Mit_Aug

November 17, 2024

[1]:
```
import numpy as np
import pandas as pd
import tensorflow as tf
import os
import os
import itertools
import numpy as np
import pandas as pd
import seaborn as sns
import tensorflow as tf
from itertools import cycle
from sklearn import metrics
import matplotlib.pyplot as plt
from sklearn.metrics import confusion_matrix, classification_report
from sklearn.model_selection import cross_val_score
import keras
from keras.utils import np_utils
from keras.models import Sequential,load_model
from keras.utils.vis_utils import plot_model
from keras.layers import Conv1D, MaxPooling1D, Dense, Dropout, Flatten,␣
 ↪Reshape, GlobalAveragePooling1D
import random
from scipy.interpolate import CubicSpline
%matplotlib inline
tf.__version__
#from keras.models import load_model
```

[1]:
```
'2.10.0'
```

[2]:
```
def load_test():
    #Test ori data
    test_x = np.load(r"D:\Research Work\Thesis\New Data\Data\MIT Processed\Test␣
 ↪Dataset\ecg_ori_all_reshaped_te_segments.npy")
    test_y = np.load(r"D:\Research Work\Thesis\New Data\Data\MIT Processed\Test␣
 ↪Dataset\ecg_ori_all_te_labels.npy")

    print(test_x.shape)
```

```
    print(test_y)
    return test_x,test_y
```

[3]:
```
def load_train():
    #Test ori data
    train_x = np.load(r"D:\Research Work\Thesis\New Data\Data\MIT␣
 ↪Processed\Train Dataset\Original\ecg_ori_all_reshaped_tr_segments.npy")
    train_y = np.load(r"D:\Research Work\Thesis\New Data\Data\MIT␣
 ↪Processed\Train Dataset\Original\ecg_ori_all_tr_labels.npy")

    print(train_x.shape)
    print(train_y)
    return train_x,train_y
```

[4]:
```
train_x,train_y = load_train()
test_x,test_y = load_test()
print(train_x.shape,train_y.shape,test_x.shape,test_y.shape)
```

```
(460, 1800, 1)
[1 3 0 0 3 2 2 1 2 0 3 0 2 1 3 3 2 0 0 0 0 0 0 0 1 2 0 0 0 2 3 0 0 1 1 0 0
 3 0 0 3 2 0 0 0 1 0 1 1 0 0 0 0 0 0 0 0 1 3 1 0 0 0 0 0 0 2 0 1 1 3 1 0 1 0
 0 0 1 3 1 0 2 0 2 1 1 2 2 1 0 1 1 2 0 2 0 0 0 2 2 3 2 0 1 0 1 0 0 0 0 0 0 0
 1 1 0 1 3 3 2 2 3 3 2 0 0 0 1 0 3 2 1 2 2 1 2 1 3 0 1 2 0 0 0 1 0 0 0 1 3
 0 0 0 1 0 0 0 3 1 1 1 2 1 1 2 0 0 0 0 1 0 3 0 0 3 2 0 1 3 3 2 1 0 0 0 0 2
 2 3 1 2 2 2 0 2 1 0 1 0 2 1 1 0 3 3 3 0 2 0 2 2 1 1 1 1 1 0 0 2 0 2 0 0 3
 1 1 3 0 1 1 0 0 0 3 0 0 1 0 0 0 2 3 0 2 0 2 0 3 2 1 0 1 0 3 3 0 0 0 2 2 0
 0 3 1 0 1 1 0 0 0 2 0 2 2 0 3 3 0 1 0 3 0 0 2 0 1 3 2 1 0 1 3 3 2 0 2 1 2
 2 0 0 0 2 0 2 1 2 0 0 1 2 3 0 2 0 2 3 1 0 3 2 3 1 0 3 1 0 1 0 3 0 0 1 2 1
 3 1 0 0 2 3 0 1 2 2 3 0 3 0 2 0 0 0 0 0 1 0 1 1 0 2 0 2 0 3 2 0 1 1 0 1 0
 3 2 1 3 0 1 0 0 0 0 3 3 0 0 2 0 2 1 0 0 2 3 3 2 2 2 2 0 2 0 1 2 0 3 2 0 0
 0 0 2 0 1 0 3 3 0 1 2 0 0 0 3 0 0 2 0 1 2 3 2 2 0 2 0 0 1 0 3 3 0 3 0 2 2
 1 2 0 0 3 1 3 0 3 1 3 0 3 0 3 2]
(192, 1800, 1)
[1 2 3 0 1 0 2 1 0 0 2 2 3 1 1 0 0 0 0 1 1 0 2 0 0 0 2 1 0 0 0 1 0 2 3 0 0
 1 0 0 1 1 2 0 0 2 2 2 2 2 0 0 0 0 1 0 1 0 1 0 1 0 0 1 2 0 3 3 0 0 0 1 1 3
 0 3 0 2 3 1 0 2 2 3 0 1 0 0 0 1 2 0 3 2 1 3 0 0 0 2 2 3 2 1 0 0 3 3 0 0 1
 0 0 3 0 2 1 3 0 0 3 1 3 2 1 1 0 0 0 0 2 2 2 3 0 0 1 0 2 0 0 3 0 0 2 2 1 2
 2 1 3 1 0 3 0 0 0 0 0 2 3 0 3 1 2 3 1 1 0 0 2 0 0 2 0 1 3 3 0 0 3 2 3 0 1
 3 0 1 1 0 2 2]
(460, 1800, 1) (460,) (192, 1800, 1) (192,)
```

[5]:
```
from collections import Counter

c = Counter(train_y)
print(c)
```

```
Counter({0: 198, 1: 95, 2: 94, 3: 73})
```

[6]:
```python
#Different Augmentation Functions
def no_augmentation(x):
    return x

# Jittering
def jitter(x, sigma=0.05):
    return x + np.random.normal(loc=0, scale=sigma, size=x.shape)

# Scaling Has issue with loading into memory.
def scale(x, sigma=0.5):
    x_scaled = np.copy(x)
    for i in range(x_scaled.shape[0]):
        factor = np.random.normal(loc=1.0, scale=sigma)
        x_scaled[i] *= factor
    return x_scaled



# Flipping
def flip(x):
    # Check if data is 2D with a single feature
    if x.ndim == 3 and x.shape[2] == 1:
        return np.flip(x, axis=1)
    else:
        # Fallback for 1D data
        return np.flip(x, axis=0)


# Permutation
def permute(x, num_segments=10):
    split = np.array_split(x, num_segments, axis=0)
    np.random.shuffle(split)
    return np.concatenate(split, axis=0)

# Magnitude Warping
def magnitude_warp(x, sigma=0.001, num_knots=4):
    time_steps = np.linspace(0, 1, num=x.shape[0])
    knot_positions = np.linspace(0, 1, num=num_knots)
    knot_values = np.random.normal(loc=1.0, scale=sigma, size=num_knots)
    spline = CubicSpline(knot_positions, knot_values)
    warp_values = spline(time_steps)
    return list(x * warp_values)


# Rotate
def rotate(x):
```

```
    if x.ndim != 2:
        raise ValueError("Input data must be a 2D array.")


    num_features = x.shape[1]


    random_rotation_matrix = np.random.normal(size=(num_features, num_features))
    q, r = np.linalg.qr(random_rotation_matrix)


    x_rotated = np.dot(x, q)

    return x_rotated


# Time Warping
def time_warp(x, sigma=0.2, num_knots=4):
    if x.ndim == 1:
        # For 1D data, we work directly with x
        original_steps = np.arange(len(x))
        new_steps = np.linspace(0, len(x) - 1, num=len(x))
    elif x.ndim == 2 and x.shape[1] == 1:
        # For 2D data with a single feature
        original_steps = np.arange(x.shape[0])
        new_steps = np.linspace(0, x.shape[0] - 1, num=x.shape[0])
    else:
        raise ValueError("Unsupported data shape for time_warp")

    knot_positions = np.linspace(0, len(new_steps) - 1, num=num_knots)
    knot_values = np.random.normal(loc=0.0, scale=sigma, size=num_knots) +␣
 ↪knot_positions
    spline = CubicSpline(knot_positions, knot_values)
    warped_steps = spline(new_steps)
    warped_steps[warped_steps < 0] = 0
    warped_steps[warped_steps > len(new_steps) - 1] = len(new_steps) - 1

    return np.array([x[int(warped_step)] if x.ndim == 1 else␣
 ↪x[int(warped_step), 0] for warped_step in warped_steps])


# Window Slicing
def window_slice(x, window_size=50):
    # Ensure the window size is smaller than the length of the data
    if window_size >= len(x):
        raise ValueError("Window size must be smaller than the length of the␣
 ↪data")
```

```
    start = np.random.randint(0, len(x) - window_size)
    windowed_data = x[start:start + window_size]
    padding_length = len(x) - window_size
    padded_data = np.pad(windowed_data, (0, padding_length), mode='constant')
    return padded_data



# Window Warping
def window_warp(x, window_size=50, scale=2):
    if len(x) <= window_size:
        raise ValueError("The window size must be less than the size of the␣
 ↪data.")
    start = random.randint(0, len(x) - window_size)
    windowed_data = x[start:start + window_size]
    warped_window = np.repeat(windowed_data, scale)
    remove_length = len(warped_window) - window_size
    if remove_length > 0:
        warped_window = warped_window[:-remove_length]
    return np.concatenate([x[:start], warped_window, x[start + window_size:]])
```

[ ]:
```
aug_function = jitter

def balance_and_augment(train_x, train_y, aug_function):
    #aug_function = globals()[function_name]
    c = Counter(train_y)
    m = max(c.values())
    aug_train, aug_y = [], []

    for k, v in c.items():
        val = m - v
        while val > 0:
            gen_idx = random.randrange(0, train_x.shape[0])
            if k != 3:
                augmented_data = aug_function(train_x[gen_idx])
            else:
                aug_train.append(train_x[gen_idx])

            if len(augmented_data)==1800:
                aug_train.append(augmented_data)
                aug_y.append(k)
            val -= 1

    print(np.array(aug_train).shape,train_x.shape)
    for i in range(len(train_x)):
        aug_train.append(train_x[i])
        aug_y.append(train_y[i])
```

```
    return np.array(aug_train), np.array(aug_y)

aug_train,aug_y = balance_and_augment(np.squeeze(train_x), train_y,␣
 ↪aug_function)
aug_train = np.expand_dims(aug_train,axis=2)
c_ = Counter(aug_y)
print(c_,aug_train.shape)
```

```
(457, 1800) (460, 1800)
Counter({1: 198, 3: 198, 2: 198, 0: 198}) (917, 1800, 1)
```

[8]:
```
#Hyper-parameters
BATCH_SIZE = 16
EPOCHS = 100
TIME_PERIODS = 1800 # The number of steps within one time segment
STEP_DISTANCE = 1800 # The steps to take from one segment to the next
#if step value is equal to TIME_PERIODS, then there is no overlap between the␣
 ↪segments
LABELS = [0,1,2,3] #nsr, afib, pvc, lb
LABEL_CONDITION=['NSR','PVC','AFIB','LB']
num_classes = 4
```

[9]:
```
print("\n--- Reshape data to be accepted by Keras ---\n")

train_samples, train_time_periods, train_sensors = train_x.shape[0],train_x.
 ↪shape[1], train_x.shape[2]
test_samples,test_time_periods, test_sensors = test_x.shape[0], test_x.
 ↪shape[1], test_x.shape[2]


train_input_shape = (train_time_periods*train_sensors)
train_x = (train_x.reshape(train_samples, train_time_periods)).astype("float64")
print('train_x shape: ', train_x.shape)
print('Train input shape:', train_input_shape)

test_input_shape = (test_time_periods*test_sensors)
test_x = (test_x.reshape(test_samples, test_time_periods)).astype("float64")
print('test_x shape: ', test_x.shape)
print('Test input shape:', test_input_shape)


#-----------------------------------------------------------------
# Convert type for Keras otherwise Keras cannot process the data
train_y = train_y.astype("float64")
print('train_y shape: ', train_y.shape)
test_y = test_y.astype("float64")
```

```
print('test_y shape: ', test_y.shape)
```

```
--- Reshape data to be accepted by Keras ---

train_x shape:  (460, 1800)
Train input shape: 1800
test_x shape:  (192, 1800)
Test input shape: 1800
train_y shape:  (460,)
test_y shape:  (192,)
```

[10]:
```
def plot_graphs(history):
    plt.plot(history.epoch, history.history["loss"], 'b', label='Training loss')
    plt.plot(history.epoch, history.history["val_loss"], 'g', label='Validation␣
 ↪loss')
    plt.legend()
    plt.title("Loss")
    plt.show()

    plt.plot(history.epoch, history.history["accuracy"], 'b', label='Training␣
 ↪accuracy')
    plt.plot(history.epoch, history.history["val_accuracy"], 'g',␣
 ↪label='Validation accuracy')
    plt.legend()
    plt.title("Accuracy")
    plt.show()

    plt.plot(history.epoch, history.history["AUC"], 'b', label='Training AUC')
    plt.plot(history.epoch, history.history["val_AUC"], 'g', label='Validation␣
 ↪AUC')
    plt.legend()
    plt.title("AUC")
    plt.show()
```

[11]:
```
def classifier():
    model = Sequential()
    #model.add(Reshape((time, features), input_shape=(input_shape,)))
    model.add(Conv1D(32, 18, name='conv0',activation='relu',␣
 ↪input_shape=(1800,1)))
    model.add(Conv1D(32, 18, name='conv1',activation='relu'))
    model.add(Conv1D(64, 18, name='conv2',activation='relu'))
    model.add(Conv1D(64, 18, name='conv3',activation='relu'))
    model.add(Conv1D(128, 18, name='conv4',activation='relu'))
    model.add(Conv1D(128, 18, name='conv5',activation='relu'))
    model.add(Conv1D(256, 18, name='conv6',activation='relu'))
    model.add(Conv1D(256, 18, name='conv7',activation='relu'))
```

```
    model.add(MaxPooling1D(3,name='max1'))
    model.add(Conv1D(32, 18, name='conv8',activation='relu'))
    model.add(Conv1D(32, 18, name='conv9',activation='relu'))
    model.add(Conv1D(64, 18, name='conv10',activation='relu'))
    model.add(Conv1D(64, 18, name='conv11',activation='relu'))
    model.add(Conv1D(128, 18, name='conv12',activation='relu'))
    model.add(Conv1D(256, 18, name='conv13',activation='relu'))
    model.add(GlobalAveragePooling1D(name='gap1'))
    model.add(Dropout(.5,name='drop1'))
    model.add(Dense(4, name='dense1',activation='softmax'))

    return model
```

[12]:
```
from keras.regularizers import l2
from keras.layers import Conv1D, MaxPooling1D, Dense, Dropout, Flatten,␣
↪Reshape, GlobalAveragePooling1D,BatchNormalization,Input,ELU

def build_improved_model():
    model = Sequential()

    # Convolutional block 1
    model.add(Conv1D(32, kernel_size=3, padding='same', input_shape=(1800, 1),␣
↪kernel_regularizer=l2(0.001), name='conv0'))
    model.add(BatchNormalization(name='bn0'))
    model.add(ELU(name='elu0'))
    model.add(Dropout(0.2, name='dropout0'))

    # Convolutional block 2
    model.add(Conv1D(32, kernel_size=3, padding='same', kernel_regularizer=l2(0.
↪001), name='conv1'))
    model.add(BatchNormalization(name='bn1'))
    model.add(ELU(name='elu1'))
    model.add(MaxPooling1D(pool_size=3, name='max0'))
    model.add(Dropout(0.2, name='dropout1'))

    # Convolutional block 3
    model.add(Conv1D(64, kernel_size=3, padding='same', kernel_regularizer=l2(0.
↪001), name='conv2'))
    model.add(BatchNormalization(name='bn2'))
    model.add(ELU(name='elu2'))
    model.add(Dropout(0.3, name='dropout2'))

    # Convolutional block 4
    model.add(Conv1D(64, kernel_size=3, padding='same', kernel_regularizer=l2(0.
↪001), name='conv3'))
    model.add(BatchNormalization(name='bn3'))
    model.add(ELU(name='elu3'))
```

```
    model.add(MaxPooling1D(pool_size=3, name='max1'))
    model.add(Dropout(0.3, name='dropout3'))

    # Convolutional block 5
    model.add(Conv1D(128, kernel_size=3, padding='same',␣
 ↪kernel_regularizer=l2(0.001), name='conv4'))
    model.add(BatchNormalization(name='bn4'))
    model.add(ELU(name='elu4'))
    model.add(Dropout(0.4, name='dropout4'))

    # Convolutional block 6
    model.add(Conv1D(128, kernel_size=3, padding='same',␣
 ↪kernel_regularizer=l2(0.001), name='conv5'))
    model.add(BatchNormalization(name='bn5'))
    model.add(ELU(name='elu5'))
    model.add(MaxPooling1D(pool_size=3, name='max2'))
    model.add(Dropout(0.4, name='dropout5'))

    # Flatten and Dense Layers
    model.add(Flatten())
    model.add(Dense(units=4, activation='softmax', kernel_regularizer=l2(0.
 ↪001), name='dense_final'))

    return model


model = build_improved_model()
model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv0 (Conv1D)              (None, 1800, 32)          128

 bn0 (BatchNormalization)    (None, 1800, 32)          128

 elu0 (ELU)                  (None, 1800, 32)          0

 dropout0 (Dropout)          (None, 1800, 32)          0

 conv1 (Conv1D)              (None, 1800, 32)          3104

 bn1 (BatchNormalization)    (None, 1800, 32)          128

 elu1 (ELU)                  (None, 1800, 32)          0
```

```
 max0 (MaxPooling1D)          (None, 600, 32)           0

 dropout1 (Dropout)           (None, 600, 32)           0

 conv2 (Conv1D)               (None, 600, 64)           6208

 bn2 (BatchNormalization)     (None, 600, 64)           256

 elu2 (ELU)                   (None, 600, 64)           0

 dropout2 (Dropout)           (None, 600, 64)           0

 conv3 (Conv1D)               (None, 600, 64)           12352

 bn3 (BatchNormalization)     (None, 600, 64)           256

 elu3 (ELU)                   (None, 600, 64)           0

 max1 (MaxPooling1D)          (None, 200, 64)           0

 dropout3 (Dropout)           (None, 200, 64)           0

 conv4 (Conv1D)               (None, 200, 128)          24704

 bn4 (BatchNormalization)     (None, 200, 128)          512

 elu4 (ELU)                   (None, 200, 128)          0

 dropout4 (Dropout)           (None, 200, 128)          0

 conv5 (Conv1D)               (None, 200, 128)          49280

 bn5 (BatchNormalization)     (None, 200, 128)          512

 elu5 (ELU)                   (None, 200, 128)          0

 max2 (MaxPooling1D)          (None, 66, 128)           0

 dropout5 (Dropout)           (None, 66, 128)           0

 flatten (Flatten)            (None, 8448)              0

 dense_final (Dense)          (None, 4)                 33796

=================================================================
Total params: 131,364
Trainable params: 130,468
Non-trainable params: 896
```

---

[13]:
```
batchsize = 32


ckpt_folder  = os.path.join(os.getcwd(), 'Aug_No_Aug_T2')
ckpt_path = os.path.join(ckpt_folder, 'No_Aug_Model_{epoch}')

model_checkpoint_callback = tf.keras.callbacks.ModelCheckpoint(
    filepath=ckpt_path,
    save_weights_only=True,
    monitor='val_accuracy',
    mode='max',
    save_best_only=True,verbose=1)


model = build_improved_model()

model.compile(loss=tf.keras.losses.CategoricalCrossentropy(), optimizer=tf.
 ↪keras.optimizers.Adam(decay=.01,learning_rate=0.001,beta_1=.009,beta_2=.
 ↪8,epsilon=1e-08), metrics=[tf.keras.metrics.CategoricalAccuracy(
       name='accuracy'),tf.keras.metrics.Recall(name='Recall'),tf.keras.
 ↪metrics.Precision(name='Precision'),tf.keras.metrics.AUC(name='AUC')])


history = model.fit(train_x,np_utils.to_categorical(train_y, num_classes),␣
 ↪epochs=150, batch_size = batchsize,
                  validation_data=(test_x,np_utils.to_categorical(test_y,␣
 ↪num_classes)), callbacks=[model_checkpoint_callback])



plot_graphs(history)
```

```
Epoch 1/150
15/15 [==============================] - ETA: 0s - loss: 3.8298 - accuracy:
0.3239 - Recall: 0.3022 - Precision: 0.3286 - AUC: 0.5528
Epoch 1: val_accuracy improved from -inf to 0.33333, saving model to d:\Research
Work\Thesis\New Data\Code-20240119T232854Z-001\Code\Aug_No_Aug_T2\No_Aug_Model_1
15/15 [==============================] - 6s 132ms/step - loss: 3.8298 -
accuracy: 0.3239 - Recall: 0.3022 - Precision: 0.3286 - AUC: 0.5528 - val_loss:
1.7503 - val_accuracy: 0.3333 - val_Recall: 0.0000e+00 - val_Precision:
0.0000e+00 - val_AUC: 0.5623
Epoch 2/150
15/15 [==============================] - ETA: 0s - loss: 2.8680 - accuracy:
0.3783 - Recall: 0.3196 - Precision: 0.3731 - AUC: 0.6232
Epoch 2: val_accuracy did not improve from 0.33333
15/15 [==============================] - 1s 46ms/step - loss: 2.8680 - accuracy:
```

```
0.3783 - Recall: 0.3196 - Precision: 0.3731 - AUC: 0.6232 - val_loss: 1.9146 -
val_accuracy: 0.2396 - val_Recall: 0.0833 - val_Precision: 0.2857 - val_AUC:
0.5460
Epoch 3/150
15/15 [==============================] - ETA: 0s - loss: 2.3716 - accuracy:
0.4391 - Recall: 0.4000 - Precision: 0.4792 - AUC: 0.6847
Epoch 3: val_accuracy did not improve from 0.33333
15/15 [==============================] - 1s 49ms/step - loss: 2.3716 - accuracy:
0.4391 - Recall: 0.4000 - Precision: 0.4792 - AUC: 0.6847 - val_loss: 1.9177 -
val_accuracy: 0.2656 - val_Recall: 0.1198 - val_Precision: 0.2091 - val_AUC:
0.5685
Epoch 4/150
14/15 [===========================>..] - ETA: 0s - loss: 2.1882 - accuracy:
0.4174 - Recall: 0.3661 - Precision: 0.4444 - AUC: 0.6900
Epoch 4: val_accuracy improved from 0.33333 to 0.35938, saving model to
d:\Research Work\Thesis\New
Data\Code-20240119T232854Z-001\Code\Aug_No_Aug_T2\No_Aug_Model_4
15/15 [==============================] - 1s 56ms/step - loss: 2.1991 - accuracy:
0.4174 - Recall: 0.3674 - Precision: 0.4459 - AUC: 0.6896 - val_loss: 2.6863 -
val_accuracy: 0.3594 - val_Recall: 0.3333 - val_Precision: 0.3699 - val_AUC:
0.5497
Epoch 5/150
14/15 [===========================>..] - ETA: 0s - loss: 2.1448 - accuracy:
0.4688 - Recall: 0.3996 - Precision: 0.5129 - AUC: 0.7033
Epoch 5: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 34ms/step - loss: 2.1367 - accuracy:
0.4630 - Recall: 0.3935 - Precision: 0.5056 - AUC: 0.7024 - val_loss: 2.9544 -
val_accuracy: 0.2552 - val_Recall: 0.2448 - val_Precision: 0.2513 - val_AUC:
0.5297
Epoch 6/150
14/15 [===========================>..] - ETA: 0s - loss: 1.8977 - accuracy:
0.4509 - Recall: 0.4018 - Precision: 0.4878 - AUC: 0.7289
Epoch 6: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 38ms/step - loss: 1.8971 - accuracy:
0.4522 - Recall: 0.4022 - Precision: 0.4881 - AUC: 0.7293 - val_loss: 2.2653 -
val_accuracy: 0.2500 - val_Recall: 0.2135 - val_Precision: 0.2455 - val_AUC:
0.5360
Epoch 7/150
13/15 [=========================>…] - ETA: 0s - loss: 1.9204 - accuracy:
0.4808 - Recall: 0.4303 - Precision: 0.5457 - AUC: 0.7427
Epoch 7: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 37ms/step - loss: 1.8907 - accuracy:
0.4804 - Recall: 0.4283 - Precision: 0.5427 - AUC: 0.7449 - val_loss: 3.1197 -
val_accuracy: 0.2344 - val_Recall: 0.2240 - val_Precision: 0.2287 - val_AUC:
0.5345
Epoch 8/150
15/15 [==============================] - ETA: 0s - loss: 1.8975 - accuracy:
0.4913 - Recall: 0.4217 - Precision: 0.5374 - AUC: 0.7535
```

```
Epoch 8: val_accuracy did not improve from 0.35938
15/15 [==============================] - 2s 117ms/step - loss: 1.8975 -
accuracy: 0.4913 - Recall: 0.4217 - Precision: 0.5374 - AUC: 0.7535 - val_loss:
2.5408 - val_accuracy: 0.2396 - val_Recall: 0.2344 - val_Precision: 0.2432 -
val_AUC: 0.5368
Epoch 9/150
15/15 [==============================] - ETA: 0s - loss: 1.7433 - accuracy:
0.5087 - Recall: 0.4522 - Precision: 0.5547 - AUC: 0.7644
Epoch 9: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 65ms/step - loss: 1.7433 - accuracy:
0.5087 - Recall: 0.4522 - Precision: 0.5547 - AUC: 0.7644 - val_loss: 2.1164 -
val_accuracy: 0.3385 - val_Recall: 0.1458 - val_Precision: 0.3333 - val_AUC:
0.6154
Epoch 10/150
15/15 [==============================] - ETA: 0s - loss: 1.6655 - accuracy:
0.5370 - Recall: 0.4891 - Precision: 0.6032 - AUC: 0.7933
Epoch 10: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 65ms/step - loss: 1.6655 - accuracy:
0.5370 - Recall: 0.4891 - Precision: 0.6032 - AUC: 0.7933 - val_loss: 1.9580 -
val_accuracy: 0.2812 - val_Recall: 0.1771 - val_Precision: 0.2556 - val_AUC:
0.6045
Epoch 11/150
15/15 [==============================] - ETA: 0s - loss: 1.7561 - accuracy:
0.5196 - Recall: 0.4565 - Precision: 0.5585 - AUC: 0.7705
Epoch 11: val_accuracy did not improve from 0.35938
15/15 [==============================] - 2s 122ms/step - loss: 1.7561 -
accuracy: 0.5196 - Recall: 0.4565 - Precision: 0.5585 - AUC: 0.7705 - val_loss:
2.4001 - val_accuracy: 0.2083 - val_Recall: 0.1927 - val_Precision: 0.2022 -
val_AUC: 0.5621
Epoch 12/150
15/15 [==============================] - ETA: 0s - loss: 1.7305 - accuracy:
0.5283 - Recall: 0.4630 - Precision: 0.5741 - AUC: 0.7709
Epoch 12: val_accuracy did not improve from 0.35938
15/15 [==============================] - 4s 289ms/step - loss: 1.7305 -
accuracy: 0.5283 - Recall: 0.4630 - Precision: 0.5741 - AUC: 0.7709 - val_loss:
2.8364 - val_accuracy: 0.2240 - val_Recall: 0.2031 - val_Precision: 0.2167 -
val_AUC: 0.5101
Epoch 13/150
15/15 [==============================] - ETA: 0s - loss: 1.5596 - accuracy:
0.5500 - Recall: 0.4674 - Precision: 0.5907 - AUC: 0.7985
Epoch 13: val_accuracy did not improve from 0.35938
15/15 [==============================] - 5s 352ms/step - loss: 1.5596 -
accuracy: 0.5500 - Recall: 0.4674 - Precision: 0.5907 - AUC: 0.7985 - val_loss:
2.3968 - val_accuracy: 0.2188 - val_Recall: 0.2031 - val_Precision: 0.2179 -
val_AUC: 0.5359
Epoch 14/150
15/15 [==============================] - ETA: 0s - loss: 1.5797 - accuracy:
0.5761 - Recall: 0.4826 - Precision: 0.6271 - AUC: 0.8056
```

```
Epoch 14: val_accuracy did not improve from 0.35938
15/15 [==============================] - 3s 220ms/step - loss: 1.5797 -
accuracy: 0.5761 - Recall: 0.4826 - Precision: 0.6271 - AUC: 0.8056 - val_loss:
2.8049 - val_accuracy: 0.2083 - val_Recall: 0.2031 - val_Precision: 0.2120 -
val_AUC: 0.5036
Epoch 15/150
15/15 [==============================] - ETA: 0s - loss: 1.4775 - accuracy:
0.5826 - Recall: 0.4848 - Precision: 0.6126 - AUC: 0.8192
Epoch 15: val_accuracy did not improve from 0.35938
15/15 [==============================] - 4s 240ms/step - loss: 1.4775 -
accuracy: 0.5826 - Recall: 0.4848 - Precision: 0.6126 - AUC: 0.8192 - val_loss:
2.8770 - val_accuracy: 0.2396 - val_Recall: 0.2240 - val_Precision: 0.2324 -
val_AUC: 0.5835
Epoch 16/150
15/15 [==============================] - ETA: 0s - loss: 1.4730 - accuracy:
0.5891 - Recall: 0.5174 - Precision: 0.6347 - AUC: 0.8249
Epoch 16: val_accuracy did not improve from 0.35938
15/15 [==============================] - 4s 271ms/step - loss: 1.4730 -
accuracy: 0.5891 - Recall: 0.5174 - Precision: 0.6347 - AUC: 0.8249 - val_loss:
2.5025 - val_accuracy: 0.2135 - val_Recall: 0.2031 - val_Precision: 0.2179 -
val_AUC: 0.5010
Epoch 17/150
15/15 [==============================] - ETA: 0s - loss: 1.4858 - accuracy:
0.5891 - Recall: 0.5217 - Precision: 0.6486 - AUC: 0.8259
Epoch 17: val_accuracy did not improve from 0.35938
15/15 [==============================] - 4s 254ms/step - loss: 1.4858 -
accuracy: 0.5891 - Recall: 0.5217 - Precision: 0.6486 - AUC: 0.8259 - val_loss:
2.1836 - val_accuracy: 0.2292 - val_Recall: 0.1927 - val_Precision: 0.2229 -
val_AUC: 0.5654
Epoch 18/150
15/15 [==============================] - ETA: 0s - loss: 1.4334 - accuracy:
0.5913 - Recall: 0.4978 - Precision: 0.6343 - AUC: 0.8333
Epoch 18: val_accuracy did not improve from 0.35938
15/15 [==============================] - 4s 278ms/step - loss: 1.4334 -
accuracy: 0.5913 - Recall: 0.4978 - Precision: 0.6343 - AUC: 0.8333 - val_loss:
2.3851 - val_accuracy: 0.2292 - val_Recall: 0.1719 - val_Precision: 0.2037 -
val_AUC: 0.5276
Epoch 19/150
15/15 [==============================] - ETA: 0s - loss: 1.4803 - accuracy:
0.5804 - Recall: 0.5174 - Precision: 0.6398 - AUC: 0.8197
Epoch 19: val_accuracy did not improve from 0.35938
15/15 [==============================] - 3s 185ms/step - loss: 1.4803 -
accuracy: 0.5804 - Recall: 0.5174 - Precision: 0.6398 - AUC: 0.8197 - val_loss:
2.2931 - val_accuracy: 0.2188 - val_Recall: 0.1458 - val_Precision: 0.1892 -
val_AUC: 0.5196
Epoch 20/150
14/15 [===========================>..] - ETA: 0s - loss: 1.4786 - accuracy:
0.5781 - Recall: 0.5000 - Precision: 0.6275 - AUC: 0.8169
```

```
Epoch 20: val_accuracy did not improve from 0.35938
15/15 [==============================] - 6s 380ms/step - loss: 1.4729 -
accuracy: 0.5804 - Recall: 0.5022 - Precision: 0.6311 - AUC: 0.8182 - val_loss:
2.3469 - val_accuracy: 0.1979 - val_Recall: 0.1823 - val_Precision: 0.2096 -
val_AUC: 0.5646
Epoch 21/150
15/15 [==============================] - ETA: 0s - loss: 1.4141 - accuracy:
0.6304 - Recall: 0.5565 - Precision: 0.6684 - AUC: 0.8349
Epoch 21: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 62ms/step - loss: 1.4141 - accuracy:
0.6304 - Recall: 0.5565 - Precision: 0.6684 - AUC: 0.8349 - val_loss: 2.2525 -
val_accuracy: 0.2500 - val_Recall: 0.1979 - val_Precision: 0.2452 - val_AUC:
0.5533
Epoch 22/150
15/15 [==============================] - ETA: 0s - loss: 1.3319 - accuracy:
0.6391 - Recall: 0.5696 - Precision: 0.7198 - AUC: 0.8596
Epoch 22: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 1.3319 - accuracy:
0.6391 - Recall: 0.5696 - Precision: 0.7198 - AUC: 0.8596 - val_loss: 2.7998 -
val_accuracy: 0.1979 - val_Recall: 0.1927 - val_Precision: 0.2033 - val_AUC:
0.5649
Epoch 23/150
15/15 [==============================] - ETA: 0s - loss: 1.4301 - accuracy:
0.6043 - Recall: 0.5587 - Precision: 0.6693 - AUC: 0.8394
Epoch 23: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 44ms/step - loss: 1.4301 - accuracy:
0.6043 - Recall: 0.5587 - Precision: 0.6693 - AUC: 0.8394 - val_loss: 2.6960 -
val_accuracy: 0.1927 - val_Recall: 0.1823 - val_Precision: 0.2011 - val_AUC:
0.5477
Epoch 24/150
14/15 [===========================>..] - ETA: 0s - loss: 1.3660 - accuracy:
0.6205 - Recall: 0.5670 - Precision: 0.6632 - AUC: 0.8498
Epoch 24: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 56ms/step - loss: 1.3595 - accuracy:
0.6239 - Recall: 0.5674 - Precision: 0.6658 - AUC: 0.8508 - val_loss: 2.4260 -
val_accuracy: 0.2656 - val_Recall: 0.2031 - val_Precision: 0.2335 - val_AUC:
0.5813
Epoch 25/150
15/15 [==============================] - ETA: 0s - loss: 1.2388 - accuracy:
0.6761 - Recall: 0.5891 - Precision: 0.7021 - AUC: 0.8757
Epoch 25: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 1.2388 - accuracy:
0.6761 - Recall: 0.5891 - Precision: 0.7021 - AUC: 0.8757 - val_loss: 2.1683 -
val_accuracy: 0.2292 - val_Recall: 0.1406 - val_Precision: 0.1915 - val_AUC:
0.5546
Epoch 26/150
14/15 [===========================>..] - ETA: 0s - loss: 1.1782 - accuracy:
0.6987 - Recall: 0.6228 - Precision: 0.7440 - AUC: 0.8910
```

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Epoch 26: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 45ms/step - loss: 1.1743 - accuracy:
0.7000 - Recall: 0.6261 - Precision: 0.7442 - AUC: 0.8919 - val_loss: 2.2536 -
val_accuracy: 0.2344 - val_Recall: 0.1875 - val_Precision: 0.2264 - val_AUC:
0.5407
Epoch 27/150
15/15 [==============================] - ETA: 0s - loss: 1.3463 - accuracy:
0.6283 - Recall: 0.5500 - Precision: 0.6951 - AUC: 0.8526
Epoch 27: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 41ms/step - loss: 1.3463 - accuracy:
0.6283 - Recall: 0.5500 - Precision: 0.6951 - AUC: 0.8526 - val_loss: 2.3849 -
val_accuracy: 0.2344 - val_Recall: 0.1823 - val_Precision: 0.2174 - val_AUC:
0.5431
Epoch 28/150
14/15 [===========================>..] - ETA: 0s - loss: 1.2773 - accuracy:
0.6540 - Recall: 0.5781 - Precision: 0.6907 - AUC: 0.8685
Epoch 28: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 58ms/step - loss: 1.2762 - accuracy:
0.6565 - Recall: 0.5804 - Precision: 0.6935 - AUC: 0.8686 - val_loss: 2.8759 -
val_accuracy: 0.2083 - val_Recall: 0.1927 - val_Precision: 0.1989 - val_AUC:
0.5629
Epoch 29/150
14/15 [===========================>..] - ETA: 0s - loss: 1.1632 - accuracy:
0.6652 - Recall: 0.6071 - Precision: 0.7273 - AUC: 0.8930
Epoch 29: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 69ms/step - loss: 1.1637 - accuracy:
0.6652 - Recall: 0.6065 - Precision: 0.7285 - AUC: 0.8927 - val_loss: 2.8262 -
val_accuracy: 0.2188 - val_Recall: 0.2083 - val_Precision: 0.2198 - val_AUC:
0.5625
Epoch 30/150
15/15 [==============================] - ETA: 0s - loss: 1.1991 - accuracy:
0.6783 - Recall: 0.5891 - Precision: 0.7207 - AUC: 0.8844
Epoch 30: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 52ms/step - loss: 1.1991 - accuracy:
0.6783 - Recall: 0.5891 - Precision: 0.7207 - AUC: 0.8844 - val_loss: 2.9301 -
val_accuracy: 0.2344 - val_Recall: 0.2240 - val_Precision: 0.2429 - val_AUC:
0.5742
Epoch 31/150
15/15 [==============================] - ETA: 0s - loss: 1.1476 - accuracy:
0.6870 - Recall: 0.6217 - Precision: 0.7352 - AUC: 0.8943
Epoch 31: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 50ms/step - loss: 1.1476 - accuracy:
0.6870 - Recall: 0.6217 - Precision: 0.7352 - AUC: 0.8943 - val_loss: 2.8948 -
val_accuracy: 0.2396 - val_Recall: 0.2292 - val_Precision: 0.2472 - val_AUC:
0.5438
Epoch 32/150
15/15 [==============================] - ETA: 0s - loss: 1.1073 - accuracy:
0.7022 - Recall: 0.6391 - Precision: 0.7350 - AUC: 0.9062
```

```
Epoch 32: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 49ms/step - loss: 1.1073 - accuracy:
0.7022 - Recall: 0.6391 - Precision: 0.7350 - AUC: 0.9062 - val_loss: 2.6266 -
val_accuracy: 0.2188 - val_Recall: 0.2031 - val_Precision: 0.2254 - val_AUC:
0.5285
Epoch 33/150
15/15 [==============================] - ETA: 0s - loss: 1.2204 - accuracy:
0.6783 - Recall: 0.6261 - Precision: 0.7347 - AUC: 0.8824
Epoch 33: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 52ms/step - loss: 1.2204 - accuracy:
0.6783 - Recall: 0.6261 - Precision: 0.7347 - AUC: 0.8824 - val_loss: 2.6693 -
val_accuracy: 0.2448 - val_Recall: 0.2344 - val_Precision: 0.2473 - val_AUC:
0.5465
Epoch 34/150
14/15 [===========================>..] - ETA: 0s - loss: 1.1649 - accuracy:
0.7009 - Recall: 0.6473 - Precision: 0.7572 - AUC: 0.8983
Epoch 34: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 48ms/step - loss: 1.1643 - accuracy:
0.7000 - Recall: 0.6435 - Precision: 0.7590 - AUC: 0.8981 - val_loss: 2.8690 -
val_accuracy: 0.2135 - val_Recall: 0.1927 - val_Precision: 0.2044 - val_AUC:
0.5660
Epoch 35/150
15/15 [==============================] - ETA: 0s - loss: 1.2292 - accuracy:
0.6739 - Recall: 0.6130 - Precision: 0.7231 - AUC: 0.8824
Epoch 35: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 47ms/step - loss: 1.2292 - accuracy:
0.6739 - Recall: 0.6130 - Precision: 0.7231 - AUC: 0.8824 - val_loss: 3.0737 -
val_accuracy: 0.2448 - val_Recall: 0.2188 - val_Precision: 0.2320 - val_AUC:
0.5432
Epoch 36/150
15/15 [==============================] - ETA: 0s - loss: 1.1213 - accuracy:
0.7087 - Recall: 0.6370 - Precision: 0.7571 - AUC: 0.9022
Epoch 36: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 47ms/step - loss: 1.1213 - accuracy:
0.7087 - Recall: 0.6370 - Precision: 0.7571 - AUC: 0.9022 - val_loss: 2.6076 -
val_accuracy: 0.2500 - val_Recall: 0.2448 - val_Precision: 0.2640 - val_AUC:
0.5522
Epoch 37/150
14/15 [===========================>..] - ETA: 0s - loss: 1.1542 - accuracy:
0.6942 - Recall: 0.6451 - Precision: 0.7468 - AUC: 0.8967
Epoch 37: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 1.1712 - accuracy:
0.6935 - Recall: 0.6435 - Precision: 0.7437 - AUC: 0.8944 - val_loss: 2.5457 -
val_accuracy: 0.2604 - val_Recall: 0.2188 - val_Precision: 0.2428 - val_AUC:
0.5691
Epoch 38/150
14/15 [===========================>..] - ETA: 0s - loss: 1.1576 - accuracy:
0.7076 - Recall: 0.6473 - Precision: 0.7572 - AUC: 0.9019
```

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Epoch 38: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 44ms/step - loss: 1.1627 - accuracy:
0.7000 - Recall: 0.6413 - Precision: 0.7526 - AUC: 0.9003 - val_loss: 2.6216 -
val_accuracy: 0.2552 - val_Recall: 0.2135 - val_Precision: 0.2384 - val_AUC:
0.5734
Epoch 39/150
13/15 [========================>…] - ETA: 0s - loss: 1.0498 - accuracy:
0.7308 - Recall: 0.6779 - Precision: 0.7726 - AUC: 0.9169
Epoch 39: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 35ms/step - loss: 1.0382 - accuracy:
0.7348 - Recall: 0.6804 - Precision: 0.7786 - AUC: 0.9193 - val_loss: 2.4113 -
val_accuracy: 0.2812 - val_Recall: 0.2656 - val_Precision: 0.2849 - val_AUC:
0.5904
Epoch 40/150
14/15 [===========================>..] - ETA: 0s - loss: 1.0451 - accuracy:
0.7411 - Recall: 0.6830 - Precision: 0.7927 - AUC: 0.9221
Epoch 40: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 49ms/step - loss: 1.0421 - accuracy:
0.7435 - Recall: 0.6848 - Precision: 0.7955 - AUC: 0.9226 - val_loss: 2.6513 -
val_accuracy: 0.2656 - val_Recall: 0.2552 - val_Precision: 0.2663 - val_AUC:
0.5592
Epoch 41/150
15/15 [==============================] - ETA: 0s - loss: 1.0777 - accuracy:
0.7326 - Recall: 0.6761 - Precision: 0.7814 - AUC: 0.9140
Epoch 41: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 1.0777 - accuracy:
0.7326 - Recall: 0.6761 - Precision: 0.7814 - AUC: 0.9140 - val_loss: 2.4944 -
val_accuracy: 0.2865 - val_Recall: 0.2604 - val_Precision: 0.2809 - val_AUC:
0.5734
Epoch 42/150
15/15 [==============================] - ETA: 0s - loss: 1.0963 - accuracy:
0.7174 - Recall: 0.6587 - Precision: 0.7671 - AUC: 0.9051
Epoch 42: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 1.0963 - accuracy:
0.7174 - Recall: 0.6587 - Precision: 0.7671 - AUC: 0.9051 - val_loss: 2.3875 -
val_accuracy: 0.3125 - val_Recall: 0.2865 - val_Precision: 0.3179 - val_AUC:
0.6074
Epoch 43/150
15/15 [==============================] - ETA: 0s - loss: 1.0455 - accuracy:
0.7283 - Recall: 0.6717 - Precision: 0.7863 - AUC: 0.9182
Epoch 43: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 48ms/step - loss: 1.0455 - accuracy:
0.7283 - Recall: 0.6717 - Precision: 0.7863 - AUC: 0.9182 - val_loss: 2.9629 -
val_accuracy: 0.2708 - val_Recall: 0.2396 - val_Precision: 0.2599 - val_AUC:
0.5650
Epoch 44/150
15/15 [==============================] - ETA: 0s - loss: 1.0425 - accuracy:
0.7239 - Recall: 0.6652 - Precision: 0.7747 - AUC: 0.9204
```

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Epoch 44: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 48ms/step - loss: 1.0425 - accuracy:
0.7239 - Recall: 0.6652 - Precision: 0.7747 - AUC: 0.9204 - val_loss: 2.2801 -
val_accuracy: 0.2917 - val_Recall: 0.2760 - val_Precision: 0.3272 - val_AUC:
0.5986
Epoch 45/150
15/15 [==============================] - ETA: 0s - loss: 1.0378 - accuracy:
0.7435 - Recall: 0.6913 - Precision: 0.7930 - AUC: 0.9214
Epoch 45: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 49ms/step - loss: 1.0378 - accuracy:
0.7435 - Recall: 0.6913 - Precision: 0.7930 - AUC: 0.9214 - val_loss: 2.4677 -
val_accuracy: 0.3021 - val_Recall: 0.2865 - val_Precision: 0.3022 - val_AUC:
0.6021
Epoch 46/150
15/15 [==============================] - ETA: 0s - loss: 1.0061 - accuracy:
0.7500 - Recall: 0.6870 - Precision: 0.7980 - AUC: 0.9261
Epoch 46: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 50ms/step - loss: 1.0061 - accuracy:
0.7500 - Recall: 0.6870 - Precision: 0.7980 - AUC: 0.9261 - val_loss: 2.7109 -
val_accuracy: 0.3021 - val_Recall: 0.2812 - val_Precision: 0.2967 - val_AUC:
0.5970
Epoch 47/150
15/15 [==============================] - ETA: 0s - loss: 1.0207 - accuracy:
0.7630 - Recall: 0.6957 - Precision: 0.8081 - AUC: 0.9249
Epoch 47: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 50ms/step - loss: 1.0207 - accuracy:
0.7630 - Recall: 0.6957 - Precision: 0.8081 - AUC: 0.9249 - val_loss: 2.3455 -
val_accuracy: 0.3125 - val_Recall: 0.2969 - val_Precision: 0.3132 - val_AUC:
0.6212
Epoch 48/150
15/15 [==============================] - ETA: 0s - loss: 1.0659 - accuracy:
0.7500 - Recall: 0.6891 - Precision: 0.8005 - AUC: 0.9163
Epoch 48: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 49ms/step - loss: 1.0659 - accuracy:
0.7500 - Recall: 0.6891 - Precision: 0.8005 - AUC: 0.9163 - val_loss: 2.5876 -
val_accuracy: 0.3385 - val_Recall: 0.3125 - val_Precision: 0.3315 - val_AUC:
0.6242
Epoch 49/150
15/15 [==============================] - ETA: 0s - loss: 0.9659 - accuracy:
0.7522 - Recall: 0.7130 - Precision: 0.8000 - AUC: 0.9351
Epoch 49: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 49ms/step - loss: 0.9659 - accuracy:
0.7522 - Recall: 0.7130 - Precision: 0.8000 - AUC: 0.9351 - val_loss: 2.5062 -
val_accuracy: 0.3229 - val_Recall: 0.3021 - val_Precision: 0.3169 - val_AUC:
0.6103
Epoch 50/150
15/15 [==============================] - ETA: 0s - loss: 0.9869 - accuracy:
0.7478 - Recall: 0.6978 - Precision: 0.7887 - AUC: 0.9298
```

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Epoch 50: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 0.9869 - accuracy:
0.7478 - Recall: 0.6978 - Precision: 0.7887 - AUC: 0.9298 - val_loss: 2.5011 -
val_accuracy: 0.3333 - val_Recall: 0.3021 - val_Precision: 0.3258 - val_AUC:
0.6108
Epoch 51/150
15/15 [==============================] - ETA: 0s - loss: 0.9676 - accuracy:
0.7804 - Recall: 0.7239 - Precision: 0.8024 - AUC: 0.9347
Epoch 51: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 44ms/step - loss: 0.9676 - accuracy:
0.7804 - Recall: 0.7239 - Precision: 0.8024 - AUC: 0.9347 - val_loss: 2.5827 -
val_accuracy: 0.3177 - val_Recall: 0.2969 - val_Precision: 0.3098 - val_AUC:
0.6079
Epoch 52/150
15/15 [==============================] - ETA: 0s - loss: 0.9781 - accuracy:
0.7217 - Recall: 0.6935 - Precision: 0.7687 - AUC: 0.9317
Epoch 52: val_accuracy did not improve from 0.35938
15/15 [==============================] - 1s 46ms/step - loss: 0.9781 - accuracy:
0.7217 - Recall: 0.6935 - Precision: 0.7687 - AUC: 0.9317 - val_loss: 2.6402 -
val_accuracy: 0.3281 - val_Recall: 0.3021 - val_Precision: 0.3187 - val_AUC:
0.6045
Epoch 53/150
15/15 [==============================] - ETA: 0s - loss: 0.9941 - accuracy:
0.7522 - Recall: 0.7130 - Precision: 0.7942 - AUC: 0.9295
Epoch 53: val_accuracy improved from 0.35938 to 0.37500, saving model to
d:\Research Work\Thesis\New
Data\Code-20240119T232854Z-001\Code\Aug_No_Aug_T2\No_Aug_Model_53
15/15 [==============================] - 1s 56ms/step - loss: 0.9941 - accuracy:
0.7522 - Recall: 0.7130 - Precision: 0.7942 - AUC: 0.9295 - val_loss: 2.3715 -
val_accuracy: 0.3750 - val_Recall: 0.3229 - val_Precision: 0.3543 - val_AUC:
0.6417
Epoch 54/150
14/15 [===========================>..] - ETA: 0s - loss: 0.9001 - accuracy:
0.7768 - Recall: 0.7277 - Precision: 0.8191 - AUC: 0.9473
Epoch 54: val_accuracy did not improve from 0.37500
15/15 [==============================] - 1s 45ms/step - loss: 0.8969 - accuracy:
0.7804 - Recall: 0.7304 - Precision: 0.8215 - AUC: 0.9480 - val_loss: 2.4946 -
val_accuracy: 0.3333 - val_Recall: 0.3177 - val_Precision: 0.3333 - val_AUC:
0.6286
Epoch 55/150
15/15 [==============================] - ETA: 0s - loss: 1.0261 - accuracy:
0.7304 - Recall: 0.6957 - Precision: 0.7786 - AUC: 0.9240
Epoch 55: val_accuracy did not improve from 0.37500
15/15 [==============================] - 1s 44ms/step - loss: 1.0261 - accuracy:
0.7304 - Recall: 0.6957 - Precision: 0.7786 - AUC: 0.9240 - val_loss: 2.5281 -
val_accuracy: 0.3281 - val_Recall: 0.3073 - val_Precision: 0.3172 - val_AUC:
0.6320
Epoch 56/150
```

```
15/15 [==============================] - ETA: 0s - loss: 0.9276 - accuracy:
0.7826 - Recall: 0.7217 - Precision: 0.8117 - AUC: 0.9431
Epoch 56: val_accuracy did not improve from 0.37500
15/15 [==============================] - 1s 50ms/step - loss: 0.9276 - accuracy:
0.7826 - Recall: 0.7217 - Precision: 0.8117 - AUC: 0.9431 - val_loss: 2.5887 -
val_accuracy: 0.3177 - val_Recall: 0.3177 - val_Precision: 0.3262 - val_AUC:
0.6225
Epoch 57/150
15/15 [==============================] - ETA: 0s - loss: 0.9450 - accuracy:
0.7674 - Recall: 0.7065 - Precision: 0.8207 - AUC: 0.9385
Epoch 57: val_accuracy improved from 0.37500 to 0.40625, saving model to
d:\Research Work\Thesis\New
Data\Code-20240119T232854Z-001\Code\Aug_No_Aug_T2\No_Aug_Model_57
15/15 [==============================] - 1s 57ms/step - loss: 0.9450 - accuracy:
0.7674 - Recall: 0.7065 - Precision: 0.8207 - AUC: 0.9385 - val_loss: 2.3708 -
val_accuracy: 0.4062 - val_Recall: 0.3646 - val_Precision: 0.3955 - val_AUC:
0.6558
Epoch 58/150
14/15 [===========================>..] - ETA: 0s - loss: 0.9804 - accuracy:
0.7522 - Recall: 0.7009 - Precision: 0.8072 - AUC: 0.9328
Epoch 58: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 49ms/step - loss: 0.9827 - accuracy:
0.7522 - Recall: 0.7022 - Precision: 0.8055 - AUC: 0.9323 - val_loss: 2.4145 -
val_accuracy: 0.3594 - val_Recall: 0.3229 - val_Precision: 0.3464 - val_AUC:
0.6429
Epoch 59/150
15/15 [==============================] - ETA: 0s - loss: 0.9175 - accuracy:
0.7761 - Recall: 0.7217 - Precision: 0.8177 - AUC: 0.9430
Epoch 59: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 47ms/step - loss: 0.9175 - accuracy:
0.7761 - Recall: 0.7217 - Precision: 0.8177 - AUC: 0.9430 - val_loss: 2.5701 -
val_accuracy: 0.3385 - val_Recall: 0.3125 - val_Precision: 0.3315 - val_AUC:
0.6316
Epoch 60/150
15/15 [==============================] - ETA: 0s - loss: 0.9275 - accuracy:
0.7717 - Recall: 0.7304 - Precision: 0.8058 - AUC: 0.9450
Epoch 60: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 49ms/step - loss: 0.9275 - accuracy:
0.7717 - Recall: 0.7304 - Precision: 0.8058 - AUC: 0.9450 - val_loss: 2.4733 -
val_accuracy: 0.3594 - val_Recall: 0.3333 - val_Precision: 0.3596 - val_AUC:
0.6452
Epoch 61/150
15/15 [==============================] - ETA: 0s - loss: 0.8766 - accuracy:
0.7870 - Recall: 0.7348 - Precision: 0.8325 - AUC: 0.9515
Epoch 61: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 45ms/step - loss: 0.8766 - accuracy:
0.7870 - Recall: 0.7348 - Precision: 0.8325 - AUC: 0.9515 - val_loss: 2.4790 -
val_accuracy: 0.3542 - val_Recall: 0.3385 - val_Precision: 0.3533 - val_AUC:
```

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0.6548
Epoch 62/150
15/15 [==============================] - ETA: 0s - loss: 0.9691 - accuracy:
0.7739 - Recall: 0.7196 - Precision: 0.8054 - AUC: 0.9338
Epoch 62: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 40ms/step - loss: 0.9691 - accuracy:
0.7739 - Recall: 0.7196 - Precision: 0.8054 - AUC: 0.9338 - val_loss: 2.6926 -
val_accuracy: 0.3281 - val_Recall: 0.3073 - val_Precision: 0.3242 - val_AUC:
0.6179
Epoch 63/150
15/15 [==============================] - ETA: 0s - loss: 0.8381 - accuracy:
0.8087 - Recall: 0.7674 - Precision: 0.8445 - AUC: 0.9587
Epoch 63: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 42ms/step - loss: 0.8381 - accuracy:
0.8087 - Recall: 0.7674 - Precision: 0.8445 - AUC: 0.9587 - val_loss: 2.5731 -
val_accuracy: 0.3646 - val_Recall: 0.3333 - val_Precision: 0.3596 - val_AUC:
0.6479
Epoch 64/150
15/15 [==============================] - ETA: 0s - loss: 0.8865 - accuracy:
0.8022 - Recall: 0.7652 - Precision: 0.8482 - AUC: 0.9498
Epoch 64: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 41ms/step - loss: 0.8865 - accuracy:
0.8022 - Recall: 0.7652 - Precision: 0.8482 - AUC: 0.9498 - val_loss: 2.4504 -
val_accuracy: 0.4010 - val_Recall: 0.3750 - val_Precision: 0.4068 - val_AUC:
0.6558
Epoch 65/150
14/15 [===========================>..] - ETA: 0s - loss: 0.9231 - accuracy:
0.7723 - Recall: 0.7299 - Precision: 0.8175 - AUC: 0.9447
Epoch 65: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 44ms/step - loss: 0.9187 - accuracy:
0.7739 - Recall: 0.7283 - Precision: 0.8211 - AUC: 0.9454 - val_loss: 2.5314 -
val_accuracy: 0.3490 - val_Recall: 0.3281 - val_Precision: 0.3443 - val_AUC:
0.6440
Epoch 66/150
15/15 [==============================] - ETA: 0s - loss: 0.8557 - accuracy:
0.8087 - Recall: 0.7630 - Precision: 0.8499 - AUC: 0.9562
Epoch 66: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 41ms/step - loss: 0.8557 - accuracy:
0.8087 - Recall: 0.7630 - Precision: 0.8499 - AUC: 0.9562 - val_loss: 2.8011 -
val_accuracy: 0.3333 - val_Recall: 0.3229 - val_Precision: 0.3407 - val_AUC:
0.6179
Epoch 67/150
15/15 [==============================] - ETA: 0s - loss: 0.8591 - accuracy:
0.8065 - Recall: 0.7652 - Precision: 0.8482 - AUC: 0.9540
Epoch 67: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 41ms/step - loss: 0.8591 - accuracy:
0.8065 - Recall: 0.7652 - Precision: 0.8482 - AUC: 0.9540 - val_loss: 2.7521 -
val_accuracy: 0.3385 - val_Recall: 0.3125 - val_Precision: 0.3297 - val_AUC:
```

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0.6245
Epoch 68/150
15/15 [==============================] - ETA: 0s - loss: 0.9282 - accuracy:
0.7696 - Recall: 0.7304 - Precision: 0.8038 - AUC: 0.9414
Epoch 68: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 43ms/step - loss: 0.9282 - accuracy:
0.7696 - Recall: 0.7304 - Precision: 0.8038 - AUC: 0.9414 - val_loss: 2.4055 -
val_accuracy: 0.3802 - val_Recall: 0.3646 - val_Precision: 0.3911 - val_AUC:
0.6668
Epoch 69/150
15/15 [==============================] - ETA: 0s - loss: 0.9163 - accuracy:
0.7913 - Recall: 0.7478 - Precision: 0.8171 - AUC: 0.9450
Epoch 69: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 44ms/step - loss: 0.9163 - accuracy:
0.7913 - Recall: 0.7478 - Precision: 0.8171 - AUC: 0.9450 - val_loss: 2.5493 -
val_accuracy: 0.4062 - val_Recall: 0.3958 - val_Precision: 0.4153 - val_AUC:
0.6655
Epoch 70/150
15/15 [==============================] - ETA: 0s - loss: 0.8543 - accuracy:
0.8087 - Recall: 0.7522 - Precision: 0.8398 - AUC: 0.9546
Epoch 70: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 46ms/step - loss: 0.8543 - accuracy:
0.8087 - Recall: 0.7522 - Precision: 0.8398 - AUC: 0.9546 - val_loss: 2.4747 -
val_accuracy: 0.3750 - val_Recall: 0.3490 - val_Precision: 0.3722 - val_AUC:
0.6632
Epoch 71/150
15/15 [==============================] - ETA: 0s - loss: 0.8513 - accuracy:
0.8043 - Recall: 0.7500 - Precision: 0.8354 - AUC: 0.9553
Epoch 71: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 45ms/step - loss: 0.8513 - accuracy:
0.8043 - Recall: 0.7500 - Precision: 0.8354 - AUC: 0.9553 - val_loss: 2.5830 -
val_accuracy: 0.3490 - val_Recall: 0.3333 - val_Precision: 0.3556 - val_AUC:
0.6470
Epoch 72/150
15/15 [==============================] - ETA: 0s - loss: 0.8371 - accuracy:
0.7978 - Recall: 0.7739 - Precision: 0.8416 - AUC: 0.9591
Epoch 72: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 44ms/step - loss: 0.8371 - accuracy:
0.7978 - Recall: 0.7739 - Precision: 0.8416 - AUC: 0.9591 - val_loss: 2.5065 -
val_accuracy: 0.4010 - val_Recall: 0.3594 - val_Precision: 0.3920 - val_AUC:
0.6613
Epoch 73/150
15/15 [==============================] - ETA: 0s - loss: 0.8208 - accuracy:
0.7978 - Recall: 0.7696 - Precision: 0.8329 - AUC: 0.9606
Epoch 73: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 42ms/step - loss: 0.8208 - accuracy:
0.7978 - Recall: 0.7696 - Precision: 0.8329 - AUC: 0.9606 - val_loss: 2.5491 -
val_accuracy: 0.3646 - val_Recall: 0.3438 - val_Precision: 0.3646 - val_AUC:
```

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0.6604
Epoch 74/150
15/15 [==============================] - ETA: 0s - loss: 0.8927 - accuracy:
0.7870 - Recall: 0.7565 - Precision: 0.8386 - AUC: 0.9506
Epoch 74: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 37ms/step - loss: 0.8927 - accuracy:
0.7870 - Recall: 0.7565 - Precision: 0.8386 - AUC: 0.9506 - val_loss: 2.8800 -
val_accuracy: 0.3281 - val_Recall: 0.3125 - val_Precision: 0.3333 - val_AUC:
0.6092
Epoch 75/150
15/15 [==============================] - ETA: 0s - loss: 0.7875 - accuracy:
0.8196 - Recall: 0.7761 - Precision: 0.8520 - AUC: 0.9663
Epoch 75: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 41ms/step - loss: 0.7875 - accuracy:
0.8196 - Recall: 0.7761 - Precision: 0.8520 - AUC: 0.9663 - val_loss: 2.5392 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3702 - val_AUC:
0.6559
Epoch 76/150
13/15 [========================>...] - ETA: 0s - loss: 0.8455 - accuracy:
0.8149 - Recall: 0.7861 - Precision: 0.8538 - AUC: 0.9555
Epoch 76: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 37ms/step - loss: 0.8385 - accuracy:
0.8174 - Recall: 0.7848 - Precision: 0.8555 - AUC: 0.9569 - val_loss: 2.4737 -
val_accuracy: 0.3854 - val_Recall: 0.3698 - val_Precision: 0.3966 - val_AUC:
0.6672
Epoch 77/150
15/15 [==============================] - ETA: 0s - loss: 0.8143 - accuracy:
0.8217 - Recall: 0.7957 - Precision: 0.8612 - AUC: 0.9619
Epoch 77: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 35ms/step - loss: 0.8143 - accuracy:
0.8217 - Recall: 0.7957 - Precision: 0.8612 - AUC: 0.9619 - val_loss: 2.8932 -
val_accuracy: 0.3385 - val_Recall: 0.3333 - val_Precision: 0.3478 - val_AUC:
0.6226
Epoch 78/150
13/15 [========================>...] - ETA: 0s - loss: 0.8330 - accuracy:
0.8149 - Recall: 0.7909 - Precision: 0.8393 - AUC: 0.9581
Epoch 78: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 34ms/step - loss: 0.8193 - accuracy:
0.8217 - Recall: 0.7978 - Precision: 0.8476 - AUC: 0.9605 - val_loss: 2.5130 -
val_accuracy: 0.3698 - val_Recall: 0.3542 - val_Precision: 0.3799 - val_AUC:
0.6551
Epoch 79/150
15/15 [==============================] - ETA: 0s - loss: 0.7996 - accuracy:
0.8174 - Recall: 0.7957 - Precision: 0.8453 - AUC: 0.9636
Epoch 79: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 31ms/step - loss: 0.7996 - accuracy:
0.8174 - Recall: 0.7957 - Precision: 0.8453 - AUC: 0.9636 - val_loss: 2.5585 -
val_accuracy: 0.3542 - val_Recall: 0.3281 - val_Precision: 0.3559 - val_AUC:
```

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0.6365
Epoch 80/150
14/15 [===========================>..] - ETA: 0s - loss: 0.8121 - accuracy:
0.8304 - Recall: 0.7991 - Precision: 0.8689 - AUC: 0.9623
Epoch 80: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 37ms/step - loss: 0.8457 - accuracy:
0.8217 - Recall: 0.7891 - Precision: 0.8582 - AUC: 0.9563 - val_loss: 2.7580 -
val_accuracy: 0.3542 - val_Recall: 0.3229 - val_Precision: 0.3483 - val_AUC:
0.6251
Epoch 81/150
15/15 [==============================] - ETA: 0s - loss: 0.8058 - accuracy:
0.8065 - Recall: 0.7913 - Precision: 0.8387 - AUC: 0.9628
Epoch 81: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 36ms/step - loss: 0.8058 - accuracy:
0.8065 - Recall: 0.7913 - Precision: 0.8387 - AUC: 0.9628 - val_loss: 2.7811 -
val_accuracy: 0.3490 - val_Recall: 0.3281 - val_Precision: 0.3520 - val_AUC:
0.6305
Epoch 82/150
15/15 [==============================] - ETA: 0s - loss: 0.8720 - accuracy:
0.8239 - Recall: 0.7783 - Precision: 0.8524 - AUC: 0.9525
Epoch 82: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 36ms/step - loss: 0.8720 - accuracy:
0.8239 - Recall: 0.7783 - Precision: 0.8524 - AUC: 0.9525 - val_loss: 2.8991 -
val_accuracy: 0.3490 - val_Recall: 0.3229 - val_Precision: 0.3407 - val_AUC:
0.6275
Epoch 83/150
13/15 [=========================>…] - ETA: 0s - loss: 0.7402 - accuracy:
0.8510 - Recall: 0.8197 - Precision: 0.8789 - AUC: 0.9732
Epoch 83: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 33ms/step - loss: 0.7493 - accuracy:
0.8435 - Recall: 0.8130 - Precision: 0.8759 - AUC: 0.9720 - val_loss: 2.7162 -
val_accuracy: 0.3542 - val_Recall: 0.3385 - val_Precision: 0.3611 - val_AUC:
0.6357
Epoch 84/150
15/15 [==============================] - ETA: 0s - loss: 0.8411 - accuracy:
0.8196 - Recall: 0.7652 - Precision: 0.8523 - AUC: 0.9581
Epoch 84: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 35ms/step - loss: 0.8411 - accuracy:
0.8196 - Recall: 0.7652 - Precision: 0.8523 - AUC: 0.9581 - val_loss: 2.5759 -
val_accuracy: 0.3698 - val_Recall: 0.3385 - val_Precision: 0.3672 - val_AUC:
0.6444
Epoch 85/150
13/15 [=========================>…] - ETA: 0s - loss: 0.8140 - accuracy:
0.8221 - Recall: 0.7981 - Precision: 0.8579 - AUC: 0.9610
Epoch 85: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 33ms/step - loss: 0.8248 - accuracy:
0.8130 - Recall: 0.7891 - Precision: 0.8501 - AUC: 0.9588 - val_loss: 2.9574 -
val_accuracy: 0.3542 - val_Recall: 0.3229 - val_Precision: 0.3407 - val_AUC:
```

```
0.6210
Epoch 86/150
15/15 [==============================] - ETA: 0s - loss: 0.7890 - accuracy:
0.8174 - Recall: 0.7804 - Precision: 0.8589 - AUC: 0.9653
Epoch 86: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 36ms/step - loss: 0.7890 - accuracy:
0.8174 - Recall: 0.7804 - Precision: 0.8589 - AUC: 0.9653 - val_loss: 2.5426 -
val_accuracy: 0.3802 - val_Recall: 0.3698 - val_Precision: 0.3944 - val_AUC:
0.6691
Epoch 87/150
15/15 [==============================] - ETA: 0s - loss: 0.7651 - accuracy:
0.8565 - Recall: 0.8261 - Precision: 0.8920 - AUC: 0.9690
Epoch 87: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 44ms/step - loss: 0.7651 - accuracy:
0.8565 - Recall: 0.8261 - Precision: 0.8920 - AUC: 0.9690 - val_loss: 2.9345 -
val_accuracy: 0.3542 - val_Recall: 0.3229 - val_Precision: 0.3444 - val_AUC:
0.6154
Epoch 88/150
15/15 [==============================] - ETA: 0s - loss: 0.7544 - accuracy:
0.8261 - Recall: 0.7957 - Precision: 0.8632 - AUC: 0.9704
Epoch 88: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 40ms/step - loss: 0.7544 - accuracy:
0.8261 - Recall: 0.7957 - Precision: 0.8632 - AUC: 0.9704 - val_loss: 2.6203 -
val_accuracy: 0.3854 - val_Recall: 0.3698 - val_Precision: 0.3944 - val_AUC:
0.6737
Epoch 89/150
15/15 [==============================] - ETA: 0s - loss: 0.7965 - accuracy:
0.8413 - Recall: 0.8043 - Precision: 0.8706 - AUC: 0.9645
Epoch 89: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 41ms/step - loss: 0.7965 - accuracy:
0.8413 - Recall: 0.8043 - Precision: 0.8706 - AUC: 0.9645 - val_loss: 2.8939 -
val_accuracy: 0.3490 - val_Recall: 0.3281 - val_Precision: 0.3520 - val_AUC:
0.6142
Epoch 90/150
15/15 [==============================] - ETA: 0s - loss: 0.7585 - accuracy:
0.8435 - Recall: 0.8022 - Precision: 0.8765 - AUC: 0.9687
Epoch 90: val_accuracy did not improve from 0.40625
15/15 [==============================] - 1s 37ms/step - loss: 0.7585 - accuracy:
0.8435 - Recall: 0.8022 - Precision: 0.8765 - AUC: 0.9687 - val_loss: 2.6254 -
val_accuracy: 0.3750 - val_Recall: 0.3594 - val_Precision: 0.3791 - val_AUC:
0.6492
Epoch 91/150
13/15 [=========================>…] - ETA: 0s - loss: 0.7255 - accuracy:
0.8582 - Recall: 0.8389 - Precision: 0.8972 - AUC: 0.9760
Epoch 91: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 33ms/step - loss: 0.7231 - accuracy:
0.8522 - Recall: 0.8326 - Precision: 0.8886 - AUC: 0.9762 - val_loss: 2.5682 -
val_accuracy: 0.3802 - val_Recall: 0.3646 - val_Precision: 0.3867 - val_AUC:
```

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0.6673
Epoch 92/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7177 - accuracy:
0.8728 - Recall: 0.8326 - Precision: 0.8923 - AUC: 0.9758
Epoch 92: val_accuracy did not improve from 0.40625
15/15 [==============================] - 0s 33ms/step - loss: 0.7196 - accuracy:
0.8739 - Recall: 0.8348 - Precision: 0.8930 - AUC: 0.9756 - val_loss: 2.6248 -
val_accuracy: 0.3646 - val_Recall: 0.3438 - val_Precision: 0.3708 - val_AUC:
0.6584
Epoch 93/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7675 - accuracy:
0.8371 - Recall: 0.8080 - Precision: 0.8599 - AUC: 0.9675
Epoch 93: val_accuracy improved from 0.40625 to 0.42188, saving model to
d:\Research Work\Thesis\New
Data\Code-20240119T232854Z-001\Code\Aug_No_Aug_T2\No_Aug_Model_93
15/15 [==============================] - 1s 43ms/step - loss: 0.7731 - accuracy:
0.8348 - Recall: 0.8065 - Precision: 0.8588 - AUC: 0.9668 - val_loss: 2.4279 -
val_accuracy: 0.4219 - val_Recall: 0.4010 - val_Precision: 0.4425 - val_AUC:
0.6893
Epoch 94/150
15/15 [==============================] - ETA: 0s - loss: 0.7680 - accuracy:
0.8435 - Recall: 0.8087 - Precision: 0.8671 - AUC: 0.9683
Epoch 94: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 44ms/step - loss: 0.7680 - accuracy:
0.8435 - Recall: 0.8087 - Precision: 0.8671 - AUC: 0.9683 - val_loss: 2.6438 -
val_accuracy: 0.3698 - val_Recall: 0.3385 - val_Precision: 0.3652 - val_AUC:
0.6550
Epoch 95/150
15/15 [==============================] - ETA: 0s - loss: 0.7658 - accuracy:
0.8435 - Recall: 0.8130 - Precision: 0.8657 - AUC: 0.9679
Epoch 95: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 43ms/step - loss: 0.7658 - accuracy:
0.8435 - Recall: 0.8130 - Precision: 0.8657 - AUC: 0.9679 - val_loss: 2.6867 -
val_accuracy: 0.3646 - val_Recall: 0.3594 - val_Precision: 0.3855 - val_AUC:
0.6615
Epoch 96/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7195 - accuracy:
0.8728 - Recall: 0.8460 - Precision: 0.8981 - AUC: 0.9748
Epoch 96: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 37ms/step - loss: 0.7405 - accuracy:
0.8674 - Recall: 0.8391 - Precision: 0.8956 - AUC: 0.9715 - val_loss: 2.9108 -
val_accuracy: 0.3542 - val_Recall: 0.3333 - val_Precision: 0.3556 - val_AUC:
0.6266
Epoch 97/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7918 - accuracy:
0.8237 - Recall: 0.7902 - Precision: 0.8530 - AUC: 0.9645
Epoch 97: val_accuracy did not improve from 0.42188
15/15 [==============================] - 0s 32ms/step - loss: 0.7901 - accuracy:
```

```
0.8239 - Recall: 0.7891 - Precision: 0.8541 - AUC: 0.9648 - val_loss: 3.0239 -
val_accuracy: 0.3490 - val_Recall: 0.3333 - val_Precision: 0.3478 - val_AUC:
0.6227
Epoch 98/150
14/15 [===========================>..] - ETA: 0s - loss: 0.8043 - accuracy:
0.8326 - Recall: 0.7991 - Precision: 0.8627 - AUC: 0.9621
Epoch 98: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 38ms/step - loss: 0.8125 - accuracy:
0.8239 - Recall: 0.7913 - Precision: 0.8565 - AUC: 0.9610 - val_loss: 2.7882 -
val_accuracy: 0.3802 - val_Recall: 0.3542 - val_Precision: 0.3757 - val_AUC:
0.6577
Epoch 99/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7449 - accuracy:
0.8549 - Recall: 0.8214 - Precision: 0.8659 - AUC: 0.9710
Epoch 99: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 40ms/step - loss: 0.7415 - accuracy:
0.8543 - Recall: 0.8217 - Precision: 0.8650 - AUC: 0.9715 - val_loss: 2.7055 -
val_accuracy: 0.3594 - val_Recall: 0.3385 - val_Precision: 0.3693 - val_AUC:
0.6468
Epoch 100/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7307 - accuracy:
0.8504 - Recall: 0.8192 - Precision: 0.8759 - AUC: 0.9736
Epoch 100: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 43ms/step - loss: 0.7310 - accuracy:
0.8478 - Recall: 0.8174 - Precision: 0.8744 - AUC: 0.9736 - val_loss: 3.2655 -
val_accuracy: 0.3385 - val_Recall: 0.3229 - val_Precision: 0.3388 - val_AUC:
0.6105
Epoch 101/150
15/15 [==============================] - ETA: 0s - loss: 0.7732 - accuracy:
0.8478 - Recall: 0.8087 - Precision: 0.8732 - AUC: 0.9663
Epoch 101: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 36ms/step - loss: 0.7732 - accuracy:
0.8478 - Recall: 0.8087 - Precision: 0.8732 - AUC: 0.9663 - val_loss: 2.8191 -
val_accuracy: 0.3594 - val_Recall: 0.3385 - val_Precision: 0.3611 - val_AUC:
0.6448
Epoch 102/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7157 - accuracy:
0.8527 - Recall: 0.8170 - Precision: 0.8862 - AUC: 0.9757
Epoch 102: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 37ms/step - loss: 0.7255 - accuracy:
0.8522 - Recall: 0.8174 - Precision: 0.8868 - AUC: 0.9739 - val_loss: 2.8389 -
val_accuracy: 0.3646 - val_Recall: 0.3333 - val_Precision: 0.3616 - val_AUC:
0.6498
Epoch 103/150
15/15 [==============================] - ETA: 0s - loss: 0.7136 - accuracy:
0.8826 - Recall: 0.8630 - Precision: 0.9064 - AUC: 0.9748
Epoch 103: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 39ms/step - loss: 0.7136 - accuracy:
```

```
0.8826 - Recall: 0.8630 - Precision: 0.9064 - AUC: 0.9748 - val_loss: 2.8609 -
val_accuracy: 0.3594 - val_Recall: 0.3385 - val_Precision: 0.3611 - val_AUC:
0.6462
Epoch 104/150
15/15 [==============================] - ETA: 0s - loss: 0.7709 - accuracy:
0.8370 - Recall: 0.8065 - Precision: 0.8729 - AUC: 0.9662
Epoch 104: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 57ms/step - loss: 0.7709 - accuracy:
0.8370 - Recall: 0.8065 - Precision: 0.8729 - AUC: 0.9662 - val_loss: 2.7004 -
val_accuracy: 0.3698 - val_Recall: 0.3542 - val_Precision: 0.3757 - val_AUC:
0.6488
Epoch 105/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7603 - accuracy:
0.8393 - Recall: 0.8147 - Precision: 0.8732 - AUC: 0.9697
Epoch 105: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 52ms/step - loss: 0.7657 - accuracy:
0.8370 - Recall: 0.8130 - Precision: 0.8698 - AUC: 0.9691 - val_loss: 2.8101 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3681 - val_AUC:
0.6536
Epoch 106/150
15/15 [==============================] - ETA: 0s - loss: 0.7591 - accuracy:
0.8457 - Recall: 0.8239 - Precision: 0.8814 - AUC: 0.9693
Epoch 106: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 48ms/step - loss: 0.7591 - accuracy:
0.8457 - Recall: 0.8239 - Precision: 0.8814 - AUC: 0.9693 - val_loss: 2.8538 -
val_accuracy: 0.3646 - val_Recall: 0.3385 - val_Precision: 0.3714 - val_AUC:
0.6463
Epoch 107/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7707 - accuracy:
0.8504 - Recall: 0.8080 - Precision: 0.8808 - AUC: 0.9682
Epoch 107: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 45ms/step - loss: 0.7676 - accuracy:
0.8522 - Recall: 0.8109 - Precision: 0.8839 - AUC: 0.9687 - val_loss: 2.9015 -
val_accuracy: 0.3750 - val_Recall: 0.3490 - val_Precision: 0.3764 - val_AUC:
0.6365
Epoch 108/150
15/15 [==============================] - ETA: 0s - loss: 0.7059 - accuracy:
0.8587 - Recall: 0.8174 - Precision: 0.8826 - AUC: 0.9771
Epoch 108: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 49ms/step - loss: 0.7059 - accuracy:
0.8587 - Recall: 0.8174 - Precision: 0.8826 - AUC: 0.9771 - val_loss: 2.8764 -
val_accuracy: 0.3646 - val_Recall: 0.3594 - val_Precision: 0.3750 - val_AUC:
0.6556
Epoch 109/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7084 - accuracy:
0.8616 - Recall: 0.8259 - Precision: 0.8831 - AUC: 0.9766
Epoch 109: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 55ms/step - loss: 0.7110 - accuracy:
```

```
0.8609 - Recall: 0.8239 - Precision: 0.8834 - AUC: 0.9763 - val_loss: 3.0106 -
val_accuracy: 0.3490 - val_Recall: 0.3333 - val_Precision: 0.3575 - val_AUC:
0.6390
Epoch 110/150
15/15 [==============================] - ETA: 0s - loss: 0.7204 - accuracy:
0.8435 - Recall: 0.8065 - Precision: 0.8668 - AUC: 0.9747
Epoch 110: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 56ms/step - loss: 0.7204 - accuracy:
0.8435 - Recall: 0.8065 - Precision: 0.8668 - AUC: 0.9747 - val_loss: 2.6747 -
val_accuracy: 0.4010 - val_Recall: 0.3802 - val_Precision: 0.4033 - val_AUC:
0.6783
Epoch 111/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7226 - accuracy:
0.8460 - Recall: 0.8281 - Precision: 0.8668 - AUC: 0.9746
Epoch 111: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 55ms/step - loss: 0.7280 - accuracy:
0.8457 - Recall: 0.8261 - Precision: 0.8676 - AUC: 0.9737 - val_loss: 2.7979 -
val_accuracy: 0.3750 - val_Recall: 0.3594 - val_Precision: 0.3833 - val_AUC:
0.6649
Epoch 112/150
15/15 [==============================] - ETA: 0s - loss: 0.7303 - accuracy:
0.8413 - Recall: 0.8152 - Precision: 0.8661 - AUC: 0.9730
Epoch 112: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 58ms/step - loss: 0.7303 - accuracy:
0.8413 - Recall: 0.8152 - Precision: 0.8661 - AUC: 0.9730 - val_loss: 2.8239 -
val_accuracy: 0.3646 - val_Recall: 0.3594 - val_Precision: 0.3730 - val_AUC:
0.6648
Epoch 113/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6719 - accuracy:
0.8772 - Recall: 0.8504 - Precision: 0.9050 - AUC: 0.9813
Epoch 113: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 55ms/step - loss: 0.6863 - accuracy:
0.8717 - Recall: 0.8435 - Precision: 0.8981 - AUC: 0.9794 - val_loss: 2.9473 -
val_accuracy: 0.3698 - val_Recall: 0.3438 - val_Precision: 0.3646 - val_AUC:
0.6386
Epoch 114/150
15/15 [==============================] - ETA: 0s - loss: 0.7150 - accuracy:
0.8587 - Recall: 0.8239 - Precision: 0.8814 - AUC: 0.9758
Epoch 114: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 51ms/step - loss: 0.7150 - accuracy:
0.8587 - Recall: 0.8239 - Precision: 0.8814 - AUC: 0.9758 - val_loss: 2.9639 -
val_accuracy: 0.3698 - val_Recall: 0.3385 - val_Precision: 0.3631 - val_AUC:
0.6439
Epoch 115/150
14/15 [===========================>..] - ETA: 0s - loss: 0.7180 - accuracy:
0.8549 - Recall: 0.8170 - Precision: 0.8819 - AUC: 0.9743
Epoch 115: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 51ms/step - loss: 0.7266 - accuracy:
```

```
0.8478 - Recall: 0.8109 - Precision: 0.8735 - AUC: 0.9730 - val_loss: 2.7018 -
val_accuracy: 0.3906 - val_Recall: 0.3490 - val_Precision: 0.3807 - val_AUC:
0.6687
Epoch 116/150
14/15 [============================>..] - ETA: 0s - loss: 0.7219 - accuracy:
0.8549 - Recall: 0.8304 - Precision: 0.8753 - AUC: 0.9743
Epoch 116: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 54ms/step - loss: 0.7154 - accuracy:
0.8587 - Recall: 0.8348 - Precision: 0.8787 - AUC: 0.9752 - val_loss: 2.7229 -
val_accuracy: 0.3906 - val_Recall: 0.3646 - val_Precision: 0.3933 - val_AUC:
0.6719
Epoch 117/150
14/15 [============================>..] - ETA: 0s - loss: 0.6928 - accuracy:
0.8705 - Recall: 0.8460 - Precision: 0.8960 - AUC: 0.9781
Epoch 117: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 54ms/step - loss: 0.6914 - accuracy:
0.8717 - Recall: 0.8478 - Precision: 0.8966 - AUC: 0.9782 - val_loss: 2.6919 -
val_accuracy: 0.3906 - val_Recall: 0.3646 - val_Precision: 0.3911 - val_AUC:
0.6758
Epoch 118/150
15/15 [==============================] - ETA: 0s - loss: 0.6609 - accuracy:
0.8761 - Recall: 0.8565 - Precision: 0.9037 - AUC: 0.9830
Epoch 118: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 53ms/step - loss: 0.6609 - accuracy:
0.8761 - Recall: 0.8565 - Precision: 0.9037 - AUC: 0.9830 - val_loss: 2.7631 -
val_accuracy: 0.3906 - val_Recall: 0.3646 - val_Precision: 0.3867 - val_AUC:
0.6677
Epoch 119/150
14/15 [============================>..] - ETA: 0s - loss: 0.7132 - accuracy:
0.8638 - Recall: 0.8304 - Precision: 0.8815 - AUC: 0.9737
Epoch 119: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 57ms/step - loss: 0.7169 - accuracy:
0.8630 - Recall: 0.8283 - Precision: 0.8799 - AUC: 0.9733 - val_loss: 2.9408 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3764 - val_AUC:
0.6422
Epoch 120/150
15/15 [==============================] - ETA: 0s - loss: 0.6549 - accuracy:
0.8891 - Recall: 0.8674 - Precision: 0.9110 - AUC: 0.9827
Epoch 120: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 55ms/step - loss: 0.6549 - accuracy:
0.8891 - Recall: 0.8674 - Precision: 0.9110 - AUC: 0.9827 - val_loss: 2.8885 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3722 - val_AUC:
0.6569
Epoch 121/150
14/15 [============================>..] - ETA: 0s - loss: 0.6964 - accuracy:
0.8683 - Recall: 0.8371 - Precision: 0.8886 - AUC: 0.9774
Epoch 121: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 60ms/step - loss: 0.6962 - accuracy:
```

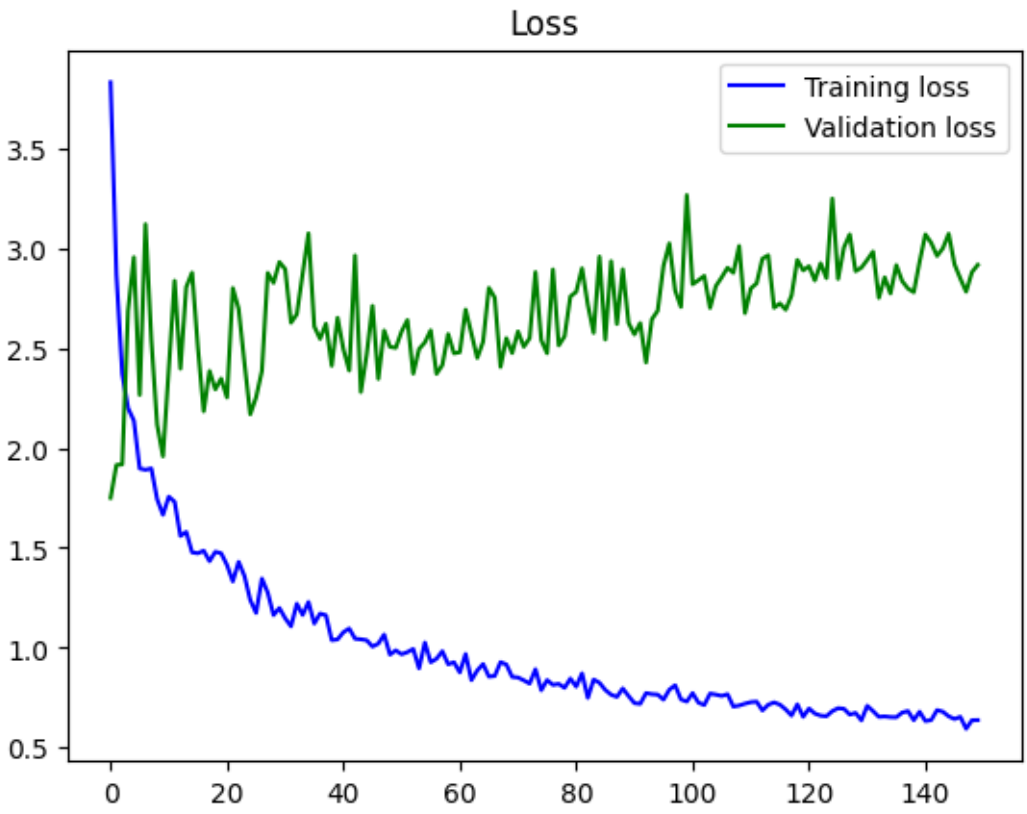
```
0.8674 - Recall: 0.8370 - Precision: 0.8871 - AUC: 0.9775 - val_loss: 2.9095 -
val_accuracy: 0.3594 - val_Recall: 0.3438 - val_Precision: 0.3687 - val_AUC:
0.6552
Epoch 122/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6681 - accuracy:
0.8795 - Recall: 0.8460 - Precision: 0.9002 - AUC: 0.9812
Epoch 122: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 61ms/step - loss: 0.6708 - accuracy:
0.8804 - Recall: 0.8478 - Precision: 0.9007 - AUC: 0.9806 - val_loss: 2.8381 -
val_accuracy: 0.3802 - val_Recall: 0.3698 - val_Precision: 0.3880 - val_AUC:
0.6629
Epoch 123/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6536 - accuracy:
0.8728 - Recall: 0.8527 - Precision: 0.8884 - AUC: 0.9827
Epoch 123: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 57ms/step - loss: 0.6603 - accuracy:
0.8696 - Recall: 0.8500 - Precision: 0.8846 - AUC: 0.9818 - val_loss: 2.9241 -
val_accuracy: 0.3750 - val_Recall: 0.3646 - val_Precision: 0.3763 - val_AUC:
0.6674
Epoch 124/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6591 - accuracy:
0.8705 - Recall: 0.8438 - Precision: 0.8936 - AUC: 0.9824
Epoch 124: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 57ms/step - loss: 0.6577 - accuracy:
0.8717 - Recall: 0.8457 - Precision: 0.8943 - AUC: 0.9825 - val_loss: 2.8494 -
val_accuracy: 0.3698 - val_Recall: 0.3542 - val_Precision: 0.3757 - val_AUC:
0.6664
Epoch 125/150
15/15 [==============================] - ETA: 0s - loss: 0.6829 - accuracy:
0.8783 - Recall: 0.8457 - Precision: 0.8922 - AUC: 0.9779
Epoch 125: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 52ms/step - loss: 0.6829 - accuracy:
0.8783 - Recall: 0.8457 - Precision: 0.8922 - AUC: 0.9779 - val_loss: 3.2480 -
val_accuracy: 0.3646 - val_Recall: 0.3490 - val_Precision: 0.3661 - val_AUC:
0.6271
Epoch 126/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6937 - accuracy:
0.8839 - Recall: 0.8594 - Precision: 0.9102 - AUC: 0.9771
Epoch 126: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 57ms/step - loss: 0.6976 - accuracy:
0.8848 - Recall: 0.8587 - Precision: 0.9101 - AUC: 0.9762 - val_loss: 2.8458 -
val_accuracy: 0.3958 - val_Recall: 0.3698 - val_Precision: 0.3859 - val_AUC:
0.6735
Epoch 127/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6818 - accuracy:
0.8594 - Recall: 0.8348 - Precision: 0.8842 - AUC: 0.9794
Epoch 127: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 52ms/step - loss: 0.6948 - accuracy:
```

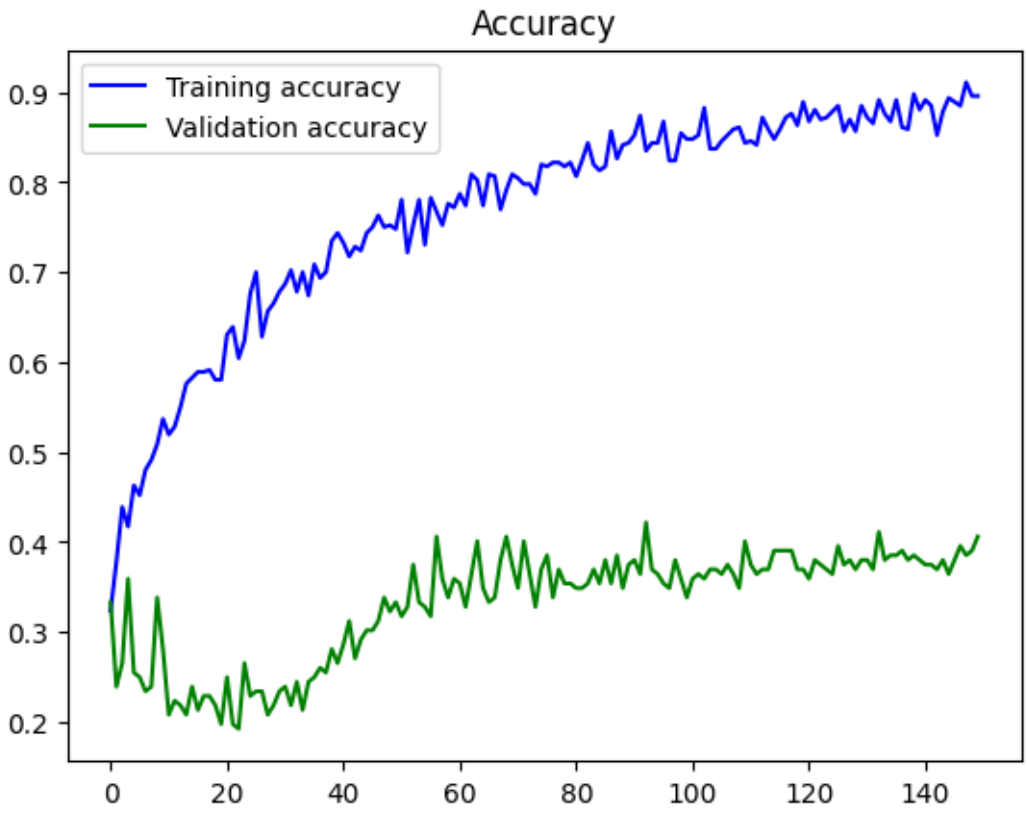
```
0.8565 - Recall: 0.8326 - Precision: 0.8845 - AUC: 0.9770 - val_loss: 3.0031 -
val_accuracy: 0.3750 - val_Recall: 0.3542 - val_Precision: 0.3736 - val_AUC:
0.6382
Epoch 128/150
14/15 [==========================>..] - ETA: 0s - loss: 0.6667 - accuracy:
0.8705 - Recall: 0.8438 - Precision: 0.9087 - AUC: 0.9812
Epoch 128: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 52ms/step - loss: 0.6658 - accuracy:
0.8696 - Recall: 0.8435 - Precision: 0.9065 - AUC: 0.9813 - val_loss: 3.0686 -
val_accuracy: 0.3802 - val_Recall: 0.3490 - val_Precision: 0.3661 - val_AUC:
0.6336
Epoch 129/150
15/15 [==============================] - ETA: 0s - loss: 0.6740 - accuracy:
0.8565 - Recall: 0.8304 - Precision: 0.8843 - AUC: 0.9809
Epoch 129: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 55ms/step - loss: 0.6740 - accuracy:
0.8565 - Recall: 0.8304 - Precision: 0.8843 - AUC: 0.9809 - val_loss: 2.8847 -
val_accuracy: 0.3698 - val_Recall: 0.3542 - val_Precision: 0.3757 - val_AUC:
0.6648
Epoch 130/150
15/15 [==============================] - ETA: 0s - loss: 0.6367 - accuracy:
0.8848 - Recall: 0.8587 - Precision: 0.9101 - AUC: 0.9854
Epoch 130: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 54ms/step - loss: 0.6367 - accuracy:
0.8848 - Recall: 0.8587 - Precision: 0.9101 - AUC: 0.9854 - val_loss: 2.9020 -
val_accuracy: 0.3802 - val_Recall: 0.3490 - val_Precision: 0.3743 - val_AUC:
0.6584
Epoch 131/150
15/15 [==============================] - ETA: 0s - loss: 0.7096 - accuracy:
0.8717 - Recall: 0.8500 - Precision: 0.8907 - AUC: 0.9753
Epoch 131: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 54ms/step - loss: 0.7096 - accuracy:
0.8717 - Recall: 0.8500 - Precision: 0.8907 - AUC: 0.9753 - val_loss: 2.9408 -
val_accuracy: 0.3802 - val_Recall: 0.3542 - val_Precision: 0.3778 - val_AUC:
0.6451
Epoch 132/150
14/15 [==========================>..] - ETA: 0s - loss: 0.6886 - accuracy:
0.8638 - Recall: 0.8415 - Precision: 0.8934 - AUC: 0.9776
Epoch 132: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 51ms/step - loss: 0.6834 - accuracy:
0.8652 - Recall: 0.8435 - Precision: 0.8961 - AUC: 0.9783 - val_loss: 2.9823 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3702 - val_AUC:
0.6493
Epoch 133/150
14/15 [==========================>..] - ETA: 0s - loss: 0.6482 - accuracy:
0.8973 - Recall: 0.8772 - Precision: 0.9161 - AUC: 0.9831
Epoch 133: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 51ms/step - loss: 0.6545 - accuracy:
```

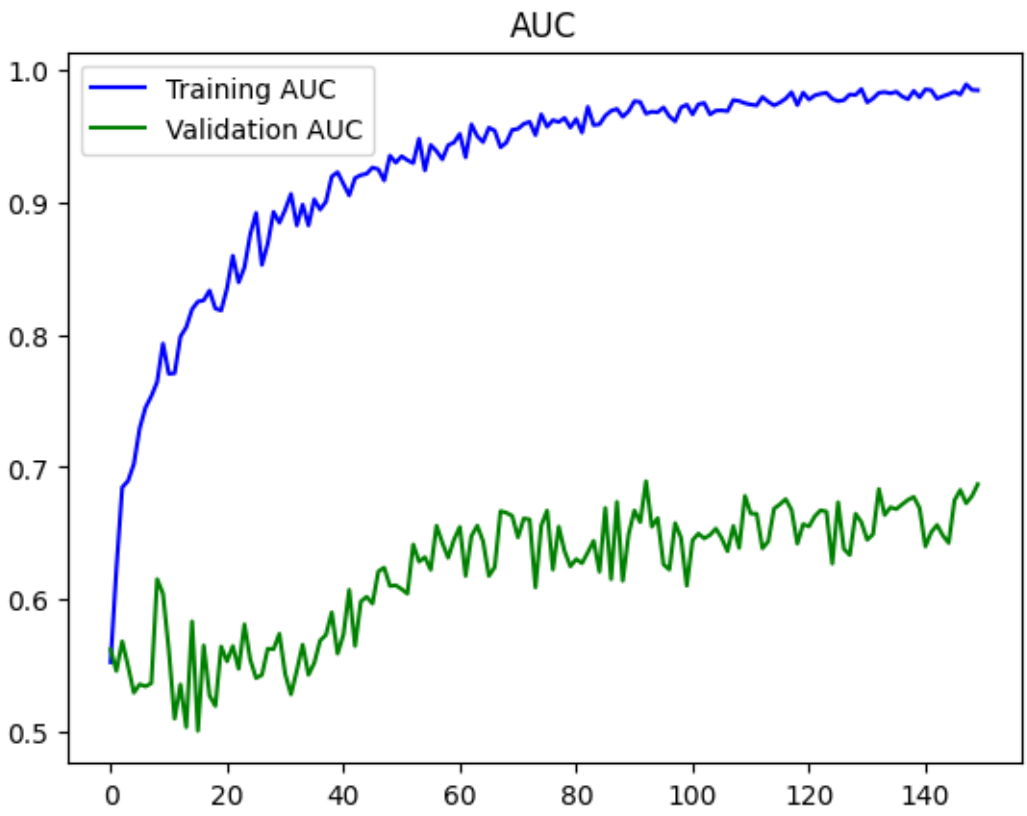
```
0.8913 - Recall: 0.8717 - Precision: 0.9114 - AUC: 0.9825 - val_loss: 2.7508 -
val_accuracy: 0.4115 - val_Recall: 0.3802 - val_Precision: 0.4011 - val_AUC:
0.6836
Epoch 134/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6592 - accuracy:
0.8750 - Recall: 0.8594 - Precision: 0.8995 - AUC: 0.9827
Epoch 134: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 36ms/step - loss: 0.6564 - accuracy:
0.8761 - Recall: 0.8609 - Precision: 0.9021 - AUC: 0.9831 - val_loss: 2.8538 -
val_accuracy: 0.3802 - val_Recall: 0.3490 - val_Precision: 0.3743 - val_AUC:
0.6638
Epoch 135/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6524 - accuracy:
0.8661 - Recall: 0.8504 - Precision: 0.8986 - AUC: 0.9821
Epoch 135: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 41ms/step - loss: 0.6533 - accuracy:
0.8674 - Recall: 0.8500 - Precision: 0.8989 - AUC: 0.9821 - val_loss: 2.7728 -
val_accuracy: 0.3854 - val_Recall: 0.3490 - val_Precision: 0.3743 - val_AUC:
0.6697
Epoch 136/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6562 - accuracy:
0.8884 - Recall: 0.8571 - Precision: 0.9035 - AUC: 0.9828
Epoch 136: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 74ms/step - loss: 0.6524 - accuracy:
0.8913 - Recall: 0.8587 - Precision: 0.9060 - AUC: 0.9833 - val_loss: 2.9149 -
val_accuracy: 0.3854 - val_Recall: 0.3698 - val_Precision: 0.3923 - val_AUC:
0.6683
Epoch 137/150
15/15 [==============================] - ETA: 0s - loss: 0.6757 - accuracy:
0.8609 - Recall: 0.8326 - Precision: 0.8784 - AUC: 0.9798
Epoch 137: val_accuracy did not improve from 0.42188
15/15 [==============================] - 2s 170ms/step - loss: 0.6757 -
accuracy: 0.8609 - Recall: 0.8326 - Precision: 0.8784 - AUC: 0.9798 - val_loss:
2.8352 - val_accuracy: 0.3906 - val_Recall: 0.3750 - val_Precision: 0.3913 -
val_AUC: 0.6719
Epoch 138/150
15/15 [==============================] - ETA: 0s - loss: 0.6834 - accuracy:
0.8587 - Recall: 0.8348 - Precision: 0.8787 - AUC: 0.9777
Epoch 138: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 101ms/step - loss: 0.6834 -
accuracy: 0.8587 - Recall: 0.8348 - Precision: 0.8787 - AUC: 0.9777 - val_loss:
2.7978 - val_accuracy: 0.3802 - val_Recall: 0.3646 - val_Precision: 0.3911 -
val_AUC: 0.6752
Epoch 139/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6354 - accuracy:
0.8996 - Recall: 0.8661 - Precision: 0.9216 - AUC: 0.9843
Epoch 139: val_accuracy did not improve from 0.42188
15/15 [==============================] - 2s 147ms/step - loss: 0.6378 -
```

```
accuracy: 0.8978 - Recall: 0.8652 - Precision: 0.9213 - AUC: 0.9840 - val_loss:
2.7793 - val_accuracy: 0.3854 - val_Recall: 0.3646 - val_Precision: 0.3911 -
val_AUC: 0.6775
Epoch 140/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6846 - accuracy:
0.8795 - Recall: 0.8482 - Precision: 0.8879 - AUC: 0.9785
Epoch 140: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 99ms/step - loss: 0.6800 - accuracy:
0.8804 - Recall: 0.8500 - Precision: 0.8886 - AUC: 0.9791 - val_loss: 2.9315 -
val_accuracy: 0.3802 - val_Recall: 0.3698 - val_Precision: 0.3859 - val_AUC:
0.6690
Epoch 141/150
15/15 [==============================] - ETA: 0s - loss: 0.6334 - accuracy:
0.8913 - Recall: 0.8674 - Precision: 0.9089 - AUC: 0.9851
Epoch 141: val_accuracy did not improve from 0.42188
15/15 [==============================] - 2s 159ms/step - loss: 0.6334 -
accuracy: 0.8913 - Recall: 0.8674 - Precision: 0.9089 - AUC: 0.9851 - val_loss:
3.0686 - val_accuracy: 0.3750 - val_Recall: 0.3594 - val_Precision: 0.3770 -
val_AUC: 0.6401
Epoch 142/150
15/15 [==============================] - ETA: 0s - loss: 0.6383 - accuracy:
0.8848 - Recall: 0.8674 - Precision: 0.9110 - AUC: 0.9845
Epoch 142: val_accuracy did not improve from 0.42188
15/15 [==============================] - 2s 114ms/step - loss: 0.6383 -
accuracy: 0.8848 - Recall: 0.8674 - Precision: 0.9110 - AUC: 0.9845 - val_loss:
3.0259 - val_accuracy: 0.3750 - val_Recall: 0.3542 - val_Precision: 0.3778 -
val_AUC: 0.6508
Epoch 143/150
14/15 [===========================>..] - ETA: 0s - loss: 0.6875 - accuracy:
0.8527 - Recall: 0.8304 - Precision: 0.8836 - AUC: 0.9782
Epoch 143: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 64ms/step - loss: 0.6882 - accuracy:
0.8522 - Recall: 0.8283 - Precision: 0.8819 - AUC: 0.9781 - val_loss: 2.9609 -
val_accuracy: 0.3698 - val_Recall: 0.3490 - val_Precision: 0.3722 - val_AUC:
0.6563
Epoch 144/150
15/15 [==============================] - ETA: 0s - loss: 0.6800 - accuracy:
0.8783 - Recall: 0.8457 - Precision: 0.8984 - AUC: 0.9799
Epoch 144: val_accuracy did not improve from 0.42188
15/15 [==============================] - 0s 34ms/step - loss: 0.6800 - accuracy:
0.8783 - Recall: 0.8457 - Precision: 0.8984 - AUC: 0.9799 - val_loss: 2.9990 -
val_accuracy: 0.3802 - val_Recall: 0.3594 - val_Precision: 0.3730 - val_AUC:
0.6484
Epoch 145/150
15/15 [==============================] - ETA: 0s - loss: 0.6570 - accuracy:
0.8935 - Recall: 0.8674 - Precision: 0.9068 - AUC: 0.9815
Epoch 145: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 47ms/step - loss: 0.6570 - accuracy:
```

```
0.8935 - Recall: 0.8674 - Precision: 0.9068 - AUC: 0.9815 - val_loss: 3.0718 -
val_accuracy: 0.3646 - val_Recall: 0.3490 - val_Precision: 0.3722 - val_AUC:
0.6428
Epoch 146/150
14/15 [==========================>..] - ETA: 0s - loss: 0.6492 - accuracy:
0.8862 - Recall: 0.8661 - Precision: 0.9087 - AUC: 0.9828
Epoch 146: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 50ms/step - loss: 0.6436 - accuracy:
0.8891 - Recall: 0.8696 - Precision: 0.9112 - AUC: 0.9834 - val_loss: 2.9190 -
val_accuracy: 0.3802 - val_Recall: 0.3698 - val_Precision: 0.3817 - val_AUC:
0.6750
Epoch 147/150
14/15 [==========================>..] - ETA: 0s - loss: 0.6584 - accuracy:
0.8839 - Recall: 0.8638 - Precision: 0.8938 - AUC: 0.9808
Epoch 147: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 42ms/step - loss: 0.6545 - accuracy:
0.8848 - Recall: 0.8652 - Precision: 0.8944 - AUC: 0.9812 - val_loss: 2.8479 -
val_accuracy: 0.3958 - val_Recall: 0.3802 - val_Precision: 0.3989 - val_AUC:
0.6828
Epoch 148/150
15/15 [==============================] - ETA: 0s - loss: 0.5947 - accuracy:
0.9109 - Recall: 0.8826 - Precision: 0.9312 - AUC: 0.9890
Epoch 148: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 45ms/step - loss: 0.5947 - accuracy:
0.9109 - Recall: 0.8826 - Precision: 0.9312 - AUC: 0.9890 - val_loss: 2.7819 -
val_accuracy: 0.3854 - val_Recall: 0.3698 - val_Precision: 0.3989 - val_AUC:
0.6727
Epoch 149/150
15/15 [==============================] - ETA: 0s - loss: 0.6374 - accuracy:
0.8957 - Recall: 0.8696 - Precision: 0.9112 - AUC: 0.9847
Epoch 149: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 48ms/step - loss: 0.6374 - accuracy:
0.8957 - Recall: 0.8696 - Precision: 0.9112 - AUC: 0.9847 - val_loss: 2.8796 -
val_accuracy: 0.3906 - val_Recall: 0.3750 - val_Precision: 0.3892 - val_AUC:
0.6781
Epoch 150/150
15/15 [==============================] - ETA: 0s - loss: 0.6381 - accuracy:
0.8957 - Recall: 0.8783 - Precision: 0.9120 - AUC: 0.9845
Epoch 150: val_accuracy did not improve from 0.42188
15/15 [==============================] - 1s 47ms/step - loss: 0.6381 - accuracy:
0.8957 - Recall: 0.8783 - Precision: 0.9120 - AUC: 0.9845 - val_loss: 2.9162 -
val_accuracy: 0.4062 - val_Recall: 0.3906 - val_Precision: 0.4098 - val_AUC:
0.6871
```


Loss
Training loss
Validation loss
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
20
40
60
80
100
120
140


Accuracy
Training accuracy
Validation accuracy
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0
20
40
60
80
100
120
140



[14]:
```
train_y
```

[14]:
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2.])
```

[ ]: