 1.0579 - val_f1_score: 0.4307 -
val_accuracy: 0.4307
Epoch 9/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0502 -
f1_score: 0.4371 - accuracy: 0.4371 - val_loss: 1.0565 - val_f1_score: 0.4345 -
val_accuracy: 0.4345
Epoch 10/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0488 -
f1_score: 0.4380 - accuracy: 0.4380 - val_loss: 1.0544 - val_f1_score: 0.4548 -
val_accuracy: 0.4548
Epoch 11/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0472 -
f1_score: 0.4439 - accuracy: 0.4439 - val_loss: 1.0505 - val_f1_score: 0.4459 -
val_accuracy: 0.4459
Epoch 12/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0435 -
f1_score: 0.4439 - accuracy: 0.4439 - val_loss: 1.0500 - val_f1_score: 0.4580 -
val_accuracy: 0.4580
Epoch 13/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 1.0456 -
f1_score: 0.4446 - accuracy: 0.4446 - val_loss: 1.0518 - val_f1_score: 0.4523 -
val_accuracy: 0.4523
Epoch 14/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0448 -
f1_score: 0.4448 - accuracy: 0.4448 - val_loss: 1.0512 - val_f1_score: 0.4504 -
val_accuracy: 0.4504
Epoch 15/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0397 -
f1_score: 0.4510 - accuracy: 0.4510 - val_loss: 1.0443 - val_f1_score: 0.4377 -
val_accuracy: 0.4377
Epoch 16/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0384 -
f1_score: 0.4474 - accuracy: 0.4474 - val_loss: 1.0324 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 17/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0372 -
f1_score: 0.4464 - accuracy: 0.4464 - val_loss: 1.0382 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 18/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0317 -
f1_score: 0.4564 - accuracy: 0.4564 - val_loss: 1.0299 - val_f1_score: 0.4447 -
val_accuracy: 0.4447
Epoch 19/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0298 -
f1_score: 0.4579 - accuracy: 0.4579 - val_loss: 1.0451 - val_f1_score: 0.4587 -
val_accuracy: 0.4587
Epoch 20/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0291 -
f1_score: 0.4642 - accuracy: 0.4642 - val_loss: 1.0313 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 21/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0309 -
f1_score: 0.4570 - accuracy: 0.4570 - val_loss: 1.0377 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 22/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0268 -
f1_score: 0.4598 - accuracy: 0.4598 - val_loss: 1.0318 - val_f1_score: 0.4542 -
val_accuracy: 0.4542
Epoch 23/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0263 -
f1_score: 0.4623 - accuracy: 0.4623 - val_loss: 1.0361 - val_f1_score: 0.4497 -
val_accuracy: 0.4497
Epoch 24/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0292 -
f1_score: 0.4588 - accuracy: 0.4588 - val_loss: 1.0291 - val_f1_score: 0.4618 -
val_accuracy: 0.4618
Epoch 25/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 1.0208 -
f1_score: 0.4633 - accuracy: 0.4633 - val_loss: 1.0391 - val_f1_score: 0.4389 -
val_accuracy: 0.4389
Epoch 26/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0258 -
f1_score: 0.4598 - accuracy: 0.4598 - val_loss: 1.0263 - val_f1_score: 0.4644 -
val_accuracy: 0.4644
Epoch 27/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0267 -
f1_score: 0.4670 - accuracy: 0.4670 - val_loss: 1.0448 - val_f1_score: 0.4758 -
val_accuracy: 0.4758
Epoch 28/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0226 -
f1_score: 0.4658 - accuracy: 0.4658 - val_loss: 1.0354 - val_f1_score: 0.4587 -
val_accuracy: 0.4587
Epoch 29/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0219 -
f1_score: 0.4663 - accuracy: 0.4663 - val_loss: 1.0401 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 30/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0203 -
f1_score: 0.4682 - accuracy: 0.4682 - val_loss: 1.0472 - val_f1_score: 0.4612 -
val_accuracy: 0.4612
Epoch 31/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0182 -
f1_score: 0.4700 - accuracy: 0.4700 - val_loss: 1.0282 - val_f1_score: 0.4663 -
val_accuracy: 0.4663
Epoch 32/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0177 -
f1_score: 0.4702 - accuracy: 0.4702 - val_loss: 1.0237 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 33/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0197 -
f1_score: 0.4617 - accuracy: 0.4617 - val_loss: 1.0244 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 34/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0203 -
f1_score: 0.4715 - accuracy: 0.4715 - val_loss: 1.0370 - val_f1_score: 0.4383 -
val_accuracy: 0.4383
Epoch 35/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0212 -
f1_score: 0.4691 - accuracy: 0.4691 - val_loss: 1.0203 - val_f1_score: 0.4637 -
val_accuracy: 0.4637
Epoch 36/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0177 -
f1_score: 0.4669 - accuracy: 0.4669 - val_loss: 1.0275 - val_f1_score: 0.4612 -
val_accuracy: 0.4612
Epoch 37/500
```

```
442/442 [==============================] - 1s 1ms/step - loss: 1.0189 -
f1_score: 0.4685 - accuracy: 0.4685 - val_loss: 1.0271 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 38/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0199 -
f1_score: 0.4674 - accuracy: 0.4674 - val_loss: 1.0248 - val_f1_score: 0.4542 -
val_accuracy: 0.4542
Epoch 39/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0205 -
f1_score: 0.4629 - accuracy: 0.4629 - val_loss: 1.0293 - val_f1_score: 0.4682 -
val_accuracy: 0.4682
Epoch 40/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0200 -
f1_score: 0.4679 - accuracy: 0.4679 - val_loss: 1.0253 - val_f1_score: 0.4402 -
val_accuracy: 0.4402
Epoch 41/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0165 -
f1_score: 0.4726 - accuracy: 0.4726 - val_loss: 1.0270 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 42/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0175 -
f1_score: 0.4661 - accuracy: 0.4661 - val_loss: 1.0402 - val_f1_score: 0.4548 -
val_accuracy: 0.4548
Epoch 43/500
442/442 [==============================] - 1s 3ms/step - loss: 1.0146 -
f1_score: 0.4692 - accuracy: 0.4692 - val_loss: 1.0261 - val_f1_score: 0.4618 -
val_accuracy: 0.4618
Epoch 44/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0170 -
f1_score: 0.4680 - accuracy: 0.4680 - val_loss: 1.0216 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 45/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0163 -
f1_score: 0.4688 - accuracy: 0.4688 - val_loss: 1.0259 - val_f1_score: 0.4669 -
val_accuracy: 0.4669
Epoch 46/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0132 -
f1_score: 0.4699 - accuracy: 0.4699 - val_loss: 1.0316 - val_f1_score: 0.4618 -
val_accuracy: 0.4618
Epoch 47/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0191 -
f1_score: 0.4605 - accuracy: 0.4605 - val_loss: 1.0266 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 48/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0144 -
f1_score: 0.4700 - accuracy: 0.4700 - val_loss: 1.0204 - val_f1_score: 0.4574 -
val_accuracy: 0.4574
Epoch 49/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 1.0116 -
f1_score: 0.4711 - accuracy: 0.4711 - val_loss: 1.0209 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 50/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0110 -
f1_score: 0.4738 - accuracy: 0.4738 - val_loss: 1.0226 - val_f1_score: 0.4517 -
val_accuracy: 0.4517
Epoch 51/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0153 -
f1_score: 0.4722 - accuracy: 0.4722 - val_loss: 1.0105 - val_f1_score: 0.4669 -
val_accuracy: 0.4669
Epoch 52/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0122 -
f1_score: 0.4728 - accuracy: 0.4728 - val_loss: 1.0351 - val_f1_score: 0.4561 -
val_accuracy: 0.4561
Epoch 53/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0139 -
f1_score: 0.4728 - accuracy: 0.4728 - val_loss: 1.0268 - val_f1_score: 0.4695 -
val_accuracy: 0.4695
Epoch 54/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0127 -
f1_score: 0.4714 - accuracy: 0.4714 - val_loss: 1.0073 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 55/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0091 -
f1_score: 0.4782 - accuracy: 0.4782 - val_loss: 1.0242 - val_f1_score: 0.4504 -
val_accuracy: 0.4504
Epoch 56/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0095 -
f1_score: 0.4720 - accuracy: 0.4720 - val_loss: 1.0277 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 57/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0063 -
f1_score: 0.4808 - accuracy: 0.4808 - val_loss: 1.0221 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 58/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0105 -
f1_score: 0.4711 - accuracy: 0.4711 - val_loss: 1.0246 - val_f1_score: 0.4574 -
val_accuracy: 0.4574
Epoch 59/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0156 -
f1_score: 0.4695 - accuracy: 0.4695 - val_loss: 1.0219 - val_f1_score: 0.4720 -
val_accuracy: 0.4720
Epoch 60/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0086 -
f1_score: 0.4694 - accuracy: 0.4694 - val_loss: 1.0168 - val_f1_score: 0.4529 -
val_accuracy: 0.4529
Epoch 61/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 1.0048 -
f1_score: 0.4782 - accuracy: 0.4782 - val_loss: 1.0202 - val_f1_score: 0.4695 -
val_accuracy: 0.4695
Epoch 62/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0087 -
f1_score: 0.4774 - accuracy: 0.4774 - val_loss: 1.0284 - val_f1_score: 0.4650 -
val_accuracy: 0.4650
Epoch 63/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0082 -
f1_score: 0.4766 - accuracy: 0.4766 - val_loss: 1.0395 - val_f1_score: 0.4510 -
val_accuracy: 0.4510
Epoch 64/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0052 -
f1_score: 0.4762 - accuracy: 0.4762 - val_loss: 1.0159 - val_f1_score: 0.4650 -
val_accuracy: 0.4650
Epoch 65/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0041 -
f1_score: 0.4760 - accuracy: 0.4760 - val_loss: 1.0060 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 66/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0061 -
f1_score: 0.4806 - accuracy: 0.4806 - val_loss: 1.0206 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 67/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0093 -
f1_score: 0.4734 - accuracy: 0.4734 - val_loss: 1.0124 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 68/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0057 -
f1_score: 0.4784 - accuracy: 0.4784 - val_loss: 1.0120 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 69/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0031 -
f1_score: 0.4803 - accuracy: 0.4803 - val_loss: 1.0145 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 70/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0061 -
f1_score: 0.4782 - accuracy: 0.4782 - val_loss: 1.0351 - val_f1_score: 0.4656 -
val_accuracy: 0.4656
Epoch 71/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0016 -
f1_score: 0.4787 - accuracy: 0.4787 - val_loss: 1.0309 - val_f1_score: 0.4676 -
val_accuracy: 0.4676
Epoch 72/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0055 -
f1_score: 0.4756 - accuracy: 0.4756 - val_loss: 1.0268 - val_f1_score: 0.4631 -
val_accuracy: 0.4631
Epoch 73/500
```

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442/442 [==============================] - 1s 1ms/step - loss: 1.0118 -
f1_score: 0.4721 - accuracy: 0.4721 - val_loss: 1.0316 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 74/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0035 -
f1_score: 0.4755 - accuracy: 0.4755 - val_loss: 1.0121 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 75/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0022 -
f1_score: 0.4770 - accuracy: 0.4770 - val_loss: 1.0174 - val_f1_score: 0.4625 -
val_accuracy: 0.4625
Epoch 76/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0028 -
f1_score: 0.4753 - accuracy: 0.4753 - val_loss: 1.0054 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 77/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0010 -
f1_score: 0.4859 - accuracy: 0.4859 - val_loss: 1.0071 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 78/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0038 -
f1_score: 0.4793 - accuracy: 0.4793 - val_loss: 1.0183 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 79/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9988 -
f1_score: 0.4850 - accuracy: 0.4850 - val_loss: 1.0130 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 80/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0014 -
f1_score: 0.4825 - accuracy: 0.4825 - val_loss: 1.0085 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 81/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0038 -
f1_score: 0.4777 - accuracy: 0.4777 - val_loss: 1.0146 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 82/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0040 -
f1_score: 0.4782 - accuracy: 0.4782 - val_loss: 1.0163 - val_f1_score: 0.4669 -
val_accuracy: 0.4669
Epoch 83/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9971 -
f1_score: 0.4836 - accuracy: 0.4836 - val_loss: 1.0166 - val_f1_score: 0.4695 -
val_accuracy: 0.4695
Epoch 84/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9998 -
f1_score: 0.4761 - accuracy: 0.4761 - val_loss: 1.0183 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 85/500
```

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442/442 [==============================] - 1s 1ms/step - loss: 0.9994 -
f1_score: 0.4796 - accuracy: 0.4796 - val_loss: 1.0095 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 86/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9961 -
f1_score: 0.4851 - accuracy: 0.4851 - val_loss: 0.9958 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 87/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0042 -
f1_score: 0.4774 - accuracy: 0.4774 - val_loss: 1.0087 - val_f1_score: 0.4618 -
val_accuracy: 0.4618
Epoch 88/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9979 -
f1_score: 0.4799 - accuracy: 0.4799 - val_loss: 1.0154 - val_f1_score: 0.4567 -
val_accuracy: 0.4567
Epoch 89/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9978 -
f1_score: 0.4799 - accuracy: 0.4799 - val_loss: 1.0077 - val_f1_score: 0.4644 -
val_accuracy: 0.4644
Epoch 90/500
442/442 [==============================] - 1s 1ms/step - loss: 1.0040 -
f1_score: 0.4739 - accuracy: 0.4739 - val_loss: 1.0024 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 91/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9946 -
f1_score: 0.4839 - accuracy: 0.4839 - val_loss: 1.0132 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 92/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9992 -
f1_score: 0.4768 - accuracy: 0.4768 - val_loss: 1.0065 - val_f1_score: 0.4587 -
val_accuracy: 0.4587
Epoch 93/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9986 -
f1_score: 0.4767 - accuracy: 0.4767 - val_loss: 1.0342 - val_f1_score: 0.4485 -
val_accuracy: 0.4485
Epoch 94/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9953 -
f1_score: 0.4772 - accuracy: 0.4772 - val_loss: 1.0423 - val_f1_score: 0.4230 -
val_accuracy: 0.4230
Epoch 95/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9965 -
f1_score: 0.4808 - accuracy: 0.4808 - val_loss: 1.0054 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 96/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0029 -
f1_score: 0.4731 - accuracy: 0.4731 - val_loss: 1.0021 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 97/500
```

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442/442 [==============================] - 1s 1ms/step - loss: 0.9951 -
f1_score: 0.4878 - accuracy: 0.4878 - val_loss: 1.0080 - val_f1_score: 0.4650 -
val_accuracy: 0.4650
Epoch 98/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9967 -
f1_score: 0.4819 - accuracy: 0.4819 - val_loss: 1.0052 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 99/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0000 -
f1_score: 0.4804 - accuracy: 0.4804 - val_loss: 1.0046 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 100/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9928 -
f1_score: 0.4810 - accuracy: 0.4810 - val_loss: 1.0220 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 101/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9976 -
f1_score: 0.4868 - accuracy: 0.4868 - val_loss: 1.0184 - val_f1_score: 0.4587 -
val_accuracy: 0.4587
Epoch 102/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9974 -
f1_score: 0.4827 - accuracy: 0.4827 - val_loss: 0.9976 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 103/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9922 -
f1_score: 0.4883 - accuracy: 0.4883 - val_loss: 1.0116 - val_f1_score: 0.4784 -
val_accuracy: 0.4784
Epoch 104/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9901 -
f1_score: 0.4821 - accuracy: 0.4821 - val_loss: 1.0042 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 105/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9917 -
f1_score: 0.4856 - accuracy: 0.4856 - val_loss: 1.0030 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 106/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9961 -
f1_score: 0.4796 - accuracy: 0.4796 - val_loss: 0.9920 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 107/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9945 -
f1_score: 0.4825 - accuracy: 0.4825 - val_loss: 1.0085 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 108/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9943 -
f1_score: 0.4794 - accuracy: 0.4794 - val_loss: 1.0246 - val_f1_score: 0.4561 -
val_accuracy: 0.4561
Epoch 109/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9897 -
f1_score: 0.4866 - accuracy: 0.4866 - val_loss: 1.0100 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 110/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9928 -
f1_score: 0.4813 - accuracy: 0.4813 - val_loss: 1.0116 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 111/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9916 -
f1_score: 0.4838 - accuracy: 0.4838 - val_loss: 0.9988 - val_f1_score: 0.4790 -
val_accuracy: 0.4790
Epoch 112/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9889 -
f1_score: 0.4856 - accuracy: 0.4856 - val_loss: 1.0008 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 113/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9891 -
f1_score: 0.4835 - accuracy: 0.4835 - val_loss: 1.0015 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 114/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9887 -
f1_score: 0.4876 - accuracy: 0.4876 - val_loss: 0.9919 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 115/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9891 -
f1_score: 0.4851 - accuracy: 0.4851 - val_loss: 0.9966 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 116/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9900 -
f1_score: 0.4880 - accuracy: 0.4880 - val_loss: 0.9899 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 117/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9897 -
f1_score: 0.4830 - accuracy: 0.4830 - val_loss: 1.0014 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 118/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9897 -
f1_score: 0.4810 - accuracy: 0.4810 - val_loss: 1.0057 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 119/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9915 -
f1_score: 0.4873 - accuracy: 0.4873 - val_loss: 0.9981 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 120/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9937 -
f1_score: 0.4786 - accuracy: 0.4786 - val_loss: 1.0038 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 121/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9852 -
f1_score: 0.4881 - accuracy: 0.4881 - val_loss: 1.0003 - val_f1_score: 0.4746 -
val_accuracy: 0.4746
Epoch 122/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9883 -
f1_score: 0.4860 - accuracy: 0.4860 - val_loss: 1.0121 - val_f1_score: 0.4593 -
val_accuracy: 0.4593
Epoch 123/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9875 -
f1_score: 0.4833 - accuracy: 0.4833 - val_loss: 1.0164 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 124/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9884 -
f1_score: 0.4841 - accuracy: 0.4841 - val_loss: 0.9976 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 125/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9911 -
f1_score: 0.4856 - accuracy: 0.4856 - val_loss: 1.0129 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 126/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9899 -
f1_score: 0.4870 - accuracy: 0.4870 - val_loss: 1.0083 - val_f1_score: 0.4656 -
val_accuracy: 0.4656
Epoch 127/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9888 -
f1_score: 0.4783 - accuracy: 0.4783 - val_loss: 1.0001 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 128/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9907 -
f1_score: 0.4843 - accuracy: 0.4843 - val_loss: 0.9873 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 129/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9909 -
f1_score: 0.4799 - accuracy: 0.4799 - val_loss: 0.9979 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 130/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9910 -
f1_score: 0.4878 - accuracy: 0.4878 - val_loss: 1.0087 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 131/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9861 -
f1_score: 0.4898 - accuracy: 0.4898 - val_loss: 1.0107 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 132/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9928 -
f1_score: 0.4837 - accuracy: 0.4837 - val_loss: 0.9954 - val_f1_score: 0.4720 -
val_accuracy: 0.4720
Epoch 133/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9905 -
f1_score: 0.4809 - accuracy: 0.4809 - val_loss: 1.0103 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 134/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9895 -
f1_score: 0.4834 - accuracy: 0.4834 - val_loss: 1.0068 - val_f1_score: 0.4612 -
val_accuracy: 0.4612
Epoch 135/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9902 -
f1_score: 0.4867 - accuracy: 0.4867 - val_loss: 1.0248 - val_f1_score: 0.4682 -
val_accuracy: 0.4682
Epoch 136/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9904 -
f1_score: 0.4830 - accuracy: 0.4830 - val_loss: 1.0012 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 137/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9890 -
f1_score: 0.4854 - accuracy: 0.4854 - val_loss: 0.9965 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 138/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9901 -
f1_score: 0.4827 - accuracy: 0.4827 - val_loss: 1.0020 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 139/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9891 -
f1_score: 0.4852 - accuracy: 0.4852 - val_loss: 1.0016 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 140/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9905 -
f1_score: 0.4846 - accuracy: 0.4846 - val_loss: 0.9948 - val_f1_score: 0.4841 -
val_accuracy: 0.4841
Epoch 141/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9899 -
f1_score: 0.4855 - accuracy: 0.4855 - val_loss: 1.0020 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 142/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9857 -
f1_score: 0.4887 - accuracy: 0.4887 - val_loss: 1.0100 - val_f1_score: 0.4606 -
val_accuracy: 0.4606
Epoch 143/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9841 -
f1_score: 0.4958 - accuracy: 0.4958 - val_loss: 1.0028 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 144/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9892 -
f1_score: 0.4861 - accuracy: 0.4861 - val_loss: 1.0019 - val_f1_score: 0.4695 -
val_accuracy: 0.4695
Epoch 145/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9834 -
f1_score: 0.4914 - accuracy: 0.4914 - val_loss: 1.0126 - val_f1_score: 0.4529 -
val_accuracy: 0.4529
Epoch 146/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9827 -
f1_score: 0.4911 - accuracy: 0.4911 - val_loss: 1.0026 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 147/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9865 -
f1_score: 0.4960 - accuracy: 0.4960 - val_loss: 0.9941 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 148/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9863 -
f1_score: 0.4871 - accuracy: 0.4871 - val_loss: 0.9992 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 149/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9906 -
f1_score: 0.4829 - accuracy: 0.4829 - val_loss: 1.0023 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 150/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9861 -
f1_score: 0.4896 - accuracy: 0.4896 - val_loss: 0.9957 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 151/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9872 -
f1_score: 0.4944 - accuracy: 0.4944 - val_loss: 1.0087 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 152/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9884 -
f1_score: 0.4868 - accuracy: 0.4868 - val_loss: 1.0050 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 153/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9914 -
f1_score: 0.4868 - accuracy: 0.4868 - val_loss: 1.0025 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 154/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9831 -
f1_score: 0.4929 - accuracy: 0.4929 - val_loss: 1.0120 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 155/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9877 -
f1_score: 0.4963 - accuracy: 0.4963 - val_loss: 1.0099 - val_f1_score: 0.4682 -
val_accuracy: 0.4682
Epoch 156/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9831 -
f1_score: 0.4922 - accuracy: 0.4922 - val_loss: 1.0022 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 157/500
```

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442/442 [==============================] - 1s 1ms/step - loss: 0.9895 -
f1_score: 0.4873 - accuracy: 0.4873 - val_loss: 1.0029 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 158/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9890 -
f1_score: 0.4932 - accuracy: 0.4932 - val_loss: 1.0038 - val_f1_score: 0.4771 -
val_accuracy: 0.4771
Epoch 159/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9871 -
f1_score: 0.4948 - accuracy: 0.4948 - val_loss: 1.0213 - val_f1_score: 0.4669 -
val_accuracy: 0.4669
Epoch 160/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9837 -
f1_score: 0.4950 - accuracy: 0.4950 - val_loss: 0.9865 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 161/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9847 -
f1_score: 0.4929 - accuracy: 0.4929 - val_loss: 1.0005 - val_f1_score: 0.4688 -
val_accuracy: 0.4688
Epoch 162/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9894 -
f1_score: 0.4895 - accuracy: 0.4895 - val_loss: 1.0008 - val_f1_score: 0.4606 -
val_accuracy: 0.4606
Epoch 163/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9864 -
f1_score: 0.4874 - accuracy: 0.4874 - val_loss: 0.9916 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 164/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9810 -
f1_score: 0.4953 - accuracy: 0.4953 - val_loss: 0.9957 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 165/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9835 -
f1_score: 0.4914 - accuracy: 0.4914 - val_loss: 1.0012 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 166/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9844 -
f1_score: 0.4931 - accuracy: 0.4931 - val_loss: 1.0107 - val_f1_score: 0.4784 -
val_accuracy: 0.4784
Epoch 167/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9859 -
f1_score: 0.4946 - accuracy: 0.4946 - val_loss: 1.0073 - val_f1_score: 0.4695 -
val_accuracy: 0.4695
Epoch 168/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9931 -
f1_score: 0.4849 - accuracy: 0.4849 - val_loss: 0.9993 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 169/500
```

```
442/442 [==============================] - 1s 1ms/step - loss: 0.9899 -
f1_score: 0.4858 - accuracy: 0.4858 - val_loss: 1.0129 - val_f1_score: 0.4701 -
val_accuracy: 0.4701
Epoch 170/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9937 -
f1_score: 0.4815 - accuracy: 0.4815 - val_loss: 1.0037 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 171/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9949 -
f1_score: 0.4765 - accuracy: 0.4765 - val_loss: 1.0070 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 172/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9890 -
f1_score: 0.4842 - accuracy: 0.4842 - val_loss: 1.0017 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 173/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9913 -
f1_score: 0.4811 - accuracy: 0.4811 - val_loss: 0.9961 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 174/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9861 -
f1_score: 0.4866 - accuracy: 0.4866 - val_loss: 1.0017 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 175/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9817 -
f1_score: 0.4926 - accuracy: 0.4926 - val_loss: 0.9999 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 176/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9835 -
f1_score: 0.4928 - accuracy: 0.4928 - val_loss: 0.9971 - val_f1_score: 0.4784 -
val_accuracy: 0.4784
Epoch 177/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9819 -
f1_score: 0.4917 - accuracy: 0.4917 - val_loss: 1.0075 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 178/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9882 -
f1_score: 0.4905 - accuracy: 0.4905 - val_loss: 1.0011 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 179/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9858 -
f1_score: 0.4942 - accuracy: 0.4942 - val_loss: 1.0109 - val_f1_score: 0.4637 -
val_accuracy: 0.4637
Epoch 180/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9902 -
f1_score: 0.4895 - accuracy: 0.4895 - val_loss: 0.9991 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 181/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9889 -
f1_score: 0.4883 - accuracy: 0.4883 - val_loss: 1.0108 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 182/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9866 -
f1_score: 0.4922 - accuracy: 0.4922 - val_loss: 1.0130 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 183/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9808 -
f1_score: 0.4902 - accuracy: 0.4902 - val_loss: 0.9955 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 184/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9810 -
f1_score: 0.4906 - accuracy: 0.4906 - val_loss: 0.9913 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 185/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9815 -
f1_score: 0.4922 - accuracy: 0.4922 - val_loss: 1.0031 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 186/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9860 -
f1_score: 0.4897 - accuracy: 0.4897 - val_loss: 1.0032 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 187/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9804 -
f1_score: 0.4972 - accuracy: 0.4972 - val_loss: 0.9950 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 188/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9862 -
f1_score: 0.4869 - accuracy: 0.4869 - val_loss: 1.0210 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 189/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9875 -
f1_score: 0.4832 - accuracy: 0.4832 - val_loss: 1.0028 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 190/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9909 -
f1_score: 0.4799 - accuracy: 0.4799 - val_loss: 1.0051 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 191/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9797 -
f1_score: 0.4931 - accuracy: 0.4931 - val_loss: 0.9982 - val_f1_score: 0.4720 -
val_accuracy: 0.4720
Epoch 192/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9844 -
f1_score: 0.4869 - accuracy: 0.4869 - val_loss: 0.9979 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 193/500
```

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442/442 [==============================] - 1s 1ms/step - loss: 0.9810 -
f1_score: 0.4967 - accuracy: 0.4967 - val_loss: 1.0153 - val_f1_score: 0.4676 -
val_accuracy: 0.4676
Epoch 194/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9847 -
f1_score: 0.4934 - accuracy: 0.4934 - val_loss: 0.9983 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 195/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9853 -
f1_score: 0.4874 - accuracy: 0.4874 - val_loss: 0.9994 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 196/500
442/442 [==============================] - 1s 2ms/step - loss: 1.0129 -
f1_score: 0.4765 - accuracy: 0.4765 - val_loss: 1.0270 - val_f1_score: 0.4555 -
val_accuracy: 0.4555
Epoch 197/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9874 -
f1_score: 0.4926 - accuracy: 0.4926 - val_loss: 0.9924 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 198/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9850 -
f1_score: 0.4877 - accuracy: 0.4877 - val_loss: 1.0020 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 199/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9832 -
f1_score: 0.4902 - accuracy: 0.4902 - val_loss: 0.9927 - val_f1_score: 0.4847 -
val_accuracy: 0.4847
Epoch 200/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9793 -
f1_score: 0.4960 - accuracy: 0.4960 - val_loss: 0.9890 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 201/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9790 -
f1_score: 0.4934 - accuracy: 0.4934 - val_loss: 0.9872 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 202/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9827 -
f1_score: 0.4934 - accuracy: 0.4934 - val_loss: 0.9935 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 203/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9782 -
f1_score: 0.4941 - accuracy: 0.4941 - val_loss: 1.0120 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 204/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9835 -
f1_score: 0.4961 - accuracy: 0.4961 - val_loss: 0.9930 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 205/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9858 -
f1_score: 0.4878 - accuracy: 0.4878 - val_loss: 1.0056 - val_f1_score: 0.4637 -
val_accuracy: 0.4637
Epoch 206/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9821 -
f1_score: 0.4948 - accuracy: 0.4948 - val_loss: 0.9985 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 207/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9774 -
f1_score: 0.4979 - accuracy: 0.4979 - val_loss: 1.0049 - val_f1_score: 0.4790 -
val_accuracy: 0.4790
Epoch 208/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9815 -
f1_score: 0.4941 - accuracy: 0.4941 - val_loss: 1.0055 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 209/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9867 -
f1_score: 0.4857 - accuracy: 0.4857 - val_loss: 1.0018 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 210/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9862 -
f1_score: 0.4821 - accuracy: 0.4821 - val_loss: 0.9960 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 211/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9786 -
f1_score: 0.4886 - accuracy: 0.4886 - val_loss: 0.9920 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 212/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9843 -
f1_score: 0.4835 - accuracy: 0.4835 - val_loss: 0.9910 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 213/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9823 -
f1_score: 0.4852 - accuracy: 0.4852 - val_loss: 0.9942 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 214/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9832 -
f1_score: 0.4881 - accuracy: 0.4881 - val_loss: 0.9895 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 215/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9829 -
f1_score: 0.4925 - accuracy: 0.4925 - val_loss: 0.9917 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 216/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9793 -
f1_score: 0.4951 - accuracy: 0.4951 - val_loss: 0.9927 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 217/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9860 -
f1_score: 0.4897 - accuracy: 0.4897 - val_loss: 0.9959 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 218/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9820 -
f1_score: 0.4911 - accuracy: 0.4911 - val_loss: 0.9933 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 219/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9754 -
f1_score: 0.4994 - accuracy: 0.4994 - val_loss: 1.0028 - val_f1_score: 0.4682 -
val_accuracy: 0.4682
Epoch 220/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9838 -
f1_score: 0.4944 - accuracy: 0.4944 - val_loss: 0.9994 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 221/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9773 -
f1_score: 0.4931 - accuracy: 0.4931 - val_loss: 0.9891 - val_f1_score: 0.4752 -
val_accuracy: 0.4752
Epoch 222/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9795 -
f1_score: 0.4898 - accuracy: 0.4898 - val_loss: 1.0048 - val_f1_score: 0.4676 -
val_accuracy: 0.4676
Epoch 223/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9820 -
f1_score: 0.4960 - accuracy: 0.4960 - val_loss: 0.9983 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 224/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9813 -
f1_score: 0.4946 - accuracy: 0.4946 - val_loss: 0.9897 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 225/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9786 -
f1_score: 0.5020 - accuracy: 0.5020 - val_loss: 1.0013 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 226/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9817 -
f1_score: 0.4965 - accuracy: 0.4965 - val_loss: 0.9955 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 227/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9807 -
f1_score: 0.4935 - accuracy: 0.4935 - val_loss: 1.0005 - val_f1_score: 0.4847 -
val_accuracy: 0.4847
Epoch 228/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9774 -
f1_score: 0.4946 - accuracy: 0.4946 - val_loss: 0.9949 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 229/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9776 -
f1_score: 0.4955 - accuracy: 0.4955 - val_loss: 0.9978 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 230/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9791 -
f1_score: 0.4968 - accuracy: 0.4968 - val_loss: 0.9995 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 231/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9746 -
f1_score: 0.5018 - accuracy: 0.5018 - val_loss: 1.0017 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 232/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9784 -
f1_score: 0.4943 - accuracy: 0.4943 - val_loss: 0.9947 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 233/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9728 -
f1_score: 0.5025 - accuracy: 0.5025 - val_loss: 1.0020 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 234/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9794 -
f1_score: 0.4950 - accuracy: 0.4950 - val_loss: 1.0056 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 235/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9804 -
f1_score: 0.4943 - accuracy: 0.4943 - val_loss: 1.0034 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 236/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9780 -
f1_score: 0.4975 - accuracy: 0.4975 - val_loss: 1.0017 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 237/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9762 -
f1_score: 0.4992 - accuracy: 0.4992 - val_loss: 0.9936 - val_f1_score: 0.4733 -
val_accuracy: 0.4733
Epoch 238/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9807 -
f1_score: 0.4919 - accuracy: 0.4919 - val_loss: 1.0014 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 239/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9773 -
f1_score: 0.5006 - accuracy: 0.5006 - val_loss: 0.9909 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 240/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9733 -
f1_score: 0.4965 - accuracy: 0.4965 - val_loss: 0.9918 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 241/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9832 -
f1_score: 0.4960 - accuracy: 0.4960 - val_loss: 0.9897 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 242/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9811 -
f1_score: 0.4937 - accuracy: 0.4937 - val_loss: 1.0007 - val_f1_score: 0.4847 -
val_accuracy: 0.4847
Epoch 243/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9762 -
f1_score: 0.5025 - accuracy: 0.5025 - val_loss: 0.9940 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 244/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9794 -
f1_score: 0.4984 - accuracy: 0.4984 - val_loss: 1.0143 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 245/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9835 -
f1_score: 0.4931 - accuracy: 0.4931 - val_loss: 1.0047 - val_f1_score: 0.4790 -
val_accuracy: 0.4790
Epoch 246/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9775 -
f1_score: 0.4955 - accuracy: 0.4955 - val_loss: 1.0034 - val_f1_score: 0.4841 -
val_accuracy: 0.4841
Epoch 247/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9755 -
f1_score: 0.4996 - accuracy: 0.4996 - val_loss: 0.9973 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 248/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9798 -
f1_score: 0.4902 - accuracy: 0.4902 - val_loss: 0.9951 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 249/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9726 -
f1_score: 0.4948 - accuracy: 0.4948 - val_loss: 0.9998 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 250/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9734 -
f1_score: 0.4958 - accuracy: 0.4958 - val_loss: 0.9929 - val_f1_score: 0.4777 -
val_accuracy: 0.4777
Epoch 251/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9766 -
f1_score: 0.4956 - accuracy: 0.4956 - val_loss: 1.0026 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 252/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9711 -
f1_score: 0.4991 - accuracy: 0.4991 - val_loss: 0.9932 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 253/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9718 -
f1_score: 0.5041 - accuracy: 0.5041 - val_loss: 0.9841 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 254/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9730 -
f1_score: 0.4972 - accuracy: 0.4972 - val_loss: 0.9940 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 255/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9809 -
f1_score: 0.4955 - accuracy: 0.4955 - val_loss: 0.9936 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 256/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9743 -
f1_score: 0.4999 - accuracy: 0.4999 - val_loss: 0.9841 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 257/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9696 -
f1_score: 0.5004 - accuracy: 0.5004 - val_loss: 0.9887 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 258/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9674 -
f1_score: 0.5040 - accuracy: 0.5040 - val_loss: 0.9974 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 259/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9666 -
f1_score: 0.5046 - accuracy: 0.5046 - val_loss: 0.9874 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 260/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9761 -
f1_score: 0.4969 - accuracy: 0.4969 - val_loss: 1.0176 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 261/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9762 -
f1_score: 0.4958 - accuracy: 0.4958 - val_loss: 0.9888 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 262/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9709 -
f1_score: 0.5013 - accuracy: 0.5013 - val_loss: 0.9854 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 263/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9725 -
f1_score: 0.5003 - accuracy: 0.5003 - val_loss: 0.9843 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 264/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9795 -
f1_score: 0.4956 - accuracy: 0.4956 - val_loss: 0.9938 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 265/500
```

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442/442 [==============================] - 1s 2ms/step - loss: 0.9683 -
f1_score: 0.5020 - accuracy: 0.5020 - val_loss: 0.9861 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 266/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9682 -
f1_score: 0.5037 - accuracy: 0.5037 - val_loss: 0.9960 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 267/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9683 -
f1_score: 0.5013 - accuracy: 0.5013 - val_loss: 0.9867 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 268/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9694 -
f1_score: 0.5030 - accuracy: 0.5030 - val_loss: 0.9938 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 269/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9646 -
f1_score: 0.5076 - accuracy: 0.5076 - val_loss: 0.9988 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 270/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9701 -
f1_score: 0.5018 - accuracy: 0.5018 - val_loss: 0.9872 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 271/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9715 -
f1_score: 0.5013 - accuracy: 0.5013 - val_loss: 0.9912 - val_f1_score: 0.4847 -
val_accuracy: 0.4847
Epoch 272/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9738 -
f1_score: 0.5047 - accuracy: 0.5047 - val_loss: 0.9871 - val_f1_score: 0.4962 -
val_accuracy: 0.4962
Epoch 273/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9826 -
f1_score: 0.4935 - accuracy: 0.4935 - val_loss: 0.9976 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 274/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9760 -
f1_score: 0.4936 - accuracy: 0.4936 - val_loss: 0.9871 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 275/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9716 -
f1_score: 0.5029 - accuracy: 0.5029 - val_loss: 0.9942 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 276/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9643 -
f1_score: 0.4999 - accuracy: 0.4999 - val_loss: 0.9940 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 277/500
```

```
442/442 [==============================] - 1s 1ms/step - loss: 0.9681 -
f1_score: 0.5069 - accuracy: 0.5069 - val_loss: 0.9972 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 278/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9656 -
f1_score: 0.5057 - accuracy: 0.5057 - val_loss: 0.9918 - val_f1_score: 0.5006 -
val_accuracy: 0.5006
Epoch 279/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9668 -
f1_score: 0.5028 - accuracy: 0.5028 - val_loss: 0.9959 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 280/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9714 -
f1_score: 0.4992 - accuracy: 0.4992 - val_loss: 0.9903 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 281/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9644 -
f1_score: 0.5069 - accuracy: 0.5069 - val_loss: 0.9850 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 282/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9726 -
f1_score: 0.4984 - accuracy: 0.4984 - val_loss: 0.9821 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 283/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9668 -
f1_score: 0.5054 - accuracy: 0.5054 - val_loss: 0.9865 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 284/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9634 -
f1_score: 0.5100 - accuracy: 0.5100 - val_loss: 1.0051 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 285/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9703 -
f1_score: 0.5034 - accuracy: 0.5034 - val_loss: 0.9919 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 286/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9719 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 1.0045 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 287/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9799 -
f1_score: 0.4906 - accuracy: 0.4906 - val_loss: 0.9914 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 288/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9641 -
f1_score: 0.5067 - accuracy: 0.5067 - val_loss: 0.9887 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 289/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9648 -
f1_score: 0.5098 - accuracy: 0.5098 - val_loss: 0.9925 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 290/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9719 -
f1_score: 0.4992 - accuracy: 0.4992 - val_loss: 0.9855 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 291/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9691 -
f1_score: 0.5014 - accuracy: 0.5014 - val_loss: 0.9939 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 292/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9703 -
f1_score: 0.5002 - accuracy: 0.5002 - val_loss: 1.0072 - val_f1_score: 0.4784 -
val_accuracy: 0.4784
Epoch 293/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9835 -
f1_score: 0.4979 - accuracy: 0.4979 - val_loss: 0.9962 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 294/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9675 -
f1_score: 0.5012 - accuracy: 0.5012 - val_loss: 0.9933 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 295/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9644 -
f1_score: 0.5054 - accuracy: 0.5054 - val_loss: 0.9965 - val_f1_score: 0.4758 -
val_accuracy: 0.4758
Epoch 296/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9653 -
f1_score: 0.5045 - accuracy: 0.5045 - val_loss: 0.9854 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 297/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9685 -
f1_score: 0.5074 - accuracy: 0.5074 - val_loss: 0.9834 - val_f1_score: 0.4962 -
val_accuracy: 0.4962
Epoch 298/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9647 -
f1_score: 0.5076 - accuracy: 0.5076 - val_loss: 0.9905 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 299/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9678 -
f1_score: 0.5061 - accuracy: 0.5061 - val_loss: 0.9954 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 300/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9666 -
f1_score: 0.5069 - accuracy: 0.5069 - val_loss: 1.0002 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 301/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9753 -
f1_score: 0.5004 - accuracy: 0.5004 - val_loss: 0.9884 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 302/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9684 -
f1_score: 0.5044 - accuracy: 0.5044 - val_loss: 0.9936 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 303/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9640 -
f1_score: 0.5060 - accuracy: 0.5060 - val_loss: 1.0092 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 304/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9666 -
f1_score: 0.5042 - accuracy: 0.5042 - val_loss: 0.9971 - val_f1_score: 0.4714 -
val_accuracy: 0.4714
Epoch 305/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9704 -
f1_score: 0.5013 - accuracy: 0.5013 - val_loss: 0.9894 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 306/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9639 -
f1_score: 0.5047 - accuracy: 0.5047 - val_loss: 0.9821 - val_f1_score: 0.4975 -
val_accuracy: 0.4975
Epoch 307/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9683 -
f1_score: 0.5045 - accuracy: 0.5045 - val_loss: 0.9980 - val_f1_score: 0.4707 -
val_accuracy: 0.4707
Epoch 308/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9655 -
f1_score: 0.5025 - accuracy: 0.5025 - val_loss: 0.9934 - val_f1_score: 0.4847 -
val_accuracy: 0.4847
Epoch 309/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9700 -
f1_score: 0.5045 - accuracy: 0.5045 - val_loss: 1.0039 - val_f1_score: 0.5025 -
val_accuracy: 0.5025
Epoch 310/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9708 -
f1_score: 0.4996 - accuracy: 0.4996 - val_loss: 1.0004 - val_f1_score: 0.4841 -
val_accuracy: 0.4841
Epoch 311/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9663 -
f1_score: 0.4992 - accuracy: 0.4992 - val_loss: 0.9855 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 312/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9667 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 0.9791 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 313/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9674 -
f1_score: 0.5074 - accuracy: 0.5074 - val_loss: 0.9838 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 314/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9656 -
f1_score: 0.5076 - accuracy: 0.5076 - val_loss: 0.9742 - val_f1_score: 0.5032 -
val_accuracy: 0.5032
Epoch 315/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9677 -
f1_score: 0.5011 - accuracy: 0.5011 - val_loss: 0.9992 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 316/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9689 -
f1_score: 0.5028 - accuracy: 0.5028 - val_loss: 1.0089 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 317/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9683 -
f1_score: 0.5059 - accuracy: 0.5059 - val_loss: 0.9933 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 318/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9686 -
f1_score: 0.5067 - accuracy: 0.5067 - val_loss: 0.9840 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 319/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9681 -
f1_score: 0.5035 - accuracy: 0.5035 - val_loss: 0.9827 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 320/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9718 -
f1_score: 0.5012 - accuracy: 0.5012 - val_loss: 0.9865 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 321/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9731 -
f1_score: 0.5001 - accuracy: 0.5001 - val_loss: 0.9819 - val_f1_score: 0.4765 -
val_accuracy: 0.4765
Epoch 322/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9677 -
f1_score: 0.5043 - accuracy: 0.5043 - val_loss: 0.9976 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 323/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9619 -
f1_score: 0.5109 - accuracy: 0.5109 - val_loss: 0.9950 - val_f1_score: 0.5000 -
val_accuracy: 0.5000
Epoch 324/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9595 -
f1_score: 0.5078 - accuracy: 0.5078 - val_loss: 0.9861 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 325/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9611 -
f1_score: 0.5046 - accuracy: 0.5046 - val_loss: 0.9875 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 326/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9709 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 0.9961 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 327/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9666 -
f1_score: 0.5037 - accuracy: 0.5037 - val_loss: 1.0058 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 328/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9711 -
f1_score: 0.4993 - accuracy: 0.4993 - val_loss: 0.9908 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 329/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9701 -
f1_score: 0.5073 - accuracy: 0.5073 - val_loss: 1.0043 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 330/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9677 -
f1_score: 0.5054 - accuracy: 0.5054 - val_loss: 0.9943 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 331/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9613 -
f1_score: 0.5105 - accuracy: 0.5105 - val_loss: 0.9919 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 332/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9672 -
f1_score: 0.5033 - accuracy: 0.5033 - val_loss: 0.9854 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 333/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9667 -
f1_score: 0.5031 - accuracy: 0.5031 - val_loss: 0.9861 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 334/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9655 -
f1_score: 0.5047 - accuracy: 0.5047 - val_loss: 0.9913 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 335/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9629 -
f1_score: 0.5082 - accuracy: 0.5082 - val_loss: 0.9958 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 336/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9654 -
f1_score: 0.5045 - accuracy: 0.5045 - val_loss: 1.0112 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 337/500
```

```
442/442 [==============================] - 1s 1ms/step - loss: 0.9662 -
f1_score: 0.5012 - accuracy: 0.5012 - val_loss: 0.9932 - val_f1_score: 0.4975 -
val_accuracy: 0.4975
Epoch 338/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9670 -
f1_score: 0.5086 - accuracy: 0.5086 - val_loss: 0.9913 - val_f1_score: 0.5089 -
val_accuracy: 0.5089
Epoch 339/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9672 -
f1_score: 0.5063 - accuracy: 0.5063 - val_loss: 0.9896 - val_f1_score: 0.4975 -
val_accuracy: 0.4975
Epoch 340/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9699 -
f1_score: 0.5035 - accuracy: 0.5035 - val_loss: 0.9958 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 341/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9593 -
f1_score: 0.5064 - accuracy: 0.5064 - val_loss: 0.9835 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 342/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9626 -
f1_score: 0.5063 - accuracy: 0.5063 - val_loss: 0.9954 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 343/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9608 -
f1_score: 0.5076 - accuracy: 0.5076 - val_loss: 0.9905 - val_f1_score: 0.4835 -
val_accuracy: 0.4835
Epoch 344/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9735 -
f1_score: 0.5025 - accuracy: 0.5025 - val_loss: 0.9964 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 345/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9679 -
f1_score: 0.5077 - accuracy: 0.5077 - val_loss: 0.9780 - val_f1_score: 0.5070 -
val_accuracy: 0.5070
Epoch 346/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9603 -
f1_score: 0.5088 - accuracy: 0.5088 - val_loss: 0.9832 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 347/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9600 -
f1_score: 0.5066 - accuracy: 0.5066 - val_loss: 0.9926 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 348/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9697 -
f1_score: 0.5055 - accuracy: 0.5055 - val_loss: 1.0012 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 349/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9662 -
f1_score: 0.5085 - accuracy: 0.5085 - val_loss: 0.9758 - val_f1_score: 0.5159 -
val_accuracy: 0.5159
Epoch 350/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9653 -
f1_score: 0.5100 - accuracy: 0.5100 - val_loss: 0.9861 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 351/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9649 -
f1_score: 0.5023 - accuracy: 0.5023 - val_loss: 0.9840 - val_f1_score: 0.5102 -
val_accuracy: 0.5102
Epoch 352/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9679 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 0.9855 - val_f1_score: 0.5006 -
val_accuracy: 0.5006
Epoch 353/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9744 -
f1_score: 0.5035 - accuracy: 0.5035 - val_loss: 0.9898 - val_f1_score: 0.5013 -
val_accuracy: 0.5013
Epoch 354/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9640 -
f1_score: 0.5085 - accuracy: 0.5085 - val_loss: 0.9913 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 355/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9630 -
f1_score: 0.5074 - accuracy: 0.5074 - val_loss: 0.9907 - val_f1_score: 0.5000 -
val_accuracy: 0.5000
Epoch 356/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9641 -
f1_score: 0.5106 - accuracy: 0.5106 - val_loss: 0.9832 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 357/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9584 -
f1_score: 0.5133 - accuracy: 0.5133 - val_loss: 0.9902 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 358/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9616 -
f1_score: 0.5141 - accuracy: 0.5141 - val_loss: 0.9965 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 359/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9606 -
f1_score: 0.5077 - accuracy: 0.5077 - val_loss: 0.9899 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 360/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9788 -
f1_score: 0.4923 - accuracy: 0.4923 - val_loss: 1.0004 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 361/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9726 -
f1_score: 0.5041 - accuracy: 0.5041 - val_loss: 0.9864 - val_f1_score: 0.5025 -
val_accuracy: 0.5025
Epoch 362/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9634 -
f1_score: 0.5028 - accuracy: 0.5028 - val_loss: 0.9838 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 363/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9658 -
f1_score: 0.4994 - accuracy: 0.4994 - val_loss: 0.9957 - val_f1_score: 0.4790 -
val_accuracy: 0.4790
Epoch 364/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9665 -
f1_score: 0.5069 - accuracy: 0.5069 - val_loss: 0.9987 - val_f1_score: 0.4905 -
val_accuracy: 0.4905
Epoch 365/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9574 -
f1_score: 0.5132 - accuracy: 0.5132 - val_loss: 0.9799 - val_f1_score: 0.5102 -
val_accuracy: 0.5102
Epoch 366/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9627 -
f1_score: 0.5057 - accuracy: 0.5057 - val_loss: 0.9908 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 367/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9670 -
f1_score: 0.5044 - accuracy: 0.5044 - val_loss: 0.9869 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 368/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9700 -
f1_score: 0.5015 - accuracy: 0.5015 - val_loss: 0.9844 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 369/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9612 -
f1_score: 0.5083 - accuracy: 0.5083 - val_loss: 0.9802 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 370/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9597 -
f1_score: 0.5157 - accuracy: 0.5157 - val_loss: 0.9921 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 371/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9674 -
f1_score: 0.5038 - accuracy: 0.5038 - val_loss: 0.9817 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 372/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9600 -
f1_score: 0.5100 - accuracy: 0.5100 - val_loss: 0.9950 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 373/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9629 -
f1_score: 0.5053 - accuracy: 0.5053 - val_loss: 0.9920 - val_f1_score: 0.5025 -
val_accuracy: 0.5025
Epoch 374/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9621 -
f1_score: 0.5082 - accuracy: 0.5082 - val_loss: 0.9784 - val_f1_score: 0.5070 -
val_accuracy: 0.5070
Epoch 375/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9631 -
f1_score: 0.5085 - accuracy: 0.5085 - val_loss: 0.9834 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 376/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9606 -
f1_score: 0.5101 - accuracy: 0.5101 - val_loss: 0.9765 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 377/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9579 -
f1_score: 0.5075 - accuracy: 0.5075 - val_loss: 0.9796 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 378/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9649 -
f1_score: 0.5040 - accuracy: 0.5040 - val_loss: 0.9768 - val_f1_score: 0.5038 -
val_accuracy: 0.5038
Epoch 379/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9585 -
f1_score: 0.5099 - accuracy: 0.5099 - val_loss: 0.9726 - val_f1_score: 0.5064 -
val_accuracy: 0.5064
Epoch 380/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9586 -
f1_score: 0.5135 - accuracy: 0.5135 - val_loss: 0.9980 - val_f1_score: 0.5000 -
val_accuracy: 0.5000
Epoch 381/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9600 -
f1_score: 0.5112 - accuracy: 0.5112 - val_loss: 0.9930 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 382/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9583 -
f1_score: 0.5114 - accuracy: 0.5114 - val_loss: 0.9821 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 383/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9729 -
f1_score: 0.4996 - accuracy: 0.4996 - val_loss: 0.9892 - val_f1_score: 0.5064 -
val_accuracy: 0.5064
Epoch 384/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9669 -
f1_score: 0.5075 - accuracy: 0.5075 - val_loss: 0.9980 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 385/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9659 -
f1_score: 0.5037 - accuracy: 0.5037 - val_loss: 0.9886 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 386/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9708 -
f1_score: 0.4968 - accuracy: 0.4968 - val_loss: 0.9847 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 387/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9663 -
f1_score: 0.5045 - accuracy: 0.5045 - val_loss: 0.9832 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 388/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9590 -
f1_score: 0.5125 - accuracy: 0.5125 - val_loss: 0.9797 - val_f1_score: 0.5038 -
val_accuracy: 0.5038
Epoch 389/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9555 -
f1_score: 0.5117 - accuracy: 0.5117 - val_loss: 0.9829 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 390/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9558 -
f1_score: 0.5119 - accuracy: 0.5119 - val_loss: 0.9794 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 391/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9603 -
f1_score: 0.5061 - accuracy: 0.5061 - val_loss: 0.9968 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 392/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9703 -
f1_score: 0.5029 - accuracy: 0.5029 - val_loss: 0.9863 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 393/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9666 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 1.0031 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 394/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9686 -
f1_score: 0.5035 - accuracy: 0.5035 - val_loss: 0.9920 - val_f1_score: 0.5070 -
val_accuracy: 0.5070
Epoch 395/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9596 -
f1_score: 0.5087 - accuracy: 0.5087 - val_loss: 0.9872 - val_f1_score: 0.5038 -
val_accuracy: 0.5038
Epoch 396/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9659 -
f1_score: 0.5049 - accuracy: 0.5049 - val_loss: 0.9944 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 397/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9705 -
f1_score: 0.5004 - accuracy: 0.5004 - val_loss: 0.9853 - val_f1_score: 0.5089 -
val_accuracy: 0.5089
Epoch 398/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9593 -
f1_score: 0.5057 - accuracy: 0.5057 - val_loss: 0.9834 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 399/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9656 -
f1_score: 0.5038 - accuracy: 0.5038 - val_loss: 0.9878 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 400/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9639 -
f1_score: 0.5062 - accuracy: 0.5062 - val_loss: 0.9834 - val_f1_score: 0.5013 -
val_accuracy: 0.5013
Epoch 401/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9605 -
f1_score: 0.5108 - accuracy: 0.5108 - val_loss: 0.9859 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 402/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9648 -
f1_score: 0.4999 - accuracy: 0.4999 - val_loss: 0.9998 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 403/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9657 -
f1_score: 0.5078 - accuracy: 0.5078 - val_loss: 0.9815 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 404/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9604 -
f1_score: 0.5142 - accuracy: 0.5142 - val_loss: 0.9757 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 405/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9687 -
f1_score: 0.5074 - accuracy: 0.5074 - val_loss: 0.9924 - val_f1_score: 0.5051 -
val_accuracy: 0.5051
Epoch 406/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9710 -
f1_score: 0.5031 - accuracy: 0.5031 - val_loss: 0.9732 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 407/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9630 -
f1_score: 0.4977 - accuracy: 0.4977 - val_loss: 0.9873 - val_f1_score: 0.5025 -
val_accuracy: 0.5025
Epoch 408/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9661 -
f1_score: 0.5029 - accuracy: 0.5029 - val_loss: 0.9973 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 409/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9617 -
f1_score: 0.5059 - accuracy: 0.5059 - val_loss: 0.9867 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 410/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9651 -
f1_score: 0.5109 - accuracy: 0.5109 - val_loss: 1.0321 - val_f1_score: 0.4606 -
val_accuracy: 0.4606
Epoch 411/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9733 -
f1_score: 0.5005 - accuracy: 0.5005 - val_loss: 0.9907 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 412/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9608 -
f1_score: 0.5091 - accuracy: 0.5091 - val_loss: 0.9910 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 413/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9660 -
f1_score: 0.5075 - accuracy: 0.5075 - val_loss: 0.9870 - val_f1_score: 0.4885 -
val_accuracy: 0.4885
Epoch 414/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9580 -
f1_score: 0.5063 - accuracy: 0.5063 - val_loss: 0.9873 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 415/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9603 -
f1_score: 0.5047 - accuracy: 0.5047 - val_loss: 0.9946 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 416/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9617 -
f1_score: 0.5068 - accuracy: 0.5068 - val_loss: 0.9839 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 417/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9605 -
f1_score: 0.5065 - accuracy: 0.5065 - val_loss: 0.9859 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 418/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9617 -
f1_score: 0.5088 - accuracy: 0.5088 - val_loss: 0.9861 - val_f1_score: 0.4975 -
val_accuracy: 0.4975
Epoch 419/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9590 -
f1_score: 0.5136 - accuracy: 0.5136 - val_loss: 0.9865 - val_f1_score: 0.4784 -
val_accuracy: 0.4784
Epoch 420/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9630 -
f1_score: 0.5081 - accuracy: 0.5081 - val_loss: 0.9870 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 421/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9663 -
f1_score: 0.5111 - accuracy: 0.5111 - val_loss: 0.9939 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 422/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9631 -
f1_score: 0.5125 - accuracy: 0.5125 - val_loss: 0.9876 - val_f1_score: 0.4955 -
val_accuracy: 0.4955
Epoch 423/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9767 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 0.9878 - val_f1_score: 0.4911 -
val_accuracy: 0.4911
Epoch 424/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9645 -
f1_score: 0.5028 - accuracy: 0.5028 - val_loss: 0.9841 - val_f1_score: 0.4917 -
val_accuracy: 0.4917
Epoch 425/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9631 -
f1_score: 0.5089 - accuracy: 0.5089 - val_loss: 0.9755 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 426/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9579 -
f1_score: 0.5114 - accuracy: 0.5114 - val_loss: 0.9863 - val_f1_score: 0.4746 -
val_accuracy: 0.4746
Epoch 427/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9528 -
f1_score: 0.5153 - accuracy: 0.5153 - val_loss: 0.9913 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 428/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9667 -
f1_score: 0.5067 - accuracy: 0.5067 - val_loss: 0.9896 - val_f1_score: 0.4828 -
val_accuracy: 0.4828
Epoch 429/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9578 -
f1_score: 0.5064 - accuracy: 0.5064 - val_loss: 0.9905 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 430/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9652 -
f1_score: 0.5099 - accuracy: 0.5099 - val_loss: 1.0193 - val_f1_score: 0.4809 -
val_accuracy: 0.4809
Epoch 431/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9685 -
f1_score: 0.5030 - accuracy: 0.5030 - val_loss: 0.9776 - val_f1_score: 0.4924 -
val_accuracy: 0.4924
Epoch 432/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9627 -
f1_score: 0.5033 - accuracy: 0.5033 - val_loss: 0.9858 - val_f1_score: 0.4898 -
val_accuracy: 0.4898
Epoch 433/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9630 -
f1_score: 0.5025 - accuracy: 0.5025 - val_loss: 0.9951 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 434/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9682 -
f1_score: 0.4992 - accuracy: 0.4992 - val_loss: 0.9896 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 435/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9775 -
f1_score: 0.4953 - accuracy: 0.4953 - val_loss: 0.9952 - val_f1_score: 0.4726 -
val_accuracy: 0.4726
Epoch 436/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9675 -
f1_score: 0.4924 - accuracy: 0.4924 - val_loss: 0.9908 - val_f1_score: 0.4879 -
val_accuracy: 0.4879
Epoch 437/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9938 -
f1_score: 0.4835 - accuracy: 0.4835 - val_loss: 1.0090 - val_f1_score: 0.4612 -
val_accuracy: 0.4612
Epoch 438/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9762 -
f1_score: 0.4987 - accuracy: 0.4987 - val_loss: 1.0002 - val_f1_score: 0.4739 -
val_accuracy: 0.4739
Epoch 439/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9768 -
f1_score: 0.5006 - accuracy: 0.5006 - val_loss: 1.0114 - val_f1_score: 0.4803 -
val_accuracy: 0.4803
Epoch 440/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9805 -
f1_score: 0.4976 - accuracy: 0.4976 - val_loss: 1.0031 - val_f1_score: 0.4720 -
val_accuracy: 0.4720
Epoch 441/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9751 -
f1_score: 0.4952 - accuracy: 0.4952 - val_loss: 1.0031 - val_f1_score: 0.4758 -
val_accuracy: 0.4758
Epoch 442/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9775 -
f1_score: 0.4973 - accuracy: 0.4973 - val_loss: 1.0077 - val_f1_score: 0.4854 -
val_accuracy: 0.4854
Epoch 443/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9646 -
f1_score: 0.5057 - accuracy: 0.5057 - val_loss: 0.9908 - val_f1_score: 0.4866 -
val_accuracy: 0.4866
Epoch 444/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9592 -
f1_score: 0.5109 - accuracy: 0.5109 - val_loss: 0.9924 - val_f1_score: 0.4860 -
val_accuracy: 0.4860
Epoch 445/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9621 -
f1_score: 0.5079 - accuracy: 0.5079 - val_loss: 0.9941 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 446/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9650 -
f1_score: 0.5086 - accuracy: 0.5086 - val_loss: 1.0018 - val_f1_score: 0.4873 -
val_accuracy: 0.4873
Epoch 447/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9730 -
f1_score: 0.5007 - accuracy: 0.5007 - val_loss: 0.9914 - val_f1_score: 0.4892 -
val_accuracy: 0.4892
Epoch 448/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9630 -
f1_score: 0.5062 - accuracy: 0.5062 - val_loss: 1.0011 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 449/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9549 -
f1_score: 0.5107 - accuracy: 0.5107 - val_loss: 0.9917 - val_f1_score: 0.5019 -
val_accuracy: 0.5019
Epoch 450/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9551 -
f1_score: 0.5134 - accuracy: 0.5134 - val_loss: 0.9830 - val_f1_score: 0.5000 -
val_accuracy: 0.5000
Epoch 451/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9594 -
f1_score: 0.5113 - accuracy: 0.5113 - val_loss: 0.9878 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 452/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9626 -
f1_score: 0.5104 - accuracy: 0.5104 - val_loss: 0.9894 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 453/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9619 -
f1_score: 0.5095 - accuracy: 0.5095 - val_loss: 0.9925 - val_f1_score: 0.4962 -
val_accuracy: 0.4962
Epoch 454/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9614 -
f1_score: 0.5133 - accuracy: 0.5133 - val_loss: 0.9792 - val_f1_score: 0.5095 -
val_accuracy: 0.5095
Epoch 455/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9570 -
f1_score: 0.5140 - accuracy: 0.5140 - val_loss: 0.9894 - val_f1_score: 0.5089 -
val_accuracy: 0.5089
Epoch 456/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9644 -
f1_score: 0.5057 - accuracy: 0.5057 - val_loss: 0.9876 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 457/500
```

```
442/442 [==============================] - 1s 1ms/step - loss: 0.9617 -
f1_score: 0.5066 - accuracy: 0.5066 - val_loss: 0.9975 - val_f1_score: 0.4822 -
val_accuracy: 0.4822
Epoch 458/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9629 -
f1_score: 0.5100 - accuracy: 0.5100 - val_loss: 0.9804 - val_f1_score: 0.5153 -
val_accuracy: 0.5153
Epoch 459/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9632 -
f1_score: 0.5052 - accuracy: 0.5052 - val_loss: 0.9969 - val_f1_score: 0.4936 -
val_accuracy: 0.4936
Epoch 460/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9574 -
f1_score: 0.5062 - accuracy: 0.5062 - val_loss: 0.9691 - val_f1_score: 0.5115 -
val_accuracy: 0.5115
Epoch 461/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9688 -
f1_score: 0.5021 - accuracy: 0.5021 - val_loss: 0.9912 - val_f1_score: 0.5013 -
val_accuracy: 0.5013
Epoch 462/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9764 -
f1_score: 0.5095 - accuracy: 0.5095 - val_loss: 0.9882 - val_f1_score: 0.4994 -
val_accuracy: 0.4994
Epoch 463/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9665 -
f1_score: 0.5095 - accuracy: 0.5095 - val_loss: 0.9878 - val_f1_score: 0.5038 -
val_accuracy: 0.5038
Epoch 464/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9643 -
f1_score: 0.5085 - accuracy: 0.5085 - val_loss: 0.9868 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 465/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9586 -
f1_score: 0.5124 - accuracy: 0.5124 - val_loss: 0.9854 - val_f1_score: 0.5076 -
val_accuracy: 0.5076
Epoch 466/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9525 -
f1_score: 0.5146 - accuracy: 0.5146 - val_loss: 0.9800 - val_f1_score: 0.5172 -
val_accuracy: 0.5172
Epoch 467/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9621 -
f1_score: 0.5089 - accuracy: 0.5089 - val_loss: 0.9868 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 468/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9647 -
f1_score: 0.5093 - accuracy: 0.5093 - val_loss: 0.9828 - val_f1_score: 0.5134 -
val_accuracy: 0.5134
Epoch 469/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9657 -
f1_score: 0.5090 - accuracy: 0.5090 - val_loss: 0.9848 - val_f1_score: 0.5070 -
val_accuracy: 0.5070
Epoch 470/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9550 -
f1_score: 0.5128 - accuracy: 0.5128 - val_loss: 0.9820 - val_f1_score: 0.5172 -
val_accuracy: 0.5172
Epoch 471/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9551 -
f1_score: 0.5152 - accuracy: 0.5152 - val_loss: 0.9892 - val_f1_score: 0.5134 -
val_accuracy: 0.5134
Epoch 472/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9582 -
f1_score: 0.5145 - accuracy: 0.5145 - val_loss: 0.9989 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 473/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9720 -
f1_score: 0.5054 - accuracy: 0.5054 - val_loss: 1.0037 - val_f1_score: 0.5013 -
val_accuracy: 0.5013
Epoch 474/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9652 -
f1_score: 0.5110 - accuracy: 0.5110 - val_loss: 0.9921 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 475/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9692 -
f1_score: 0.5092 - accuracy: 0.5092 - val_loss: 0.9902 - val_f1_score: 0.5064 -
val_accuracy: 0.5064
Epoch 476/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9623 -
f1_score: 0.5140 - accuracy: 0.5140 - val_loss: 0.9849 - val_f1_score: 0.5013 -
val_accuracy: 0.5013
Epoch 477/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9562 -
f1_score: 0.5149 - accuracy: 0.5149 - val_loss: 1.0084 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 478/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9515 -
f1_score: 0.5216 - accuracy: 0.5216 - val_loss: 0.9815 - val_f1_score: 0.5089 -
val_accuracy: 0.5089
Epoch 479/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9570 -
f1_score: 0.5135 - accuracy: 0.5135 - val_loss: 0.9874 - val_f1_score: 0.5038 -
val_accuracy: 0.5038
Epoch 480/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9621 -
f1_score: 0.5135 - accuracy: 0.5135 - val_loss: 0.9824 - val_f1_score: 0.4816 -
val_accuracy: 0.4816
Epoch 481/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9626 -
f1_score: 0.5093 - accuracy: 0.5093 - val_loss: 0.9840 - val_f1_score: 0.4796 -
val_accuracy: 0.4796
Epoch 482/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9558 -
f1_score: 0.5144 - accuracy: 0.5144 - val_loss: 0.9963 - val_f1_score: 0.4930 -
val_accuracy: 0.4930
Epoch 483/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9577 -
f1_score: 0.5148 - accuracy: 0.5148 - val_loss: 0.9881 - val_f1_score: 0.4962 -
val_accuracy: 0.4962
Epoch 484/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9666 -
f1_score: 0.5055 - accuracy: 0.5055 - val_loss: 1.0077 - val_f1_score: 0.5045 -
val_accuracy: 0.5045
Epoch 485/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9652 -
f1_score: 0.5077 - accuracy: 0.5077 - val_loss: 0.9974 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 486/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9624 -
f1_score: 0.5083 - accuracy: 0.5083 - val_loss: 0.9819 - val_f1_score: 0.5095 -
val_accuracy: 0.5095
Epoch 487/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9511 -
f1_score: 0.5183 - accuracy: 0.5183 - val_loss: 0.9812 - val_f1_score: 0.5057 -
val_accuracy: 0.5057
Epoch 488/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9642 -
f1_score: 0.5109 - accuracy: 0.5109 - val_loss: 0.9820 - val_f1_score: 0.5051 -
val_accuracy: 0.5051
Epoch 489/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9617 -
f1_score: 0.5135 - accuracy: 0.5135 - val_loss: 0.9828 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 490/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9697 -
f1_score: 0.5071 - accuracy: 0.5071 - val_loss: 0.9875 - val_f1_score: 0.4949 -
val_accuracy: 0.4949
Epoch 491/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9623 -
f1_score: 0.5130 - accuracy: 0.5130 - val_loss: 0.9800 - val_f1_score: 0.5089 -
val_accuracy: 0.5089
Epoch 492/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9610 -
f1_score: 0.5138 - accuracy: 0.5138 - val_loss: 1.0027 - val_f1_score: 0.4943 -
val_accuracy: 0.4943
Epoch 493/500
```

```
442/442 [==============================] - 1s 2ms/step - loss: 0.9613 -
f1_score: 0.5073 - accuracy: 0.5073 - val_loss: 0.9896 - val_f1_score: 0.5178 -
val_accuracy: 0.5178
Epoch 494/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9619 -
f1_score: 0.5153 - accuracy: 0.5153 - val_loss: 1.0072 - val_f1_score: 0.4968 -
val_accuracy: 0.4968
Epoch 495/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9696 -
f1_score: 0.4999 - accuracy: 0.4999 - val_loss: 0.9941 - val_f1_score: 0.4987 -
val_accuracy: 0.4987
Epoch 496/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9617 -
f1_score: 0.5091 - accuracy: 0.5091 - val_loss: 0.9907 - val_f1_score: 0.4981 -
val_accuracy: 0.4981
Epoch 497/500
442/442 [==============================] - 1s 1ms/step - loss: 0.9689 -
f1_score: 0.5015 - accuracy: 0.5015 - val_loss: 0.9933 - val_f1_score: 0.5083 -
val_accuracy: 0.5083
Epoch 498/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9605 -
f1_score: 0.5127 - accuracy: 0.5127 - val_loss: 0.9874 - val_f1_score: 0.5312 -
val_accuracy: 0.5312
Epoch 499/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9638 -
f1_score: 0.5081 - accuracy: 0.5081 - val_loss: 0.9777 - val_f1_score: 0.5159 -
val_accuracy: 0.5159
Epoch 500/500
442/442 [==============================] - 1s 2ms/step - loss: 0.9574 -
f1_score: 0.5117 - accuracy: 0.5117 - val_loss: 0.9949 - val_f1_score: 0.5000 -
val_accuracy: 0.5000
```

[259]:
```
pred_smote, test_smote, y_pred_smote, y_test_smote, X_test_smote =␣
↪test_pipeline(model_smote)
```

```
dropping ID column
dropping ['ID', 'Var_1', 'Age']…
replacing numerical nans with mode…
replacing categorical nans with None string…
label encoding categorical data…
SUCCESSFULLY PERFORMED PREPROCESSING
83/83 [==============================] - 0s 477us/step
```

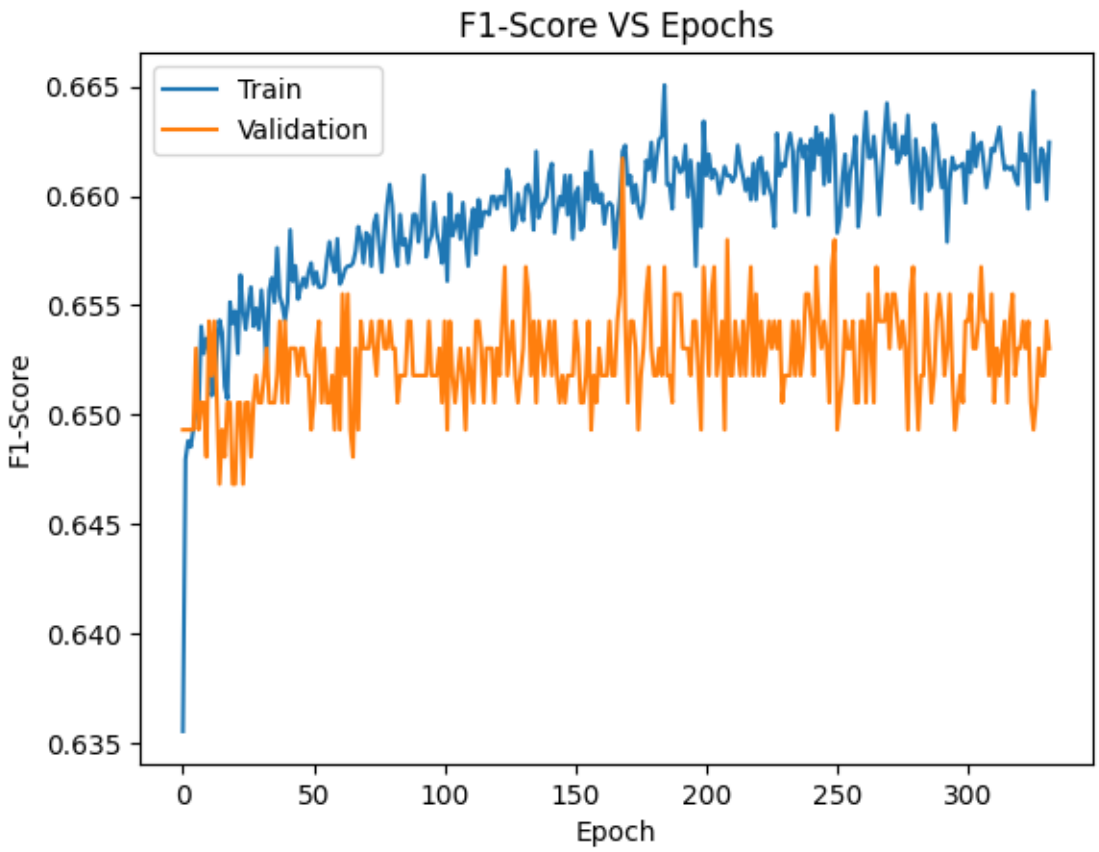
[272]:
```
# Classification metrics for Test
print(f'f1_score for the test data is:', f1_score(pred_smote, test_smote,␣
↪average='macro'))
```

```
print(f'recall for the test data is:', recall_score(pred_smote, test_smote,␣
 ↪average='macro'))
print(f'precision for the test data is:', precision_score(pred_smote,␣
 ↪test_smote, average='macro'))
print(f'accuracy for the test data is: {accuracy_score(pred_smote,␣
 ↪test_smote)}')
```

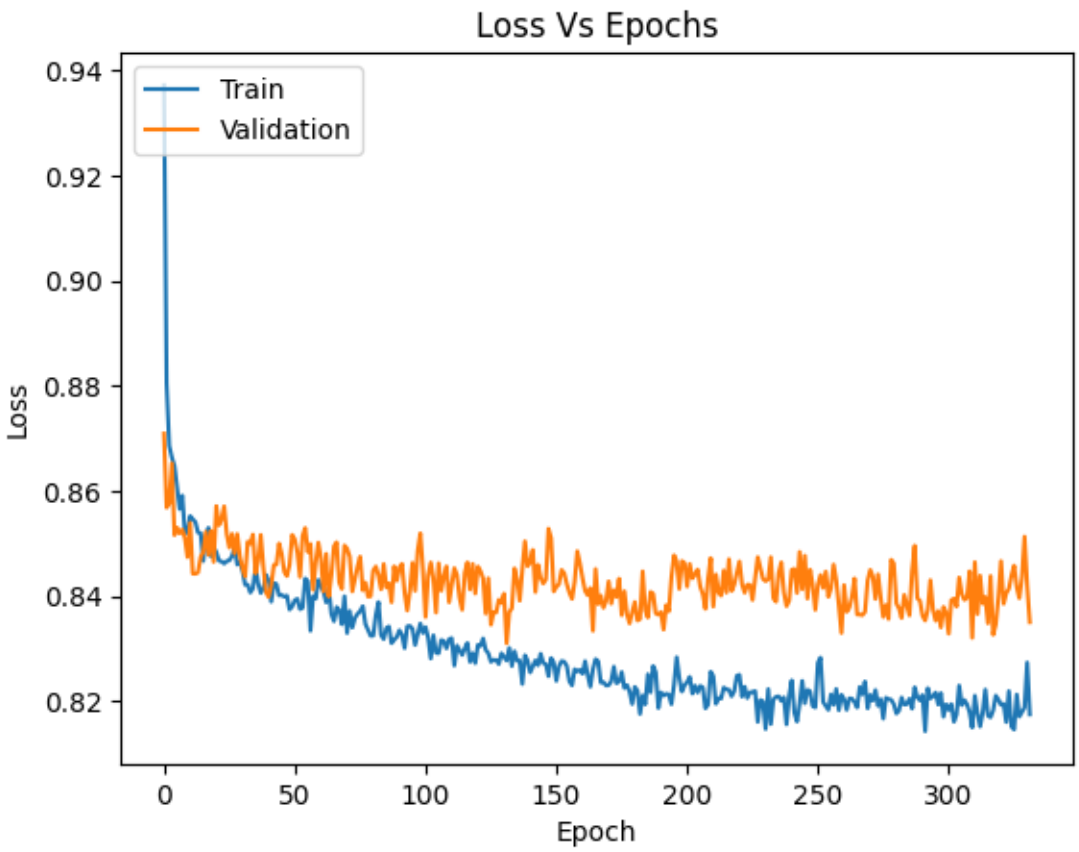
```
f1_score for the test data is: 0.42865639531183425
recall for the test data is: 0.4319648903554185
precision for the test data is: 0.45932621682535535
accuracy for the test data is: 0.49105443471640653
```

f1_score, and precision increased compare to previous data which means that number of true positive incrased and number of false positives decreased. The model is no longer identifying what belongs to class B and C as Class A.This makes sense as we increased number of minority classes and made a balanced dataset. Now that recall and precision is closer to each other and greater than 0.4 the Harmonic mean (f1_score) has also increased significantly from 0.28 to 0.42. If we had larger dataset to better trian our model, we would have good metrics.

[261]:
```
plt.plot(history_smote.history['f1_score'])
plt.plot(history_smote.history['val_f1_score'])
plt.title('F1-Score VS Epochs')
plt.ylabel('F1-Score')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



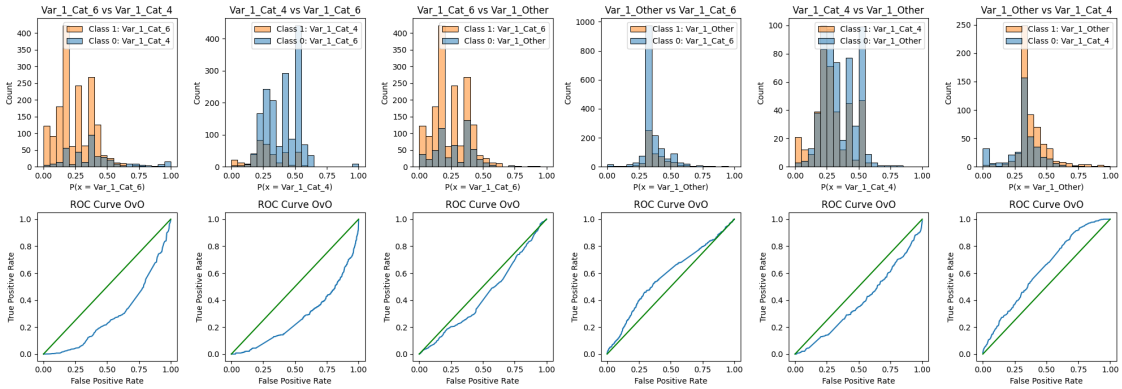
[262]:
```
plt.plot(history_smote.history['loss'])
plt.plot(history_smote.history['val_loss'])
plt.title('Loss Vs Epochs')
plt.ylabel('Loss')
plt.xlabel('Epoch')
plt.legend(['Train', 'Validation'], loc='upper left')
plt.show()
```



Similiar to previous situation, model is learning and loss is decreasing while f1_score is increasing. We would have achieved a better result if we had more data and trained with a more complicated (more layers and neurons) model.

[263]:
```
plot_roc_auc(test_smote, y_pred_smote)
```

```
[['Var_1_Cat_6', 'Var_1_Cat_4'], ['Var_1_Cat_4', 'Var_1_Cat_6'], ['Var_1_Cat_6',
'Var_1_Other'], ['Var_1_Other', 'Var_1_Cat_6'], ['Var_1_Cat_4', 'Var_1_Other'],
['Var_1_Other', 'Var_1_Cat_4']]
```



While overall our model is not a good model but after SMOTE you can see that because we increased number of Cat_4 and Other classes we are getting slightly better ROC curve (more area under the curve) for Other vs Cat_6, Cat_6 vs Other, Other vs Cat_4 and Cat_4 vs Other.