

```
In [1]: #!unzip dank_data-master.zip  
#!pip install tensorflow_addons  
#!wget http://nlp.stanford.edu/data/glove.6B.zip  
#!unzip glove*.zip
```

```
In [2]: import glob  
import pandas as pd  
import warnings  
warnings.filterwarnings("ignore")  
from tensorflow.keras.preprocessing.image import ImageDataGenerator  
from tensorflow.keras.layers import Dense, Input, Conv2D, MaxPool2D, Activation, Dropout, Flatten, Embedding, LSTM, concatenate  
from tensorflow.keras.models import Model  
import tensorflow as tf  
import logging  
import numpy as np  
import tensorflow_addons as tfa  
from tensorflow.keras.preprocessing.text import Tokenizer  
from sklearn.preprocessing import LabelEncoder  
from sklearn.preprocessing import StandardScaler  
from tensorflow.keras.applications.vgg19 import VGG19  
from tensorflow.keras.applications.vgg19 import preprocess_input  
from tensorflow.keras.callbacks import LearningRateScheduler  
from tensorflow.keras.callbacks import ReduceLROnPlateau  
from tensorflow.keras.callbacks import ModelCheckpoint  
from tensorflow.keras.callbacks import EarlyStopping  
from sklearn.metrics import confusion_matrix, accuracy_score, f1_score  
import seaborn as sns  
import matplotlib.pyplot as plt
```

```
In [3]: training='/content/dank_data-master/data/training/*'  
test='/content/dank_data-master/data/test/*'  
validation='/content/dank_data-master/data/validation/*'
```

```
In [4]: training = glob.glob(training)  
test = glob.glob(test)  
validation = glob.glob(validation)
```

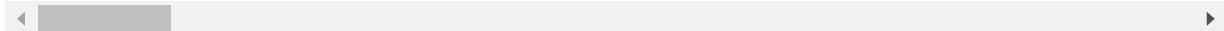
```
In [5]: final_dank=pd.read_csv('/content/dank_data-master/data/final_dank.csv')  
train_labels = [fn.split('/')[-1].split('.')[0].strip() for fn in training]  
validation_labels = [fn.split('/')[-1].split('.')[0].strip() for fn in validation]  
test_labels = [fn.split('/')[-1].split('.')[0].strip() for fn in test]
```

```
In [6]: for labels in train_labels:
    if labels==train_labels[0]:
        train_data =final_dank[final_dank['id']==labels]
    else :
        train_data =train_data.append(final_dank[final_dank['id']==labels],sort=False)
for labels in validation_labels:
    if labels==validation_labels[0]:
        val_data =final_dank[final_dank['id']==labels]
    else :
        val_data =val_data.append(final_dank[final_dank['id']==labels],sort=False)
for labels in test_labels:
    if labels==test_labels[0]:
        test_data =final_dank[final_dank['id']==labels]
    else :
        test_data =test_data.append(final_dank[final_dank['id']==labels],sort=False)
print(train_data.shape)
print(test_data.shape)
print(val_data.shape)
train_data.head(5)
```

(3405, 68)
(1719, 68)
(1688, 68)

Out[6]:

	Unnamed: 0	level_0	index	author	awards	processed_words	created_utc
53606	96606	1118.0	32771.0	SwiftScout4	[]	['dowk']	1.584914e+09
35469	61068	63931.0	63931.0	Captain_Trisl	[]	['boy', 'hang', 'quarantine', 'orona', 'extra']	1.584168e+09
11453	25253	26477.0	26477.0	Kenmoops	[]	['vehe', 'believ', 'lie', 'girl']	1.584383e+09
53276	96125	621.0	32274.0	fantastich_freidrich	[]	['human', 'come', 'futuretim', 'travel', 'trap...']	1.584917e+09
65568	129029	4832.0	66485.0	YashSSJB1	[]	['centr', 'attractionm', 'show', 'fulli', 'bui...']	1.584688e+09



```
In [7]: def file_extension(x):
    return x+".jpg"
train_data['id'] = train_data['id'].apply(file_extension)
val_data['id'] = val_data['id'].apply(file_extension)
test_data['id'] = test_data['id'].apply(file_extension)
```

```
In [8]: def numeric_to_string(x):
    if (x==1.0):
        return 'Not_dank'
    elif (x==0.0):
        return 'Dank'
train_data['dank_level_new'] = train_data['dank_level'].apply(numeric_to_string)
val_data['dank_level_new'] = val_data['dank_level'].apply(numeric_to_string)
test_data['dank_level_new'] = test_data['dank_level'].apply(numeric_to_string)
```

```
In [9]:  
logger = logging.getLogger()  
logger.disabled = False  
train_datagen = ImageDataGenerator(zoom_range=0.3, rotation_range=50,  
                                     width_shift_range=0.2, height_shift_range=  
                                     0.2, shear_range=0.2,  
                                     horizontal_flip=True, fill_mode='nearest')  
train_generator = train_datagen.flow_from_dataframe(  
    dataframe=train_data,  
    directory="/content/dank_data-master/data/training/",  
    x_col="id",  
    y_col="dank_level_new",  
    subset="training",  
    batch_size=30,  
    seed=42,  
    class_mode="binary",  
    target_size=(156,156))  
predict_datagen = ImageDataGenerator(preprocessing_function=preprocess_input  
)  
train_prediction_generator = predict_datagen.flow_from_dataframe(  
    dataframe=train_data,  
    directory="/content/dank_data-master/data/training/",  
    x_col="id",  
    y_col="dank_level_new",  
    batch_size=30,  
    seed=42,  
    class_mode="binary",  
    shuffle=False,  
    target_size=(156,156))  
validation_prediction_generator = predict_datagen.flow_from_dataframe(  
    dataframe=val_data,  
    directory="/content/dank_data-master/data/validation/",  
    x_col="id",  
    y_col="dank_level_new",  
    batch_size=30,  
    seed=42,  
    shuffle=False,  
    class_mode="binary",  
    target_size=(156,156))  
test_prediction_generator = predict_datagen.flow_from_dataframe(  
    dataframe=test_data,  
    directory="/content/dank_data-master/data/test/",  
    x_col="id",  
    y_col="dank_level_new",  
    batch_size=30,  
    seed=42,  
    shuffle=False,  
    class_mode="binary",  
    target_size=(156,156))
```

Found 3405 validated image filenames belonging to 2 classes.
Found 3405 validated image filenames belonging to 2 classes.
Found 1688 validated image filenames belonging to 2 classes.
Found 1719 validated image filenames belonging to 2 classes.

```
In [10]: IMAGE_SIZE = [156,156]
vgg19 = VGG19(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)
```

Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg19/vgg19_weights_tf_dim_ordering_tf_kernels_notop.h5
80142336/80134624 [=====] - 0s 0us/step

```
In [11]: for layer in vgg19.layers[:16]:
    layer.trainable = False
```

```
In [12]: #Flatten
flatten = Flatten(data_format='channels_last',name='Flatten')(vgg19.output)

#FC Layer
FC1 = Dense(units=512,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=32),name='FC1')(flatten)
x = Dropout(0.3)(FC1)
#FC Layer
FC2 = Dense(units=256,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33),name='FC2')(x)
x = Dropout(0.3)(FC2)
#FC Layer
FC3 = Dense(units=128,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33),name='FC3')(x)
x = Dropout(0.3)(FC3)
#FC Layer
FC4 = Dense(units=64,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33),name='FC4')(x)
x = Dropout(0.3)(FC4)

#output Layer
Out = Dense(units=1,activation='sigmoid',kernel_initializer=tf.keras.initializers.glorot_normal(seed=3),name='Output')(x)

model = Model(inputs=vgg19.input, outputs=Out)
model.summary()
```

Model: "model"

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	[(None, 156, 156, 3)]	0
block1_conv1 (Conv2D)	(None, 156, 156, 64)	1792
block1_conv2 (Conv2D)	(None, 156, 156, 64)	36928
block1_pool (MaxPooling2D)	(None, 78, 78, 64)	0
block2_conv1 (Conv2D)	(None, 78, 78, 128)	73856
block2_conv2 (Conv2D)	(None, 78, 78, 128)	147584
block2_pool (MaxPooling2D)	(None, 39, 39, 128)	0
block3_conv1 (Conv2D)	(None, 39, 39, 256)	295168
block3_conv2 (Conv2D)	(None, 39, 39, 256)	590080
block3_conv3 (Conv2D)	(None, 39, 39, 256)	590080
block3_conv4 (Conv2D)	(None, 39, 39, 256)	590080
block3_pool (MaxPooling2D)	(None, 19, 19, 256)	0
block4_conv1 (Conv2D)	(None, 19, 19, 512)	1180160
block4_conv2 (Conv2D)	(None, 19, 19, 512)	2359808
block4_conv3 (Conv2D)	(None, 19, 19, 512)	2359808
block4_conv4 (Conv2D)	(None, 19, 19, 512)	2359808
block4_pool (MaxPooling2D)	(None, 9, 9, 512)	0
block5_conv1 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv2 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv3 (Conv2D)	(None, 9, 9, 512)	2359808
block5_conv4 (Conv2D)	(None, 9, 9, 512)	2359808
block5_pool (MaxPooling2D)	(None, 4, 4, 512)	0
Flatten (Flatten)	(None, 8192)	0
FC1 (Dense)	(None, 512)	4194816
dropout (Dropout)	(None, 512)	0
FC2 (Dense)	(None, 256)	131328
dropout_1 (Dropout)	(None, 256)	0

FC3 (Dense)	(None, 128)	32896
dropout_2 (Dropout)	(None, 128)	0
FC4 (Dense)	(None, 64)	8256
dropout_3 (Dropout)	(None, 64)	0
Output (Dense)	(None, 1)	65
<hr/>		
Total params: 24,391,745		
Trainable params: 13,806,593		
Non-trainable params: 10,585,152		

```
In [13]: def scheduler(epoch,lr):
    if((epoch+1)%3==0):
        lr=lr*0.95
        return lr
    else:
        return lr
```

```
In [14]: filepath="model_save/weights-{epoch:02d}-{val_accuracy:.4f}.h5"
checkpoint = ModelCheckpoint(filepath=filepath, monitor='val_accuracy', mode='auto')

lrschedule = tf.keras.callbacks.LearningRateScheduler(scheduler,verbose=0.1)

#stop the training if your validation accuracy is not increased in last 2 epochs.
early_stop= EarlyStopping(monitor='val_accuracy', patience=3,verbose=1)

#If your validation accuracy at that epoch is less than previous epoch accuracy, you have to decrease the
#Learning rate by 10%
reduce_lr = ReduceLROnPlateau(monitor='val_accuracy', factor=0.75,
                             patience=3, min_lr=0.001,verbose=1)

model.compile(
    loss='binary_crossentropy',
    optimizer=tf.keras.optimizers.RMSprop(lr=1e-5),
    metrics=[ 'accuracy',tf.keras.metrics.Precision(),tf.keras.metrics.Recall(),tf.keras.metrics.F1Score(num_classes=1)]
)
```

```
In [15]: history=model.fit_generator(train_generator,steps_per_epoch=len(train_generator),epochs=50,validation_data=test_prediction_generator,validation_steps=len(test_prediction_generator),use_multiprocessing=False,workers=12,callbacks=[lrschedule,checkpoint,reduce_lr])
```

Epoch 1/50

Epoch 00001: LearningRateScheduler reducing learning rate to 9.9999974737875
2e-06.

114/114 [=====] - 135s 853ms/step - loss: 3.6040 - accuracy: 0.4894 - precision: 0.4835 - recall: 0.5506 - f1_score: 0.6585 - val_loss: 0.8417 - val_accuracy: 0.4933 - val_precision: 0.4799 - val_recall: 0.5752 - val_f1_score: 0.6518

Epoch 2/50

Epoch 00002: LearningRateScheduler reducing learning rate to 9.9999974737875
2e-06.

114/114 [=====] - 96s 789ms/step - loss: 0.8700 - accuracy: 0.5080 - precision: 0.4994 - recall: 0.5149 - f1_score: 0.6587 - val_loss: 0.7078 - val_accuracy: 0.5090 - val_precision: 0.4937 - val_recall: 0.6113 - val_f1_score: 0.6518

Epoch 3/50

Epoch 00003: LearningRateScheduler reducing learning rate to 9.4999976000981
3e-06.

114/114 [=====] - 94s 779ms/step - loss: 0.7044 - accuracy: 0.5134 - precision: 0.5070 - recall: 0.5182 - f1_score: 0.6606 - val_loss: 0.6978 - val_accuracy: 0.5067 - val_precision: 0.4901 - val_recall: 0.5078 - val_f1_score: 0.6518

Epoch 4/50

Epoch 00004: LearningRateScheduler reducing learning rate to 9.4999957811087
4e-06.

114/114 [=====] - 95s 787ms/step - loss: 0.6994 - accuracy: 0.4834 - precision: 0.4763 - recall: 0.2949 - f1_score: 0.6675 - val_loss: 0.6974 - val_accuracy: 0.5096 - val_precision: 0.4907 - val_recall: 0.3815 - val_f1_score: 0.6518

Epoch 5/50

Epoch 00005: LearningRateScheduler reducing learning rate to 9.4999957811087
4e-06.

114/114 [=====] - 93s 765ms/step - loss: 0.6972 - accuracy: 0.5171 - precision: 0.5101 - recall: 0.2913 - f1_score: 0.6569 - val_loss: 0.6957 - val_accuracy: 0.4968 - val_precision: 0.4678 - val_recall: 0.2972 - val_f1_score: 0.6518

Epoch 6/50

Epoch 00006: LearningRateScheduler reducing learning rate to 9.02499959920533
e-06.

114/114 [=====] - 95s 784ms/step - loss: 0.6942 - accuracy: 0.4850 - precision: 0.4418 - recall: 0.1585 - f1_score: 0.6611 - val_loss: 0.6967 - val_accuracy: 0.4852 - val_precision: 0.4338 - val_recall: 0.2130 - val_f1_score: 0.6518

Epoch 7/50

Epoch 00007: LearningRateScheduler reducing learning rate to 9.02499959920533
e-06.

114/114 [=====] - 96s 775ms/step - loss: 0.6946 - accuracy: 0.5001 - precision: 0.4775 - recall: 0.1480 - f1_score: 0.6598 - val_loss: 0.6951 - val_accuracy: 0.4904 - val_precision: 0.4501 - val_recall: 0.2443 - val_f1_score: 0.6518

Epoch 8/50

Epoch 00008: LearningRateScheduler reducing learning rate to 9.02499959920533e-06.
114/114 [=====] - 97s 783ms/step - loss: 0.6944 - accuracy: 0.5176 - precision: 0.5121 - recall: 0.1557 - f1_score: 0.6538 - val_loss: 0.6949 - val_accuracy: 0.4939 - val_precision: 0.4541 - val_recall: 0.2323 - val_f1_score: 0.6518
Epoch 9/50

Epoch 00009: LearningRateScheduler reducing learning rate to 8.573749619245064e-06.
114/114 [=====] - 95s 780ms/step - loss: 0.6948 - accuracy: 0.4910 - precision: 0.4171 - recall: 0.1446 - f1_score: 0.6502 - val_loss: 0.6943 - val_accuracy: 0.5026 - val_precision: 0.4318 - val_recall: 0.0915 - val_f1_score: 0.6518
Epoch 10/50

Epoch 00010: LearningRateScheduler reducing learning rate to 8.573749255447183e-06.
114/114 [=====] - 97s 779ms/step - loss: 0.6944 - accuracy: 0.5068 - precision: 0.4617 - recall: 0.0632 - f1_score: 0.6558 - val_loss: 0.6935 - val_accuracy: 0.5020 - val_precision: 0.3656 - val_recall: 0.0409 - val_f1_score: 0.6518
Epoch 11/50

Epoch 00011: LearningRateScheduler reducing learning rate to 8.573749255447183e-06.
114/114 [=====] - 93s 770ms/step - loss: 0.6938 - accuracy: 0.4902 - precision: 0.4176 - recall: 0.0548 - f1_score: 0.6667 - val_loss: 0.6928 - val_accuracy: 0.5084 - val_precision: 0.4028 - val_recall: 0.0349 - val_f1_score: 0.6518
Epoch 12/50

Epoch 00012: LearningRateScheduler reducing learning rate to 8.145061792674824e-06.
114/114 [=====] - 95s 761ms/step - loss: 0.6928 - accuracy: 0.4940 - precision: 0.4109 - recall: 0.0562 - f1_score: 0.6619 - val_loss: 0.6928 - val_accuracy: 0.5125 - val_precision: 0.4568 - val_recall: 0.0445 - val_f1_score: 0.6518
Epoch 13/50

Epoch 00013: LearningRateScheduler reducing learning rate to 8.145061656250618e-06.
114/114 [=====] - 92s 764ms/step - loss: 0.6943 - accuracy: 0.4947 - precision: 0.4630 - recall: 0.0650 - f1_score: 0.6669 - val_loss: 0.6938 - val_accuracy: 0.5108 - val_precision: 0.4107 - val_recall: 0.0277 - val_f1_score: 0.6518
Epoch 14/50

Epoch 00014: LearningRateScheduler reducing learning rate to 8.145061656250618e-06.
114/114 [=====] - 95s 762ms/step - loss: 0.6974 - accuracy: 0.4855 - precision: 0.3932 - recall: 0.0611 - f1_score: 0.6647 - val_loss: 0.6993 - val_accuracy: 0.5166 - val_precision: 0.5000 - val_recall: 0.0036 - val_f1_score: 0.6518
Epoch 15/50

Epoch 00015: LearningRateScheduler reducing learning rate to 7.73780857343808 7e-06.
114/114 [=====] - 93s 771ms/step - loss: 0.6932 - accuracy: 0.5019 - precision: 0.5190 - recall: 0.0739 - f1_score: 0.6673 - val_loss: 0.6954 - val_accuracy: 0.5166 - val_precision: 0.5000 - val_recall: 0.024 - val_f1_score: 0.6518
Epoch 16/50

Epoch 00016: LearningRateScheduler reducing learning rate to 7.73780811869073 7e-06.
114/114 [=====] - 92s 759ms/step - loss: 0.6938 - accuracy: 0.5049 - precision: 0.4163 - recall: 0.0446 - f1_score: 0.6541 - val_loss: 0.6944 - val_accuracy: 0.5177 - val_precision: 1.0000 - val_recall: 0.024 - val_f1_score: 0.6518
Epoch 17/50

Epoch 00017: LearningRateScheduler reducing learning rate to 7.73780811869073 7e-06.
114/114 [=====] - 92s 768ms/step - loss: 0.6936 - accuracy: 0.4848 - precision: 0.3690 - recall: 0.0273 - f1_score: 0.6712 - val_loss: 0.6960 - val_accuracy: 0.5172 - val_precision: 1.0000 - val_recall: 0.012 - val_f1_score: 0.6518
Epoch 18/50

Epoch 00018: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 91s 748ms/step - loss: 0.6949 - accuracy: 0.4924 - precision: 0.5216 - recall: 0.0494 - f1_score: 0.6758 - val_loss: 0.6955 - val_accuracy: 0.5166 - val_precision: 0.5000 - val_recall: 0.012 - val_f1_score: 0.6518
Epoch 19/50

Epoch 00019: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 97s 802ms/step - loss: 0.6918 - accuracy: 0.5111 - precision: 0.4611 - recall: 0.0443 - f1_score: 0.6537 - val_loss: 0.6956 - val_accuracy: 0.5166 - val_precision: 0.0000e+00 - val_recall: 0.0000e+00 - val_f1_score: 0.6518
Epoch 20/50

Epoch 00020: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 100s 810ms/step - loss: 0.6902 - accuracy: 0.5113 - precision: 0.4562 - recall: 0.0444 - f1_score: 0.6529 - val_loss: 0.6946 - val_accuracy: 0.5166 - val_precision: 0.0000e+00 - val_recall: 0.0000e+00 - val_f1_score: 0.6518
Epoch 21/50

Epoch 00021: LearningRateScheduler reducing learning rate to 6.98337182711838 9e-06.
114/114 [=====] - 98s 790ms/step - loss: 0.6895 - accuracy: 0.5118 - precision: 0.4501 - recall: 0.0607 - f1_score: 0.6500 - val_loss: 0.6939 - val_accuracy: 0.5166 - val_precision: 0.0000e+00 - val_recall: 0.0000e+00 - val_f1_score: 0.6518
Epoch 22/50

Epoch 00022: LearningRateScheduler reducing learning rate to 6.98337180438102

2e-06.
114/114 [=====] - 99s 830ms/step - loss: 0.6912 - accuracy: 0.5238 - precision: 0.5269 - recall: 0.1544 - f1_score: 0.6523 - val_loss: 0.6934 - val_accuracy: 0.5113 - val_precision: 0.4960 - val_recall: 0.6775 - val_f1_score: 0.6518
Epoch 23/50

Epoch 00023: LearningRateScheduler reducing learning rate to 6.98337180438102 2e-06.
114/114 [=====] - 102s 818ms/step - loss: 0.6920 - accuracy: 0.5060 - precision: 0.4840 - recall: 0.2326 - f1_score: 0.6543 - val_loss: 0.6928 - val_accuracy: 0.5079 - val_precision: 0.4932 - val_recall: 0.6510 - val_f1_score: 0.6518
Epoch 24/50

Epoch 00024: LearningRateScheduler reducing learning rate to 6.63420321416197 04e-06.
114/114 [=====] - 97s 818ms/step - loss: 0.6873 - accuracy: 0.4996 - precision: 0.4626 - recall: 0.2717 - f1_score: 0.6484 - val_loss: 0.6987 - val_accuracy: 0.5224 - val_precision: 0.5056 - val_recall: 0.5427 - val_f1_score: 0.6518
Epoch 25/50

Epoch 00025: LearningRateScheduler reducing learning rate to 6.63420314594986 85e-06.
114/114 [=====] - 99s 794ms/step - loss: 0.6898 - accuracy: 0.5280 - precision: 0.5149 - recall: 0.5249 - f1_score: 0.6548 - val_loss: 0.6944 - val_accuracy: 0.5084 - val_precision: 0.4940 - val_recall: 0.6883 - val_f1_score: 0.6518
Epoch 26/50

Epoch 00026: LearningRateScheduler reducing learning rate to 6.63420314594986 85e-06.
114/114 [=====] - 97s 806ms/step - loss: 0.6902 - accuracy: 0.5366 - precision: 0.5329 - recall: 0.6687 - f1_score: 0.6712 - val_loss: 0.6949 - val_accuracy: 0.5207 - val_precision: 0.5033 - val_recall: 0.6498 - val_f1_score: 0.6518
Epoch 27/50

Epoch 00027: LearningRateScheduler reducing learning rate to 6.30249298865237 4e-06.
114/114 [=====] - 96s 796ms/step - loss: 0.6906 - accuracy: 0.5127 - precision: 0.5091 - recall: 0.6430 - f1_score: 0.6649 - val_loss: 0.6947 - val_accuracy: 0.5259 - val_precision: 0.5075 - val_recall: 0.6498 - val_f1_score: 0.6518
Epoch 28/50

Epoch 00028: LearningRateScheduler reducing learning rate to 6.30249314781394 8e-06.
114/114 [=====] - 97s 806ms/step - loss: 0.6914 - accuracy: 0.5268 - precision: 0.5145 - recall: 0.6960 - f1_score: 0.6602 - val_loss: 0.6962 - val_accuracy: 0.5143 - val_precision: 0.4982 - val_recall: 0.6546 - val_f1_score: 0.6518
Epoch 29/50

Epoch 00029: LearningRateScheduler reducing learning rate to 6.30249314781394 8e-06.

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114/114 [=====] - 97s 805ms/step - loss: 0.6886 - accuracy: 0.5555 - precision: 0.5375 - recall: 0.7402 - f1_score: 0.6627 - val_loss: 0.6958 - val_accuracy: 0.5137 - val_precision: 0.4977 - val_recall: 0.6606 - val_f1_score: 0.6518
Epoch 30/50

Epoch 00030: LearningRateScheduler reducing learning rate to 5.98736849042325e-06.
114/114 [=====] - 99s 804ms/step - loss: 0.6880 - accuracy: 0.5384 - precision: 0.5185 - recall: 0.7560 - f1_score: 0.6554 - val_loss: 0.6959 - val_accuracy: 0.5230 - val_precision: 0.5050 - val_recall: 0.6631 - val_f1_score: 0.6518
Epoch 31/50

Epoch 00031: LearningRateScheduler reducing learning rate to 5.987368695059558e-06.
114/114 [=====] - 95s 779ms/step - loss: 0.6893 - accuracy: 0.5234 - precision: 0.5054 - recall: 0.7626 - f1_score: 0.6528 - val_loss: 0.6962 - val_accuracy: 0.5236 - val_precision: 0.5054 - val_recall: 0.6799 - val_f1_score: 0.6518
Epoch 32/50

Epoch 00032: LearningRateScheduler reducing learning rate to 5.987368695059558e-06.
114/114 [=====] - 96s 798ms/step - loss: 0.6826 - accuracy: 0.5726 - precision: 0.5488 - recall: 0.7746 - f1_score: 0.6626 - val_loss: 0.6955 - val_accuracy: 0.5265 - val_precision: 0.5100 - val_recall: 0.5211 - val_f1_score: 0.6518
Epoch 33/50

Epoch 00033: LearningRateScheduler reducing learning rate to 5.68800026030658e-06.
114/114 [=====] - 95s 784ms/step - loss: 0.6852 - accuracy: 0.5453 - precision: 0.5289 - recall: 0.7124 - f1_score: 0.6606 - val_loss: 0.6965 - val_accuracy: 0.5369 - val_precision: 0.5202 - val_recall: 0.5415 - val_f1_score: 0.6518
Epoch 34/50

Epoch 00034: LearningRateScheduler reducing learning rate to 5.688000328518683e-06.
114/114 [=====] - 95s 791ms/step - loss: 0.6873 - accuracy: 0.5387 - precision: 0.5249 - recall: 0.7080 - f1_score: 0.6618 - val_loss: 0.6969 - val_accuracy: 0.5451 - val_precision: 0.5259 - val_recall: 0.5993 - val_f1_score: 0.6518
Epoch 35/50

Epoch 00035: LearningRateScheduler reducing learning rate to 5.688000328518683e-06.
114/114 [=====] - 96s 795ms/step - loss: 0.6814 - accuracy: 0.5277 - precision: 0.5021 - recall: 0.7002 - f1_score: 0.6445 - val_loss: 0.6974 - val_accuracy: 0.5241 - val_precision: 0.5073 - val_recall: 0.5403 - val_f1_score: 0.6518
Epoch 36/50

Epoch 00036: LearningRateScheduler reducing learning rate to 5.403600312092749e-06.
114/114 [=====] - 100s 803ms/step - loss: 0.6937 - a
```

accuracy: 0.5541 - precision: 0.5322 - recall: 0.7297 - f1_score: 0.6563 - val_loss: 0.6943 - val_accuracy: 0.5393 - val_precision: 0.5186 - val_recall: 0.6546 - val_f1_score: 0.6518
Epoch 37/50

Epoch 00037: LearningRateScheduler reducing learning rate to 5.40360042577958e-06.
114/114 [=====] - 97s 803ms/step - loss: 0.6843 - accuracy: 0.5448 - precision: 0.5330 - recall: 0.7698 - f1_score: 0.6691 - val_loss: 0.6976 - val_accuracy: 0.5358 - val_precision: 0.5170 - val_recall: 0.6053 - val_f1_score: 0.6518
Epoch 38/50

Epoch 00038: LearningRateScheduler reducing learning rate to 5.40360042577958e-06.
114/114 [=====] - 99s 796ms/step - loss: 0.6784 - accuracy: 0.5680 - precision: 0.5533 - recall: 0.7173 - f1_score: 0.6678 - val_loss: 0.7158 - val_accuracy: 0.5317 - val_precision: 0.5173 - val_recall: 0.4681 - val_f1_score: 0.6518
Epoch 39/50

Epoch 00039: LearningRateScheduler reducing learning rate to 5.13342040449060e-06.
114/114 [=====] - 102s 809ms/step - loss: 0.6910 - accuracy: 0.5452 - precision: 0.5332 - recall: 0.7298 - f1_score: 0.6662 - val_loss: 0.6994 - val_accuracy: 0.5492 - val_precision: 0.5297 - val_recall: 0.6017 - val_f1_score: 0.6518
Epoch 40/50

Epoch 00040: LearningRateScheduler reducing learning rate to 5.13342047270271e-06.
114/114 [=====] - 97s 803ms/step - loss: 0.6849 - accuracy: 0.5482 - precision: 0.5297 - recall: 0.7326 - f1_score: 0.6598 - val_loss: 0.7005 - val_accuracy: 0.5375 - val_precision: 0.5199 - val_recall: 0.5656 - val_f1_score: 0.6518
Epoch 41/50

Epoch 00041: LearningRateScheduler reducing learning rate to 5.13342047270271e-06.
114/114 [=====] - 100s 806ms/step - loss: 0.6871 - accuracy: 0.5437 - precision: 0.5239 - recall: 0.7479 - f1_score: 0.6575 - val_loss: 0.7103 - val_accuracy: 0.5532 - val_precision: 0.5370 - val_recall: 0.5499 - val_f1_score: 0.6518
Epoch 42/50

Epoch 00042: LearningRateScheduler reducing learning rate to 4.876749449067574e-06.
114/114 [=====] - 98s 797ms/step - loss: 0.6797 - accuracy: 0.5598 - precision: 0.5297 - recall: 0.7368 - f1_score: 0.6483 - val_loss: 0.6990 - val_accuracy: 0.5369 - val_precision: 0.5169 - val_recall: 0.6450 - val_f1_score: 0.6518
Epoch 43/50

Epoch 00043: LearningRateScheduler reducing learning rate to 4.8767492444312666e-06.
114/114 [=====] - 100s 802ms/step - loss: 0.6823 - accuracy: 0.5637 - precision: 0.5435 - recall: 0.7637 - f1_score: 0.6639 - val

```
_loss: 0.6965 - val_accuracy: 0.5364 - val_precision: 0.5152 - val_recall: 0.  
6931 - val_f1_score: 0.6518  
Epoch 44/50  
  
Epoch 00044: LearningRateScheduler reducing learning rate to 4.87674924443126  
66e-06.  
114/114 [=====] - 96s 788ms/step - loss: 0.6888 - ac  
curacy: 0.5431 - precision: 0.5235 - recall: 0.8116 - f1_score: 0.6602 - val_  
loss: 0.7194 - val_accuracy: 0.5329 - val_precision: 0.5188 - val_recall: 0.4  
645 - val_f1_score: 0.6518  
Epoch 45/50  
  
Epoch 00045: LearningRateScheduler reducing learning rate to 4.63291178220970  
3e-06.  
114/114 [=====] - 101s 809ms/step - loss: 0.6789 - a  
ccuracy: 0.5825 - precision: 0.5624 - recall: 0.7230 - f1_score: 0.6633 - val_  
loss: 0.7005 - val_accuracy: 0.5398 - val_precision: 0.5196 - val_recall: 0.  
6366 - val_f1_score: 0.6518  
Epoch 46/50  
  
Epoch 00046: LearningRateScheduler reducing learning rate to 4.63291189589654  
1e-06.  
114/114 [=====] - 100s 810ms/step - loss: 0.6761 - a  
ccuracy: 0.5856 - precision: 0.5666 - recall: 0.7867 - f1_score: 0.6743 - val_  
loss: 0.7054 - val_accuracy: 0.5311 - val_precision: 0.5123 - val_recall: 0.  
6245 - val_f1_score: 0.6518  
Epoch 47/50  
  
Epoch 00047: LearningRateScheduler reducing learning rate to 4.63291189589654  
1e-06.  
114/114 [=====] - 96s 802ms/step - loss: 0.6761 - ac  
curacy: 0.5667 - precision: 0.5402 - recall: 0.7805 - f1_score: 0.6578 - val_  
loss: 0.7097 - val_accuracy: 0.5329 - val_precision: 0.5133 - val_recall: 0.6  
486 - val_f1_score: 0.6518  
Epoch 48/50  
  
Epoch 00048: LearningRateScheduler reducing learning rate to 4.40126630110171  
36e-06.  
114/114 [=====] - 96s 790ms/step - loss: 0.6790 - ac  
curacy: 0.5360 - precision: 0.5132 - recall: 0.7860 - f1_score: 0.6515 - val_  
loss: 0.7040 - val_accuracy: 0.5317 - val_precision: 0.5112 - val_recall: 0.7  
136 - val_f1_score: 0.6518  
Epoch 49/50  
  
Epoch 00049: LearningRateScheduler reducing learning rate to 4.40126632383908  
15e-06.  
114/114 [=====] - 96s 803ms/step - loss: 0.6728 - ac  
curacy: 0.5618 - precision: 0.5348 - recall: 0.8069 - f1_score: 0.6571 - val_  
loss: 0.7160 - val_accuracy: 0.5230 - val_precision: 0.5055 - val_recall: 0.6  
125 - val_f1_score: 0.6518  
Epoch 50/50  
  
Epoch 00050: LearningRateScheduler reducing learning rate to 4.40126632383908  
15e-06.  
114/114 [=====] - 96s 793ms/step - loss: 0.6814 - ac  
curacy: 0.5789 - precision: 0.5570 - recall: 0.7670 - f1_score: 0.6659 - val_
```

```
loss: 0.7243 - val_accuracy: 0.5236 - val_precision: 0.5062 - val_recall: 0.5
909 - val_f1_score: 0.6518
```

In [57]:

```
model_checkpoint = Model(inputs=vgg19.input, outputs=FC3)
model_checkpoint.save('bestmodel_vgg19_lstm.h5')
new_model = tf.keras.models.load_model('bestmodel_vgg19_lstm.h5')
```

WARNING:tensorflow:No training configuration found in the save file, so the model was *not* compiled. Compile it manually.

In [58]:

```
predict_train=new_model.predict_generator(train_prediction_generator,steps=len(train_prediction_generator),workers=12)
predict_test=new_model.predict_generator(test_prediction_generator,steps=len(test_prediction_generator),workers=12)
predict_train.shape
```

Out[58]: (3405, 128)

In [18]:

```
train_data_words=train_data['processed_words'].values
validation_words=val_data['processed_words'].values
test_data_words=test_data['processed_words'].values

tokenizer = Tokenizer()
tokenizer.fit_on_texts(train_data_words)
vocab_size=len(tokenizer.word_index)
encoded_Xtrain_words = [tf.keras.preprocessing.text.one_hot(d, vocab_size,filters='!"#%&()*+,-./:;<=>?@[\\]^{|}~\\t\\n') for d in train_data_words]
encoded_validation_words = [tf.keras.preprocessing.text.one_hot(d, vocab_size,filters='!"#%&()*+,-./:;<=>?@[\\]^{|}~\\t\\n') for d in validation_words]
encoded_Xtest_words = [tf.keras.preprocessing.text.one_hot(d, vocab_size,filters='!"#%&()*+,-./:;<=>?@[\\]^{|}~\\t\\n') for d in test_data_words]

padded_Xtrain_words = tf.keras.preprocessing.sequence.pad_sequences(encoded_Xtrain_words, maxlen=20, padding='post')
padded_Xvalidation_words = tf.keras.preprocessing.sequence.pad_sequences(encoded_validation_words, maxlen=20, padding='post')
padded_Xtest_words = tf.keras.preprocessing.sequence.pad_sequences(encoded_Xtest_words, maxlen=20, padding='post')
```

In [19]:

```
embeddings_index = dict()
f = open('/content/glove.6B.300d.txt')

for line in f:
    values = line.split()
    word = values[0]
    coefs = np.asarray(values[1:], dtype='float32')
    embeddings_index[word] = coefs

f.close()
print('Loaded %s word vectors.' % len(embeddings_index))
```

Loaded 400000 word vectors.

```
In [20]: embedding_matrix = np.zeros((vocab_size+1, 300))
for word, i in tokenizer.word_index.items():
    embedding_vector = embeddings_index.get(word)
    if embedding_vector is not None:
        embedding_matrix[i] = embedding_vector
```

```
In [21]: labelencoder = LabelEncoder()
labelencoder.fit(train_data[' subreddit'].values)
subreddit_train=labelencoder.transform(train_data[' subreddit'].values).reshape(-1,1)
subreddit_validation=labelencoder.transform(val_data[' subreddit'].values).reshape(-1,1)
subreddit_test=labelencoder.transform(test_data[' subreddit'].values).reshape(-1, 1)

print(subreddit_train.shape)
print(subreddit_test.shape)
print(subreddit_validation.shape)
```

(3405, 1)
(1719, 1)
(1688, 1)

```
In [22]: labelencoder = LabelEncoder()
labelencoder.fit(train_data[' is_nsfw'].values)
is_nsfw_train=labelencoder.transform(train_data[' is_nsfw'].values).reshape(-1, 1)
is_nsfw_validation=labelencoder.transform(val_data[' is_nsfw'].values).reshape(-1,1)
is_nsfw_test=labelencoder.transform(test_data[' is_nsfw'].values).reshape(-1,1)

print(is_nsfw_train.shape)
print(is_nsfw_test.shape)
print(is_nsfw_validation.shape)
```

(3405, 1)
(1719, 1)
(1688, 1)

```
In [23]: time_of_day_train=(train_data['time_of_day'].values).reshape(-1,1)
time_of_day_validation=(val_data['time_of_day'].values).reshape(-1,1)
time_of_day_test=(test_data['time_of_day'].values).reshape(-1,1)

print(time_of_day_train.shape)
print(time_of_day_validation.shape)
print(time_of_day_test.shape)
```

(3405, 1)
(1688, 1)
(1719, 1)

```
In [24]: scaler = StandardScaler()
scaler=scaler.fit(train_data['created_utc'].values.reshape(-1, 1))

created_utc_train=scaler.transform(train_data['created_utc'].values.reshape(-1, 1))
created_utc_validation=scaler.transform(val_data['created_utc'].values.reshape(-1, 1))
created_utc_test=scaler.transform(test_data['created_utc'].values.reshape(-1, 1))

print(created_utc_train.shape)
print(created_utc_test.shape)
print(created_utc_validation.shape)
```

```
(3405, 1)
(1719, 1)
(1688, 1)
```

```
In [25]: scaler = StandardScaler()
scaler=scaler.fit(train_data['subscribers'].values.reshape(-1, 1))

subscribers_train=scaler.transform(train_data['subscribers'].values.reshape(-1, 1))
subscribers_validation=scaler.transform(val_data['subscribers'].values.reshape(-1, 1))
subscribers_test=scaler.transform(test_data['subscribers'].values.reshape(-1, 1))

print(subscribers_train.shape)
print(subscribers_validation.shape)
print(subscribers_test.shape)
```

```
(3405, 1)
(1688, 1)
(1719, 1)
```

```
In [59]: #words embedding layer
words = Input(shape=(20,),name="words")
embedding=Embedding(vocab_size+1,300,weights=[embedding_matrix],input_length=20,trainable=False)(words)
lstm_layer=LSTM(500)(embedding)
flatten1 = Flatten(data_format='channels_last')(lstm_layer)

image_predicted =Input(shape=(predict_train.shape[1],),name="image_predicted")
flatten2= Flatten(data_format='channels_last')(image_predicted)

#categore_data
subreddit_train_layer =Input(shape=(subreddit_train.shape[1],),name="subreddit_train_layer")
flatten3= Flatten(data_format='channels_last')(subreddit_train_layer)
#####
is_nsfw_train_layer =Input(shape=(is_nsfw_train.shape[1],),name="is_nsfw_train_layer")
flatten4 = Flatten(data_format='channels_last')(is_nsfw_train_layer)
#####
time_of_day_train_layer =Input(shape=(time_of_day_train.shape[1],),name="time_of_day_train_layer")
flatten5 = Flatten(data_format='channels_last')(time_of_day_train_layer)

#numeric_data
created_utc_train_layer =Input(shape=(created_utc_train.shape[1],),name="created_utc_train_layer")
created_utc_dence = Dense(units=3,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(created_utc_train_layer)

#numeric_data
subscribers_train_layer =Input(shape=(subscribers_train.shape[1],),name="subscribers_train_layer")
subscribers_dence = Dense(units=3,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(subscribers_train_layer)

#concat layer
concatenated = concatenate([subscribers_train_layer,created_utc_dence,flatten5,flatten4,flatten3,flatten2,flatten1],axis = -1)

dense_layer1 = Dense(units=420,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(concatenated)
dropout1=Dropout(0.3)(dense_layer1)

dense_layer2 = Dense(units=210,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(dropout1)
dropout2=Dropout(0.3)(dense_layer2)

dense_layer3 = Dense(units=105,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(dropout2)
dropout3=Dropout(0.3)(dense_layer3)

dense_layer4 = Dense(units=60,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(dropout3)
dropout4=Dropout(0.3)(dense_layer4)

dense_layer5 = Dense(units=30,activation='relu',kernel_initializer=tf.keras.in
```

```
initializers.glorot_normal(seed=33))(dropout4)
dropout5=Dropout(0.3)(dense_layer5)

dense_layer6 = Dense(units=15,activation='relu',kernel_initializer=tf.keras.initializers.glorot_normal(seed=33))(dropout5)

Out = Dense(units=1,activation='sigmoid',kernel_initializer=tf.keras.initializers.glorot_normal(seed=3),name='Output')(dense_layer6)

model = Model(inputs=[image_predicted,words,subreddit_train_layer,is_nsfw_train_layer,time_of_day_train_layer,created_utc_train_layer,subscribers_train_layer],outputs=Out)
model.summary()
```

Model: "model_8"

Layer (type)	Output Shape	Param #	Connected to
words (InputLayer)	[None, 20]	0	
embedding_4 (Embedding)	(None, 20, 300)	2712000	words[0][0]
created_utc_train_layer (InputLayer)	[None, 1]	0	
time_of_day_train_layer (InputLayer)	[None, 1]	0	
is_nsfw_train_layer (InputLayer)	[None, 1]	0	
subreddit_train_layer (InputLayer)	[None, 1]	0	
image_predicted (InputLayer)	[None, 128]	0	
lstm_4 (LSTM)	(None, 500)	1602000	embedding_4[0][0]
subscribers_train_layer (InputLayer)	[None, 1]	0	
dense_24 (Dense)	(None, 3)	6	created_utc_train_layer[0][0]
flatten_20 (Flatten)	(None, 1)	0	time_of_day_train_layer[0][0]
flatten_19 (Flatten)	(None, 1)	0	is_nsfw_train_layer[0][0]
flatten_18 (Flatten)	(None, 1)	0	subreddit_train_layer[0][0]
flatten_17 (Flatten)	(None, 128)	0	image_predicted[0][0]
flatten_16 (Flatten)	(None, 500)	0	lstm_4[0][0]

	7.FE_VGG19_lstm		
concatenate_3 (Concatenate)	(None, 635)	0	subscribers_
train_layer[0][0]			dense_24[0]
[0]			flatten_20
[0][0]			flatten_19
[0][0]			flatten_18
[0][0]			flatten_17
[0][0]			flatten_16
[0][0]			

dense_26 (Dense)	(None, 420)	267120	concatenate_
3[0][0]			

dropout_19 (Dropout)	(None, 420)	0	dense_26[0]
[0]			

dense_27 (Dense)	(None, 210)	88410	dropout_19
[0][0]			

dropout_20 (Dropout)	(None, 210)	0	dense_27[0]
[0]			

dense_28 (Dense)	(None, 105)	22155	dropout_20
[0][0]			

dropout_21 (Dropout)	(None, 105)	0	dense_28[0]
[0]			

dense_29 (Dense)	(None, 60)	6360	dropout_21
[0][0]			

dropout_22 (Dropout)	(None, 60)	0	dense_29[0]
[0]			

dense_30 (Dense)	(None, 30)	1830	dropout_22
[0][0]			

dropout_23 (Dropout)	(None, 30)	0	dense_30[0]
[0]			

dense_31 (Dense)	(None, 15)	465	dropout_23

[0][0]

Output (Dense) [0]	(None, 1)	16	dense_31[0]
<hr/>			
<hr/>			
Total params: 4,700,362			
Trainable params: 1,988,362			
Non-trainable params: 2,712,000			



```
In [61]: filepath="model_save_new/weights-{epoch:02d}-{val_accuracy:.4f}.h5"
checkpoint = ModelCheckpoint(filepath=filepath, monitor='val_accuracy', mode='auto')

lrschedule = tf.keras.callbacks.LearningRateScheduler(scheduler, verbose=0.1)

#stop the training if your validation accuracy is not increased in last 2 epochs.
early_stop= EarlyStopping(monitor='val_accuracy', patience=2,verbose=1)

#If your validation accuracy at that epoch is less than previous epoch accuracy, you have to decrease the
#Learning rate by 10%
reduce_lr = ReduceLROnPlateau(monitor='val_accuracy', factor=0.9,
                               patience=0, min_lr=0.001, verbose=1)

model.compile(
    loss='binary_crossentropy',
    optimizer=tf.keras.optimizers.RMSprop(lr=1e-5),
    metrics=[ 'accuracy',tf.keras.metrics.Precision(),tf.keras.metrics.Recall(),tf.keras.metrics.F1Score(num_classes=1)]
)
```

```
In [62]: y_train =train_data['dank_level'].values
y_test =test_data['dank_level'].values
y_train.shape
```

Out[62]: (3405,)

```
In [66]: history=model.fit({"image_predicted":predict_train,"words":padded_Xtrain_words  
," subreddit_train_layer":subreddit_train,"is_nsfw_train_layer":is_nsfw_train,  
"time_of_day_train_layer":time_of_day_train,  
"created_utc_train_layer":created_utc_train,"subscribers_t  
rain_layer":subscribers_train},  
y_train,epochs=50,batch_size=30,  
validation_data=( {"image_predicted":predict_test,"words":pad  
ded_Xtest_words," subreddit_train_layer":subreddit_test,"is_nsfw_train_layer":i  
s_nsfw_test,"time_of_day_train_layer":time_of_day_test,  
"created_utc_train_layer":created_utc_test,"subscribers_tr  
ain_layer":subscribers_test},y_test),callbacks=[lrschedule,checkpoint,reduce_lr])
```

Epoch 1/50

Epoch 00001: LearningRateScheduler reducing learning rate to 8.52575908538710 8e-07.

114/114 [=====] - 2s 13ms/step - loss: 0.6819 - accuracy: 0.5636 - precision_7: 0.5589 - recall_7: 0.5450 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5327 - val_recall_7: 0.6173 - val_f1_score: 0.6518

Epoch 2/50

Epoch 00002: LearningRateScheduler reducing learning rate to 8.52575908538710 8e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6801 - accuracy: 0.5571 - precision_7: 0.5509 - recall_7: 0.5509 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5509 - val_precision_7: 0.5308 - val_recall_7: 0.6113 - val_f1_score: 0.6518

Epoch 3/50

Epoch 00003: LearningRateScheduler reducing learning rate to 8.09947113111775 2e-07.

114/114 [=====] - 1s 12ms/step - loss: 0.6822 - accuracy: 0.5598 - precision_7: 0.5551 - recall_7: 0.5402 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 4/50

Epoch 00004: LearningRateScheduler reducing learning rate to 8.09947096058749 6e-07.

114/114 [=====] - 1s 12ms/step - loss: 0.6822 - accuracy: 0.5648 - precision_7: 0.5604 - recall_7: 0.5444 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 5/50

Epoch 00005: LearningRateScheduler reducing learning rate to 8.09947096058749 6e-07.

114/114 [=====] - 1s 12ms/step - loss: 0.6804 - accuracy: 0.5601 - precision_7: 0.5569 - recall_7: 0.5277 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5515 - val_precision_7: 0.5312 - val_recall_7: 0.6137 - val_f1_score: 0.6518

Epoch 6/50

Epoch 00006: LearningRateScheduler reducing learning rate to 7.69449741255812 1e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6819 - accuracy: 0.5621 - precision_7: 0.5580 - recall_7: 0.5390 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 7/50

Epoch 00007: LearningRateScheduler reducing learning rate to 7.69449741255812 1e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6835 - accuracy: 0.5586 - precision_7: 0.5538 - recall_7: 0.5396 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5521 - val_precision_7: 0.5317 - val_recall_7: 0.6149 - val_f1_score: 0.6518

Epoch 8/50

Epoch 00008: LearningRateScheduler reducing learning rate to 7.69449741255812e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6829 - accuracy: 0.5674 - precision_7: 0.5642 - recall_7: 0.5390 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5326 - val_recall_7: 0.6185 - val_f1_score: 0.6518
Epoch 9/50

Epoch 00009: LearningRateScheduler reducing learning rate to 7.309772541930215e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6812 - accuracy: 0.5548 - precision_7: 0.5503 - recall_7: 0.5313 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5326 - val_recall_7: 0.6185 - val_f1_score: 0.6518
Epoch 10/50

Epoch 00010: LearningRateScheduler reducing learning rate to 7.309772627195343e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6810 - accuracy: 0.5686 - precision_7: 0.5655 - recall_7: 0.5396 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5526 - val_precision_7: 0.5322 - val_recall_7: 0.6173 - val_f1_score: 0.6518
Epoch 11/50

Epoch 00011: LearningRateScheduler reducing learning rate to 7.309772627195343e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6823 - accuracy: 0.5621 - precision_7: 0.5585 - recall_7: 0.5348 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5521 - val_precision_7: 0.5314 - val_recall_7: 0.6209 - val_f1_score: 0.6518
Epoch 12/50

Epoch 00012: LearningRateScheduler reducing learning rate to 6.944283995835576e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6823 - accuracy: 0.5580 - precision_7: 0.5531 - recall_7: 0.5396 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5326 - val_recall_7: 0.6197 - val_f1_score: 0.6518
Epoch 13/50

Epoch 00013: LearningRateScheduler reducing learning rate to 6.944284223209252e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6831 - accuracy: 0.5468 - precision_7: 0.5421 - recall_7: 0.5217 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5544 - val_precision_7: 0.5345 - val_recall_7: 0.6065 - val_f1_score: 0.6518
Epoch 14/50

Epoch 00014: LearningRateScheduler reducing learning rate to 6.944284223209252e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6847 - accuracy: 0.5474 - precision_7: 0.5424 - recall_7: 0.5253 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5340 - val_recall_7: 0.5957 - val_f1_score: 0.6518
Epoch 15/50

Epoch 00015: LearningRateScheduler reducing learning rate to 6.59707001204878 8e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6790 - accuracy: 0.5674 - precision_7: 0.5633 - recall_7: 0.5462 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5561 - val_precision_7: 0.5364 - val_recall_7: 0.6029 - val_f1_score: 0.6518
Epoch 16/50

Epoch 00016: LearningRateScheduler reducing learning rate to 6.59706984151853 2e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6791 - accuracy: 0.5706 - precision_7: 0.5670 - recall_7: 0.5468 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5561 - val_precision_7: 0.5364 - val_recall_7: 0.6029 - val_f1_score: 0.6518
Epoch 17/50

Epoch 00017: LearningRateScheduler reducing learning rate to 6.59706984151853 2e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6818 - accuracy: 0.5592 - precision_7: 0.5539 - recall_7: 0.5444 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5331 - val_recall_7: 0.6113 - val_f1_score: 0.6518
Epoch 18/50

Epoch 00018: LearningRateScheduler reducing learning rate to 6.26721634944260 6e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6821 - accuracy: 0.5586 - precision_7: 0.5555 - recall_7: 0.5247 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5573 - val_precision_7: 0.5374 - val_recall_7: 0.6053 - val_f1_score: 0.6518
Epoch 19/50

Epoch 00019: LearningRateScheduler reducing learning rate to 6.26721657681628 1e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6820 - accuracy: 0.5498 - precision_7: 0.5452 - recall_7: 0.5247 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5561 - val_precision_7: 0.5364 - val_recall_7: 0.6029 - val_f1_score: 0.6518
Epoch 20/50

Epoch 00020: LearningRateScheduler reducing learning rate to 6.26721657681628 1e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6849 - accuracy: 0.5430 - precision_7: 0.5375 - recall_7: 0.5253 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 21/50

Epoch 00021: LearningRateScheduler reducing learning rate to 5.95385574797546 7e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6811 - accuracy: 0.5621 - precision_7: 0.5582 - recall_7: 0.5366 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 22/50

Epoch 00022: LearningRateScheduler reducing learning rate to 5.95385586166230

5e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6824 - accuracy: 0.5559 - precision_7: 0.5520 - recall_7: 0.5283 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 23/50

Epoch 00023: LearningRateScheduler reducing learning rate to 5.95385586166230 5e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6822 - accuracy: 0.5554 - precision_7: 0.5512 - recall_7: 0.5289 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5532 - val_precision_7: 0.5340 - val_recall_7: 0.5957 - val_f1_score: 0.6518
Epoch 24/50

Epoch 00024: LearningRateScheduler reducing learning rate to 5.65616306857918 9e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6839 - accuracy: 0.5524 - precision_7: 0.5471 - recall_7: 0.5360 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 25/50

Epoch 00025: LearningRateScheduler reducing learning rate to 5.65616289804893 3e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6811 - accuracy: 0.5642 - precision_7: 0.5616 - recall_7: 0.5295 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 26/50

Epoch 00026: LearningRateScheduler reducing learning rate to 5.65616289804893 3e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6810 - accuracy: 0.5645 - precision_7: 0.5606 - recall_7: 0.5402 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 27/50

Epoch 00027: LearningRateScheduler reducing learning rate to 5.37335475314648 7e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6797 - accuracy: 0.5653 - precision_7: 0.5614 - recall_7: 0.5420 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 28/50

Epoch 00028: LearningRateScheduler reducing learning rate to 5.37335495209845 2e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6828 - accuracy: 0.5510 - precision_7: 0.5460 - recall_7: 0.5301 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5550 - val_precision_7: 0.5354 - val_recall_7: 0.6005 - val_f1_score: 0.6518
Epoch 29/50

Epoch 00029: LearningRateScheduler reducing learning rate to 5.37335495209845 2e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6814 - accuracy: 0.5642 - precision_7: 0.5604 - recall_7: 0.5390 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 30/50

Epoch 00030: LearningRateScheduler reducing learning rate to 5.104687204493529e-07.

114/114 [=====] - 1s 12ms/step - loss: 0.6812 - accuracy: 0.5480 - precision_7: 0.5435 - recall_7: 0.5205 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 31/50

Epoch 00031: LearningRateScheduler reducing learning rate to 5.104687375023786e-07.

114/114 [=====] - 1s 12ms/step - loss: 0.6828 - accuracy: 0.5468 - precision_7: 0.5429 - recall_7: 0.5122 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 32/50

Epoch 00032: LearningRateScheduler reducing learning rate to 5.104687375023786e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6806 - accuracy: 0.5580 - precision_7: 0.5539 - recall_7: 0.5325 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 33/50

Epoch 00033: LearningRateScheduler reducing learning rate to 4.849453006272597e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6829 - accuracy: 0.5612 - precision_7: 0.5569 - recall_7: 0.5396 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 34/50

Epoch 00034: LearningRateScheduler reducing learning rate to 4.849453034694307e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6806 - accuracy: 0.5583 - precision_7: 0.5526 - recall_7: 0.5479 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 35/50

Epoch 00035: LearningRateScheduler reducing learning rate to 4.849453034694307e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6790 - accuracy: 0.5692 - precision_7: 0.5656 - recall_7: 0.5444 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518

Epoch 36/50

Epoch 00036: LearningRateScheduler reducing learning rate to 4.606980382959591e-07.

114/114 [=====] - 1s 13ms/step - loss: 0.6830 - accu

racy: 0.5521 - precision_7: 0.5474 - recall_7: 0.5295 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5561 - val_precision_7: 0.5364 - val_recall_7: 0.6029 - val_f1_score: 0.6518
Epoch 37/50

Epoch 00037: LearningRateScheduler reducing learning rate to 4.60698032611617e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6825 - accuracy: 0.5498 - precision_7: 0.5442 - recall_7: 0.5348 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 38/50

Epoch 00038: LearningRateScheduler reducing learning rate to 4.60698032611617e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6818 - accuracy: 0.5630 - precision_7: 0.5586 - recall_7: 0.5420 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 39/50

Epoch 00039: LearningRateScheduler reducing learning rate to 4.37663130981036e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6830 - accuracy: 0.5648 - precision_7: 0.5608 - recall_7: 0.5408 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 40/50

Epoch 00040: LearningRateScheduler reducing learning rate to 4.37663118191267e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6820 - accuracy: 0.5577 - precision_7: 0.5531 - recall_7: 0.5366 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 41/50

Epoch 00041: LearningRateScheduler reducing learning rate to 4.37663118191267e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6821 - accuracy: 0.5518 - precision_7: 0.5471 - recall_7: 0.5289 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 42/50

Epoch 00042: LearningRateScheduler reducing learning rate to 4.15779962281703e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6812 - accuracy: 0.5651 - precision_7: 0.5610 - recall_7: 0.5426 - f1_score: 0.6605 - val_loss: 0.6878 - val_accuracy: 0.5567 - val_precision_7: 0.5369 - val_recall_7: 0.6041 - val_f1_score: 0.6518
Epoch 43/50

Epoch 00043: LearningRateScheduler reducing learning rate to 4.15779965123874e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6800 - accuracy: 0.5683 - precision_7: 0.5650 - recall_7: 0.5408 - f1_score: 0.6605 - va

```
l_loss: 0.6878 - val_accuracy: 0.5544 - val_precision_7: 0.5342 - val_recall_
7: 0.6101 - val_f1_score: 0.6518
Epoch 44/50

Epoch 00044: LearningRateScheduler reducing learning rate to 4.15779965123874
7e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6812 - accuracy: 0.5554 - precision_7: 0.5511 - recall_7: 0.5301 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5503 - val_precision_7: 0.5303 - val_recall_7: 0.6113 - val_f1_score: 0.6518
Epoch 45/50

Epoch 00045: LearningRateScheduler reducing learning rate to 3.94990966867680
94e-07.
114/114 [=====] - 1s 12ms/step - loss: 0.6807 - accuracy: 0.5609 - precision_7: 0.5579 - recall_7: 0.5283 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5503 - val_precision_7: 0.5303 - val_recall_7: 0.6113 - val_f1_score: 0.6518
Epoch 46/50

Epoch 00046: LearningRateScheduler reducing learning rate to 3.94990962604424
57e-07.
114/114 [=====] - 2s 13ms/step - loss: 0.6800 - accuracy: 0.5630 - precision_7: 0.5589 - recall_7: 0.5396 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5509 - val_precision_7: 0.5308 - val_recall_7: 0.6125 - val_f1_score: 0.6518
Epoch 47/50

Epoch 00047: LearningRateScheduler reducing learning rate to 3.94990962604424
57e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6807 - accuracy: 0.5633 - precision_7: 0.5596 - recall_7: 0.5366 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5515 - val_precision_7: 0.5312 - val_recall_7: 0.6149 - val_f1_score: 0.6518
Epoch 48/50

Epoch 00048: LearningRateScheduler reducing learning rate to 3.75241414474203
3e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6835 - accuracy: 0.5651 - precision_7: 0.5607 - recall_7: 0.5450 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5503 - val_precision_7: 0.5302 - val_recall_7: 0.6125 - val_f1_score: 0.6518
Epoch 49/50

Epoch 00049: LearningRateScheduler reducing learning rate to 3.75241427263972
6e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6817 - accuracy: 0.5542 - precision_7: 0.5500 - recall_7: 0.5277 - f1_score: 0.6605 - val_loss: 0.6879 - val_accuracy: 0.5503 - val_precision_7: 0.5302 - val_recall_7: 0.6125 - val_f1_score: 0.6518
Epoch 50/50

Epoch 00050: LearningRateScheduler reducing learning rate to 3.75241427263972
6e-07.
114/114 [=====] - 1s 13ms/step - loss: 0.6813 - accuracy: 0.5557 - precision_7: 0.5507 - recall_7: 0.5372 - f1_score: 0.6605 - va
```

```
l_loss: 0.6879 - val_accuracy: 0.5503 - val_precision_7: 0.5302 - val_recall_
7: 0.6125 - val_f1_score: 0.6518
```

In [67]:

```
model.save('bestmodel_vgg19_lstm_1.h5')
new_model = tf.keras.models.load_model('bestmodel_vgg19_lstm_1.h5')
```

In [74]:

```
test_prediction=model.predict([predict_test,padded_Xtest_words,subreddit_test,
                               is_nsfw_test,time_of_day_test,
                               created_utc_test,subscribers_test])
test_prediction=((test_prediction > 0.5)+0).ravel()
print(test_prediction.shape)
y_test =tf.keras.utils.to_categorical(test_data['dank_level'].values,2)
y_test=np.argmax(y_test, axis=-1)
y_test.shape
```

(1719,)

Out[74]:

(1719,)

In [75]:

```
accuracy=accuracy_score(y_test,test_prediction)
print("Test accuracy_score",accuracy)
f1_test_score=f1_score(y_test,test_prediction)
print("Test F1_score",f1_test_score)
print("Test confusion matrix")
cnf_matrix2=confusion_matrix(y_test,test_prediction)
p = sns.heatmap(pd.DataFrame(cnf_matrix2), annot=True, cmap="YlGnBu" ,fmt='g')
plt.title('Test confusion matrix', y=1.1)
plt.ylabel('Actual label')
plt.xlabel('Predicted label')
```

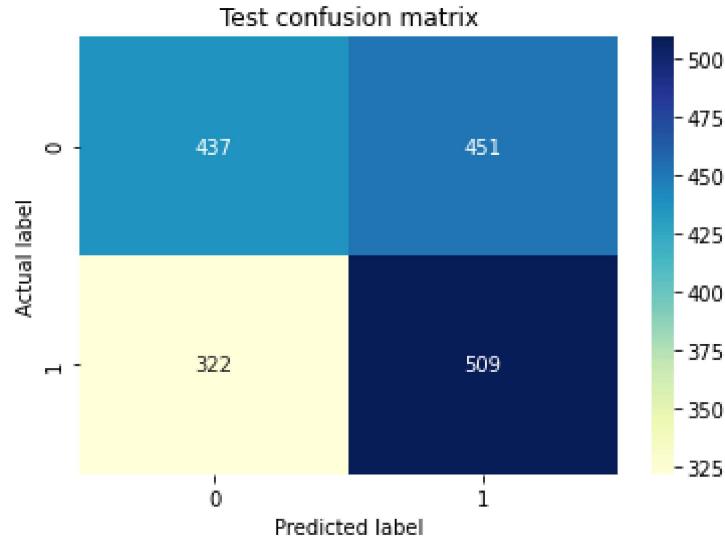
Test accuracy_score 0.5503199534613147

Test F1_score 0.568397543271915

Test confusion matrix

Out[75]:

Text(0.5, 15.0, 'Predicted label')



```
In [34]: file = '/content/model_1.png'
tf.keras.utils.plot_model(model,to_file=file, show_shapes=True)
```

Out[34]:

