

```
In [1]: #!unzip dank_data-master.zip  
#!pip install tensorflow_addons
```

```
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 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.vgg16 import VGG16  
from tensorflow.keras.applications.vgg16 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)
```

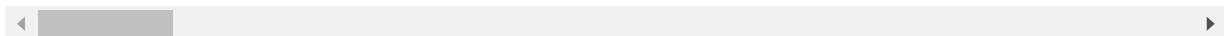
```
In [5]: final_dank=pd.read_csv('/content/dank_data-master/data/final_dank.csv')  
train_labels = [fn.split('/')[-1].split('.')[0].strip() for fn in training]  
validation_labels = [fn.split('/')[-1].split('.')[0].strip() for fn in validation]  
test_labels = [fn.split('/')[-1].split('.')[0].strip() 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	de...
57342	102450	7205.0	38858.0	DogOfLight	[]	['favorit...', 'schoolpe', 'street', 'hawa', 'sch...']	1.584874e+09	
46401	77706	81429.0	13082.0	Chronus112110	[]	['long', 'come', 'extrem', 'toilet', 'paper', ...]	1.584522e+09	
1257	1907	1996.0	1996.0	usamarafiq	[]	['me_irlthi', 'ship', 'ship', 'ship', 'ship', ...]	1.584439e+09	
67637	132246	8203.0	69856.0	usamarafiq	[]	['me_irlthi', 'ship', 'ship', 'ship', 'ship', ...]	1.584439e+09	
60768	107533	12496.0	44149.0	giantlaserbeams	[]	['home', 'ventil', 'see', 'problem', 'laura', ...]	1.584830e+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]: 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",
    has_ext=False,
    subset="training",
    batch_size=30,
    seed=42,
    class_mode="binary",
    target_size= (512,512))
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",
    has_ext=False,
    batch_size=30,
    seed=42,
    class_mode="binary",
    target_size= (512,512))
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",
    has_ext=False,
    batch_size=30,
    seed=42,
    class_mode="binary",
    target_size= (512,512))
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",
    has_ext=False,
    batch_size=30,
    seed=42,
    shuffle=False,
    class_mode="binary",
    target_size= (512,512))
```

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.

```
--- Logging error ---
Traceback (most recent call last):
  File "/usr/lib/python3.7/logging/__init__.py", line 1025, in emit
    msg = self.format(record)
  File "/usr/lib/python3.7/logging/__init__.py", line 869, in format
    return fmt.format(record)
  File "/usr/lib/python3.7/logging/__init__.py", line 608, in format
    record.message = record.getMessage()
  File "/usr/lib/python3.7/logging/__init__.py", line 369, in getMessage
    msg = msg % self.args
TypeError: not all arguments converted during string formatting
Call stack:
  File "/usr/lib/python3.7/runpy.py", line 193, in _run_module_as_main
    "__main__", mod_spec)
  File "/usr/lib/python3.7/runpy.py", line 85, in _run_code
    exec(code, run_globals)
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6, in <module>
    app.launch_new_instance()
  File "/usr/local/lib/python3.7/dist-packages/traitlets/config/application.p
y", line 845, in launch_instance
    app.start()
  File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelapp.py", line
499, in start
    self.io_loop.start()
  File "/usr/local/lib/python3.7/dist-packages/tornado/platform/asyncio.py",
line 132, in start
    self.asyncio_loop.run_forever()
  File "/usr/lib/python3.7/asyncio/base_events.py", line 541, in run_forever
    self._run_once()
  File "/usr/lib/python3.7/asyncio/base_events.py", line 1786, in _run_once
    handle._run()
  File "/usr/lib/python3.7/asyncio/events.py", line 88, in _run
    self._context.run(self._callback, *self._args)
  File "/usr/local/lib/python3.7/dist-packages/tornado/ioloop.py", line 758,
in _run_callback
    ret = callback()
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e 300, in null_wrapper
    return fn(*args, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 535, in <lambda>
    self.io_loop.add_callback(lambda: self._handle_events(self.socket, 0))
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 451, in _handle_events
    self._handle_recv()
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 480, in _handle_recv
    self._run_callback(callback, msg)
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 434, in _run_callback
    callback(*args, **kwargs)
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e 300, in null_wrapper
    return fn(*args, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
283, in dispatcher
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        return self.dispatch_shell(stream, msg)
    File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
233, in dispatch_shell
        handler(stream, idents, msg)
    File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
399, in execute_request
        user_expressions, allow_stdin)
    File "/usr/local/lib/python3.7/dist-packages/ipykernel/ipkernel.py", line 2
08, in do_execute
        res = shell.run_cell(code, store_history=store_history, silent=silent)
    File "/usr/local/lib/python3.7/dist-packages/ipykernel/zmqshell.py", line 5
37, in run_cell
        return super(ZMQInteractiveShell, self).run_cell(*args, **kwargs)
    File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.
py", line 2718, in run_cell
        interactivity=interactivity, compiler=compiler, result=result)
    File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.
py", line 2822, in run_ast_nodes
        if self.run_code(code, result):
    File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.
py", line 2882, in run_code
        exec(code_obj, self.user_global_ns, self.user_ns)
    File "<ipython-input-9-4acb8ce2119a>", line 14, in <module>
        target_size= (512,512))
    File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/keras/prepro
cessing/image.py", line 1063, in flow_from_dataframe
        'to match the exact filenames in disk.', DeprecationWarning)
    File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/platform/tf_
logging.py", line 173, in warn
        get_logger().warning(msg, *args, **kwargs)
Message: 'has_ext is deprecated, filenames in the dataframe have to match the
exact filenames in disk.'
Arguments: (<class 'DeprecationWarning'>,)
--- Logging error ---
Traceback (most recent call last):
  File "/usr/lib/python3.7/logging/__init__.py", line 1025, in emit
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  File "/usr/lib/python3.7/logging/__init__.py", line 869, in format
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    record.message = record.getMessage()
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Call stack:
  File "/usr/lib/python3.7/runpy.py", line 193, in _run_module_as_main
    "__main__", mod_spec)
  File "/usr/lib/python3.7/runpy.py", line 85, in _run_code
    exec(code, run_globals)
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6, in <module>
    app.launch_new_instance()
  File "/usr/local/lib/python3.7/dist-packages/traitlets/config/application.p
y", line 845, in launch_instance
    app.start()
  File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelapp.py", line
499, in start

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        self.io_loop.start()
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line 132, in start
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        self._run_once()
    File "/usr/lib/python3.7/asyncio/base_events.py", line 1786, in _run_once
        handle._run()
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        self._context.run(self._callback, *self._args)
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        return fn(*args, **kwargs)
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ine 451, in _handle_events
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    File "/usr/local/lib/python3.7/dist-packages/ipykernel/zmqshell.py", line 5
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        return super(ZMQInteractiveShell, self).run_cell(*args, **kwargs)
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        if self.run_code(code, result):
    File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.
py", line 2882, in run_code
        exec(code_obj, self.user_global_ns, self.user_ns)
    File "<ipython-input-9-4acb8ce2119a>", line 25, in <module>
        target_size= (512,512))
```

```
File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/keras/preprocessing/image.py", line 1063, in flow_from_dataframe
    'to match the exact filenames in disk.', DeprecationWarning)
File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/platform/tf_logging.py", line 173, in warn
    get_logger().warning(msg, *args, **kwargs)
Message: 'has_ext is deprecated, filenames in the dataframe have to match the exact filenames in disk.'
Arguments: (<class 'DeprecationWarning'>,)
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    "__main__", mod_spec)
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6, in <module>
    app.launch_new_instance()
  File "/usr/local/lib/python3.7/dist-packages/traitlets/config/application.py", line 845, in launch_instance
    app.start()
  File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelapp.py", line 499, in start
    self.io_loop.start()
  File "/usr/local/lib/python3.7/dist-packages/tornado/platform/asyncio.py", line 132, in start
    self.asyncio_loop.run_forever()
  File "/usr/lib/python3.7/asyncio/base_events.py", line 541, in run_forever
    self._run_once()
  File "/usr/lib/python3.7/asyncio/base_events.py", line 1786, in _run_once
    handle._run()
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    self._context.run(self._callback, *self._args)
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    ret = callback()
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    return fn(*args, **kwargs)
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", line 535, in <lambda>
    self.io_loop.add_callback(lambda: self._handle_events(self.socket, 0))
  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", line 451, in _handle_events
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        self._run_callback(callback, msg)
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    py", line 2882, in run_code
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    record.message = record.getMessage()
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  File "/usr/lib/python3.7/runpy.py", line 193, in _run_module_as_main
    "__main__", mod_spec)
  File "/usr/lib/python3.7/runpy.py", line 85, in _run_code

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```
exec(code, run_globals)
  File "/usr/local/lib/python3.7/dist-packages/ipykernel_launcher.py", line 1
6, in <module>
    app.launch_new_instance()
      File "/usr/local/lib/python3.7/dist-packages/traitlets/config/application.p
y", line 845, in launch_instance
        app.start()
          File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelapp.py", line
499, in start
            self.io_loop.start()
              File "/usr/local/lib/python3.7/dist-packages/tornado/platform/asyncio.py",
line 132, in start
                self.asyncio_loop.run_forever()
                  File "/usr/lib/python3.7/asyncio/base_events.py", line 541, in run_forever
                    self._run_once()
                      File "/usr/lib/python3.7/asyncio/base_events.py", line 1786, in _run_once
                        handle._run()
                          File "/usr/lib/python3.7/asyncio/events.py", line 88, in _run
                            self._context.run(self._callback, *self._args)
                              File "/usr/local/lib/python3.7/dist-packages/tornado/ioloop.py", line 758,
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        ret = callback()
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            return fn(*args, **kwargs)
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          File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 451, in _handle_events
            self._handle_recv()
              File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 480, in _handle_recv
                self._run_callback(callback, msg)
                  File "/usr/local/lib/python3.7/dist-packages/zmq/eventloop/zmqstream.py", l
ine 434, in _run_callback
                    callback(*args, **kwargs)
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              File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
283, in dispatcher
                return self.dispatch_shell(stream, msg)
                  File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
233, in dispatch_shell
                    handler(stream, idents, msg)
                      File "/usr/local/lib/python3.7/dist-packages/ipykernel/kernelbase.py", line
399, in execute_request
                        user_expressions, allow_stdin)
                          File "/usr/local/lib/python3.7/dist-packages/ipykernel/ipkernel.py", line 2
08, in do_execute
                            res = shell.run_cell(code, store_history=store_history, silent=silent)
                              File "/usr/local/lib/python3.7/dist-packages/ipykernel/zmqshell.py", line 5
37, in run_cell
                                return super(ZMQInteractiveShell, self).run_cell(*args, **kwargs)
                                  File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.
py", line 2718, in run_cell
```

```
    interactivity=interactivity, compiler=compiler, result=result)
File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.py", line 2822, in run_ast_nodes
    if self.run_code(code, result):
File "/usr/local/lib/python3.7/dist-packages/IPython/core/interactiveshell.py", line 2882, in run_code
    exec(code_obj, self.user_global_ns, self.user_ns)
File "<ipython-input-9-4acb8ce2119a>", line 46, in <module>
    target_size= (512,512))
File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/keras/preprocessing/image.py", line 1063, in flow_from_dataframe
    'to match the exact filenames in disk.', DeprecationWarning)
File "/usr/local/lib/python3.7/dist-packages/tensorflow/python/platform/tf_logging.py", line 173, in warn
    get_logger().warning(msg, *args, **kwargs)
Message: 'has_ext is deprecated, filenames in the dataframe have to match the exact filenames in disk.'
Arguments: (<class 'DeprecationWarning'>,)
```

In [10]:

```
IMAGE_SIZE = [512,512]
vgg16 = VGG16(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)
```

```
Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/vgg16/vgg16_weights_tf_dim_ordering_tf_kernels_notop.h5
58892288/58889256 [=====] - 1s 0us/step
```

In [11]:

```
for layer in vgg16.layers[:11]:
    layer.trainable = False
```

```
In [12]: #Flatten
flatten = Flatten(data_format='channels_last',name='Flatten')(vgg16.output)

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

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

model = Model(inputs=vgg16.input, outputs=Out)
model.summary()
```

Model: "model"

Layer (type)	Output Shape	Param #
<hr/>		
input_1 (InputLayer)	[(None, 512, 512, 3)]	0
block1_conv1 (Conv2D)	(None, 512, 512, 64)	1792
block1_conv2 (Conv2D)	(None, 512, 512, 64)	36928
block1_pool (MaxPooling2D)	(None, 256, 256, 64)	0
block2_conv1 (Conv2D)	(None, 256, 256, 128)	73856
block2_conv2 (Conv2D)	(None, 256, 256, 128)	147584
block2_pool (MaxPooling2D)	(None, 128, 128, 128)	0
block3_conv1 (Conv2D)	(None, 128, 128, 256)	295168
block3_conv2 (Conv2D)	(None, 128, 128, 256)	590080
block3_conv3 (Conv2D)	(None, 128, 128, 256)	590080
block3_pool (MaxPooling2D)	(None, 64, 64, 256)	0
block4_conv1 (Conv2D)	(None, 64, 64, 512)	1180160
block4_conv2 (Conv2D)	(None, 64, 64, 512)	2359808
block4_conv3 (Conv2D)	(None, 64, 64, 512)	2359808
block4_pool (MaxPooling2D)	(None, 32, 32, 512)	0
block5_conv1 (Conv2D)	(None, 32, 32, 512)	2359808
block5_conv2 (Conv2D)	(None, 32, 32, 512)	2359808
block5_conv3 (Conv2D)	(None, 32, 32, 512)	2359808
block5_pool (MaxPooling2D)	(None, 16, 16, 512)	0
Flatten (Flatten)	(None, 131072)	0
FC1 (Dense)	(None, 256)	33554688
dropout (Dropout)	(None, 256)	0
FC2 (Dense)	(None, 128)	32896
dropout_1 (Dropout)	(None, 128)	0
Output (Dense)	(None, 1)	129
<hr/>		
Total params: 48,302,401		
Trainable params: 46,566,913		

Non-trainable params: 1,735,488

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

```
In [16]: 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 [17]: 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 [=====] - 286s 2s/step - loss: 0.6622 - accuracy: 0.5784 - precision_1: 0.5835 - recall_1: 0.5762 - f1_score: 0.6710 - val_loss: 0.6869 - val_accuracy: 0.5625 - val_precision_1: 0.6321 - val_recall_1: 0.2274 - val_f1_score: 0.6518

Epoch 2/50

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

114/114 [=====] - 285s 2s/step - loss: 0.6617 - accuracy: 0.5967 - precision_1: 0.6028 - recall_1: 0.5353 - f1_score: 0.6599 - val_loss: 0.7020 - val_accuracy: 0.5608 - val_precision_1: 0.6218 - val_recall_1: 0.2335 - val_f1_score: 0.6518

Epoch 3/50

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

114/114 [=====] - 285s 2s/step - loss: 0.6503 - accuracy: 0.6058 - precision_1: 0.6117 - recall_1: 0.5783 - f1_score: 0.6658 - val_loss: 0.6869 - val_accuracy: 0.5794 - val_precision_1: 0.6130 - val_recall_1: 0.3526 - val_f1_score: 0.6518

Epoch 4/50

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

114/114 [=====] - 285s 2s/step - loss: 0.6409 - accuracy: 0.6165 - precision_1: 0.6131 - recall_1: 0.6093 - f1_score: 0.6622 - val_loss: 0.7006 - val_accuracy: 0.5701 - val_precision_1: 0.6186 - val_recall_1: 0.2888 - val_f1_score: 0.6518

Epoch 5/50

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

114/114 [=====] - 286s 2s/step - loss: 0.6469 - accuracy: 0.6112 - precision_1: 0.5987 - recall_1: 0.5720 - f1_score: 0.6478 - val_loss: 0.6798 - val_accuracy: 0.6009 - val_precision_1: 0.5960 - val_recall_1: 0.5415 - val_f1_score: 0.6518

Epoch 6/50

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

114/114 [=====] - 285s 2s/step - loss: 0.6516 - accuracy: 0.6276 - precision_1: 0.6117 - recall_1: 0.6415 - f1_score: 0.6536 - val_loss: 0.7468 - val_accuracy: 0.5881 - val_precision_1: 0.6836 - val_recall_1: 0.2756 - val_f1_score: 0.6518

Epoch 7/50

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

114/114 [=====] - 284s 2s/step - loss: 0.6339 - accuracy: 0.6393 - precision_1: 0.6416 - recall_1: 0.6219 - f1_score: 0.6639 - val_loss: 0.6961 - val_accuracy: 0.6062 - val_precision_1: 0.6167 - val_recall_1: 0.4898 - val_f1_score: 0.6518

Epoch 8/50

Epoch 00008: LearningRateScheduler reducing learning rate to 9.02499959920533e-06.

114/114 [=====] - 283s 2s/step - loss: 0.6168 - accuracy: 0.6476 - precision_1: 0.6440 - recall_1: 0.6717 - f1_score: 0.6707 - val_loss: 0.7626 - val_accuracy: 0.5800 - val_precision_1: 0.6764 - val_recall_1: 0.2515 - val_f1_score: 0.6518

Epoch 9/50

Epoch 00009: LearningRateScheduler reducing learning rate to 8.573749619245064e-06.

114/114 [=====] - 286s 2s/step - loss: 0.6294 - accuracy: 0.6261 - precision_1: 0.6152 - recall_1: 0.6248 - f1_score: 0.6560 - val_loss: 0.7229 - val_accuracy: 0.5945 - val_precision_1: 0.6241 - val_recall_1: 0.4055 - val_f1_score: 0.6518

Epoch 10/50

Epoch 00010: LearningRateScheduler reducing learning rate to 8.573749255447183e-06.

114/114 [=====] - 286s 2s/step - loss: 0.6206 - accuracy: 0.6553 - precision_1: 0.6373 - recall_1: 0.7188 - f1_score: 0.6660 - val_loss: 0.7280 - val_accuracy: 0.5899 - val_precision_1: 0.6329 - val_recall_1: 0.3610 - val_f1_score: 0.6518

Epoch 11/50

Epoch 00011: LearningRateScheduler reducing learning rate to 8.573749255447183e-06.

114/114 [=====] - 292s 2s/step - loss: 0.6058 - accuracy: 0.6615 - precision_1: 0.6464 - recall_1: 0.6968 - f1_score: 0.6629 - val_loss: 0.7558 - val_accuracy: 0.5794 - val_precision_1: 0.6350 - val_recall_1: 0.3057 - val_f1_score: 0.6518

Epoch 12/50

Epoch 00012: LearningRateScheduler reducing learning rate to 8.145061792674824e-06.

114/114 [=====] - 287s 2s/step - loss: 0.6147 - accuracy: 0.6518 - precision_1: 0.6322 - recall_1: 0.6878 - f1_score: 0.6569 - val_loss: 0.8023 - val_accuracy: 0.5858 - val_precision_1: 0.6798 - val_recall_1: 0.2708 - val_f1_score: 0.6518

Epoch 13/50

Epoch 00013: LearningRateScheduler reducing learning rate to 8.145061656250618e-06.

114/114 [=====] - 284s 2s/step - loss: 0.6045 - accuracy: 0.6617 - precision_1: 0.6431 - recall_1: 0.7040 - f1_score: 0.6599 - val_loss: 0.7457 - val_accuracy: 0.5969 - val_precision_1: 0.6078 - val_recall_1: 0.4681 - val_f1_score: 0.6518

Epoch 14/50

Epoch 00014: LearningRateScheduler reducing learning rate to 8.145061656250618e-06.

114/114 [=====] - 284s 2s/step - loss: 0.6071 - accuracy: 0.6624 - precision_1: 0.6399 - recall_1: 0.7304 - f1_score: 0.6632 - val_loss: 0.8179 - val_accuracy: 0.5835 - val_precision_1: 0.6392 - val_recall_1: 0.3177 - val_f1_score: 0.6518

Epoch 15/50

Epoch 00015: LearningRateScheduler reducing learning rate to 7.73780857343808 7e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5892 - accuracy: 0.6793 - precision_1: 0.6573 - recall_1: 0.7205 - f1_score: 0.6571 - val_loss: 0.9326 - val_accuracy: 0.5794 - val_precision_1: 0.6985 - val_recall_1: 0.2286 - val_f1_score: 0.6518
Epoch 16/50

Epoch 00016: LearningRateScheduler reducing learning rate to 7.73780811869073 7e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5968 - accuracy: 0.6629 - precision_1: 0.6423 - recall_1: 0.7098 - f1_score: 0.6590 - val_loss: 1.0330 - val_accuracy: 0.5654 - val_precision_1: 0.7039 - val_recall_1: 0.1745 - val_f1_score: 0.6518
Epoch 17/50

Epoch 00017: LearningRateScheduler reducing learning rate to 7.73780811869073 7e-06.
114/114 [=====] - 280s 2s/step - loss: 0.5816 - accuracy: 0.6894 - precision_1: 0.6651 - recall_1: 0.7370 - f1_score: 0.6574 - val_loss: 0.9049 - val_accuracy: 0.5620 - val_precision_1: 0.6548 - val_recall_1: 0.1986 - val_f1_score: 0.6518
Epoch 18/50

Epoch 00018: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 281s 2s/step - loss: 0.5697 - accuracy: 0.7004 - precision_1: 0.6872 - recall_1: 0.7272 - f1_score: 0.6620 - val_loss: 0.9490 - val_accuracy: 0.5748 - val_precision_1: 0.6938 - val_recall_1: 0.2154 - val_f1_score: 0.6518
Epoch 19/50

Epoch 00019: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 283s 2s/step - loss: 0.5734 - accuracy: 0.6928 - precision_1: 0.6762 - recall_1: 0.7408 - f1_score: 0.6657 - val_loss: 0.9665 - val_accuracy: 0.5823 - val_precision_1: 0.6928 - val_recall_1: 0.2443 - val_f1_score: 0.6512
Epoch 20/50

Epoch 00020: LearningRateScheduler reducing learning rate to 7.3509177127562e -06.
114/114 [=====] - 287s 2s/step - loss: 0.5653 - accuracy: 0.7099 - precision_1: 0.6891 - recall_1: 0.7511 - f1_score: 0.6600 - val_loss: 1.1559 - val_accuracy: 0.5730 - val_precision_1: 0.7137 - val_recall_1: 0.1949 - val_f1_score: 0.6518
Epoch 21/50

Epoch 00021: LearningRateScheduler reducing learning rate to 6.98337182711838 9e-06.
114/114 [=====] - 285s 2s/step - loss: 0.5465 - accuracy: 0.7094 - precision_1: 0.6908 - recall_1: 0.7572 - f1_score: 0.6661 - val_loss: 0.9898 - val_accuracy: 0.5771 - val_precision_1: 0.6818 - val_recall_1: 0.2347 - val_f1_score: 0.6518
Epoch 22/50

Epoch 00022: LearningRateScheduler reducing learning rate to 6.98337180438102

2e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5659 - accuracy: 0.6939 - precision_1: 0.6714 - recall_1: 0.7446 - f1_score: 0.6609 - val_loss: 1.2321 - val_accuracy: 0.5620 - val_precision_1: 0.6893 - val_recall_1: 0.1709 - val_f1_score: 0.6512
Epoch 23/50

Epoch 00023: LearningRateScheduler reducing learning rate to 6.98337180438102 2e-06.
114/114 [=====] - 282s 2s/step - loss: 0.5672 - accuracy: 0.7012 - precision_1: 0.6744 - recall_1: 0.7630 - f1_score: 0.6605 - val_loss: 1.3435 - val_accuracy: 0.5590 - val_precision_1: 0.6995 - val_recall_1: 0.1540 - val_f1_score: 0.6512
Epoch 24/50

Epoch 00024: LearningRateScheduler reducing learning rate to 6.63420321416197 04e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5405 - accuracy: 0.7200 - precision_1: 0.6952 - recall_1: 0.7626 - f1_score: 0.6570 - val_loss: 1.3698 - val_accuracy: 0.5660 - val_precision_1: 0.7033 - val_recall_1: 0.1769 - val_f1_score: 0.6512
Epoch 25/50

Epoch 00025: LearningRateScheduler reducing learning rate to 6.63420314594986 85e-06.
114/114 [=====] - 284s 2s/step - loss: 0.5482 - accuracy: 0.7164 - precision_1: 0.6896 - recall_1: 0.7940 - f1_score: 0.6698 - val_loss: 1.7059 - val_accuracy: 0.5492 - val_precision_1: 0.6818 - val_recall_1: 0.1264 - val_f1_score: 0.6510
Epoch 26/50

Epoch 00026: LearningRateScheduler reducing learning rate to 6.63420314594986 85e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5228 - accuracy: 0.7372 - precision_1: 0.7128 - recall_1: 0.7769 - f1_score: 0.6575 - val_loss: 1.7614 - val_accuracy: 0.5567 - val_precision_1: 0.7041 - val_recall_1: 0.1432 - val_f1_score: 0.6512
Epoch 27/50

Epoch 00027: LearningRateScheduler reducing learning rate to 6.30249298865237 4e-06.
114/114 [=====] - 283s 2s/step - loss: 0.5223 - accuracy: 0.7534 - precision_1: 0.7271 - recall_1: 0.8004 - f1_score: 0.6606 - val_loss: 1.8117 - val_accuracy: 0.5480 - val_precision_1: 0.6709 - val_recall_1: 0.1276 - val_f1_score: 0.6517
Epoch 28/50

Epoch 00028: LearningRateScheduler reducing learning rate to 6.30249314781394 8e-06.
114/114 [=====] - 284s 2s/step - loss: 0.5324 - accuracy: 0.7322 - precision_1: 0.6962 - recall_1: 0.7977 - f1_score: 0.6546 - val_loss: 1.4870 - val_accuracy: 0.5765 - val_precision_1: 0.6900 - val_recall_1: 0.2250 - val_f1_score: 0.6510
Epoch 29/50

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

114/114 [=====] - 282s 2s/step - loss: 0.5309 - accuracy: 0.7317 - precision_1: 0.6949 - recall_1: 0.7841 - f1_score: 0.6477 - val_loss: 1.9239 - val_accuracy: 0.5492 - val_precision_1: 0.7373 - val_recall_1: 0.1047 - val_f1_score: 0.6515
Epoch 30/50

Epoch 00030: LearningRateScheduler reducing learning rate to 5.98736849042325e-06.

114/114 [=====] - 283s 2s/step - loss: 0.5293 - accuracy: 0.7200 - precision_1: 0.7010 - recall_1: 0.7690 - f1_score: 0.6679 - val_loss: 1.9024 - val_accuracy: 0.5573 - val_precision_1: 0.6750 - val_recall_1: 0.1625 - val_f1_score: 0.6512

Epoch 31/50

Epoch 00031: LearningRateScheduler reducing learning rate to 5.987368695059558e-06.

114/114 [=====] - 283s 2s/step - loss: 0.4855 - accuracy: 0.7614 - precision_1: 0.7310 - recall_1: 0.8140 - f1_score: 0.6589 - val_loss: 2.1222 - val_accuracy: 0.5486 - val_precision_1: 0.7236 - val_recall_1: 0.1071 - val_f1_score: 0.6512

Epoch 32/50

Epoch 00032: LearningRateScheduler reducing learning rate to 5.987368695059558e-06.

114/114 [=====] - 282s 2s/step - loss: 0.4998 - accuracy: 0.7396 - precision_1: 0.7206 - recall_1: 0.7918 - f1_score: 0.6721 - val_loss: 2.0558 - val_accuracy: 0.5614 - val_precision_1: 0.6791 - val_recall_1: 0.1757 - val_f1_score: 0.6517

Epoch 33/50

Epoch 00033: LearningRateScheduler reducing learning rate to 5.68800026030658e-06.

114/114 [=====] - 282s 2s/step - loss: 0.4902 - accuracy: 0.7520 - precision_1: 0.7172 - recall_1: 0.8094 - f1_score: 0.6557 - val_loss: 1.7960 - val_accuracy: 0.5695 - val_precision_1: 0.6743 - val_recall_1: 0.2118 - val_f1_score: 0.6509

Epoch 34/50

Epoch 00034: LearningRateScheduler reducing learning rate to 5.688000328518683e-06.

114/114 [=====] - 282s 2s/step - loss: 0.4965 - accuracy: 0.7509 - precision_1: 0.7086 - recall_1: 0.8154 - f1_score: 0.6509 - val_loss: 2.4818 - val_accuracy: 0.5445 - val_precision_1: 0.7400 - val_recall_1: 0.0890 - val_f1_score: 0.6506

Epoch 35/50

Epoch 00035: LearningRateScheduler reducing learning rate to 5.688000328518683e-06.

114/114 [=====] - 285s 2s/step - loss: 0.4784 - accuracy: 0.7688 - precision_1: 0.7389 - recall_1: 0.8088 - f1_score: 0.6527 - val_loss: 2.0256 - val_accuracy: 0.5666 - val_precision_1: 0.6792 - val_recall_1: 0.1961 - val_f1_score: 0.6517

Epoch 36/50

Epoch 00036: LearningRateScheduler reducing learning rate to 5.403600312092749e-06.

114/114 [=====] - 286s 2s/step - loss: 0.4831 - accu

racy: 0.7602 - precision_1: 0.7305 - recall_1: 0.8238 - f1_score: 0.6672 - val_loss: 2.0001 - val_accuracy: 0.5654 - val_precision_1: 0.6981 - val_recall_1: 0.1781 - val_f1_score: 0.6517
Epoch 37/50

Epoch 00037: LearningRateScheduler reducing learning rate to 5.40360042577958e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4791 - accuracy: 0.7739 - precision_1: 0.7453 - recall_1: 0.8198 - f1_score: 0.6587 - val_loss: 2.4203 - val_accuracy: 0.5509 - val_precision_1: 0.6686 - val_recall_1: 0.1408 - val_f1_score: 0.6519
Epoch 38/50

Epoch 00038: LearningRateScheduler reducing learning rate to 5.40360042577958e-06.
114/114 [=====] - 286s 2s/step - loss: 0.4492 - accuracy: 0.7954 - precision_1: 0.7744 - recall_1: 0.8196 - f1_score: 0.6560 - val_loss: 2.4756 - val_accuracy: 0.5602 - val_precision_1: 0.7049 - val_recall_1: 0.1552 - val_f1_score: 0.6514
Epoch 39/50

Epoch 00039: LearningRateScheduler reducing learning rate to 5.13342040449060e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4617 - accuracy: 0.7741 - precision_1: 0.7494 - recall_1: 0.8208 - f1_score: 0.6660 - val_loss: 2.1977 - val_accuracy: 0.5701 - val_precision_1: 0.6597 - val_recall_1: 0.2286 - val_f1_score: 0.6524
Epoch 40/50

Epoch 00040: LearningRateScheduler reducing learning rate to 5.13342047270271e-06.
114/114 [=====] - 288s 2s/step - loss: 0.4513 - accuracy: 0.7881 - precision_1: 0.7609 - recall_1: 0.8294 - f1_score: 0.6592 - val_loss: 2.1238 - val_accuracy: 0.5812 - val_precision_1: 0.6796 - val_recall_1: 0.2527 - val_f1_score: 0.6514
Epoch 41/50

Epoch 00041: LearningRateScheduler reducing learning rate to 5.13342047270271e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4343 - accuracy: 0.8014 - precision_1: 0.7737 - recall_1: 0.8426 - f1_score: 0.6597 - val_loss: 2.0977 - val_accuracy: 0.5777 - val_precision_1: 0.6438 - val_recall_1: 0.2828 - val_f1_score: 0.6509
Epoch 42/50

Epoch 00042: LearningRateScheduler reducing learning rate to 4.8767494449067574e-06.
114/114 [=====] - 285s 2s/step - loss: 0.4739 - accuracy: 0.7766 - precision_1: 0.7463 - recall_1: 0.8494 - f1_score: 0.6740 - val_loss: 2.8122 - val_accuracy: 0.5462 - val_precision_1: 0.6861 - val_recall_1: 0.1131 - val_f1_score: 0.6508
Epoch 43/50

Epoch 00043: LearningRateScheduler reducing learning rate to 4.8767492444312666e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4504 - accuracy: 0.7910 - precision_1: 0.7613 - recall_1: 0.8351 - f1_score: 0.6585 - va

l_loss: 2.9181 - val_accuracy: 0.5561 - val_precision_1: 0.7179 - val_recall_1: 0.1348 - val_f1_score: 0.6531
Epoch 44/50

Epoch 00044: LearningRateScheduler reducing learning rate to 4.87674924443126e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4518 - accuracy: 0.7830 - precision_1: 0.7473 - recall_1: 0.8528 - f1_score: 0.6671 - val_loss: 3.4878 - val_accuracy: 0.5451 - val_precision_1: 0.6400 - val_recall_1: 0.1348 - val_f1_score: 0.6511
Epoch 45/50

Epoch 00045: LearningRateScheduler reducing learning rate to 4.63291178220970e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4204 - accuracy: 0.8058 - precision_1: 0.7783 - recall_1: 0.8597 - f1_score: 0.6715 - val_loss: 2.8769 - val_accuracy: 0.5538 - val_precision_1: 0.6429 - val_recall_1: 0.1733 - val_f1_score: 0.6510
Epoch 46/50

Epoch 00046: LearningRateScheduler reducing learning rate to 4.63291189589654e-06.
114/114 [=====] - 288s 2s/step - loss: 0.4258 - accuracy: 0.7871 - precision_1: 0.7536 - recall_1: 0.8266 - f1_score: 0.6490 - val_loss: 3.4313 - val_accuracy: 0.5468 - val_precision_1: 0.6733 - val_recall_1: 0.1215 - val_f1_score: 0.6506
Epoch 47/50

Epoch 00047: LearningRateScheduler reducing learning rate to 4.63291189589654e-06.
114/114 [=====] - 287s 2s/step - loss: 0.4373 - accuracy: 0.8031 - precision_1: 0.7831 - recall_1: 0.8345 - f1_score: 0.6631 - val_loss: 3.1558 - val_accuracy: 0.5561 - val_precision_1: 0.6667 - val_recall_1: 0.1637 - val_f1_score: 0.6488
Epoch 48/50

Epoch 00048: LearningRateScheduler reducing learning rate to 4.40126630110171e-06.
114/114 [=====] - 293s 2s/step - loss: 0.4249 - accuracy: 0.7988 - precision_1: 0.7698 - recall_1: 0.8426 - f1_score: 0.6614 - val_loss: 3.0520 - val_accuracy: 0.5492 - val_precision_1: 0.6609 - val_recall_1: 0.1384 - val_f1_score: 0.6509
Epoch 49/50

Epoch 00049: LearningRateScheduler reducing learning rate to 4.40126632383908e-06.
114/114 [=====] - 290s 2s/step - loss: 0.3898 - accuracy: 0.8152 - precision_1: 0.7866 - recall_1: 0.8452 - f1_score: 0.6500 - val_loss: 2.6486 - val_accuracy: 0.5573 - val_precision_1: 0.6316 - val_recall_1: 0.2022 - val_f1_score: 0.6508
Epoch 50/50

Epoch 00050: LearningRateScheduler reducing learning rate to 4.40126632383908e-06.
114/114 [=====] - 293s 2s/step - loss: 0.4163 - accuracy: 0.8121 - precision_1: 0.7789 - recall_1: 0.8680 - f1_score: 0.6641 - va

```
l_loss: 3.4158 - val_accuracy: 0.5492 - val_precision_1: 0.6667 - val_recall_
1: 0.1348 - val_f1_score: 0.6508
```

In [18]:

```
model_checkpoint = Model(inputs=vgg16.input, outputs=Out)
model_checkpoint.load_weights('/content/model_save/weights-05-0.6009.h5')
model_checkpoint.save('bestmodel.h5')
new_model = tf.keras.models.load_model('bestmodel.h5')
```

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

In [19]:

```
test_prediction=new_model.predict_generator(test_prediction_generator,steps=le
n(test_prediction_generator),workers=12)
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[19]: (1719,)

In [20]:

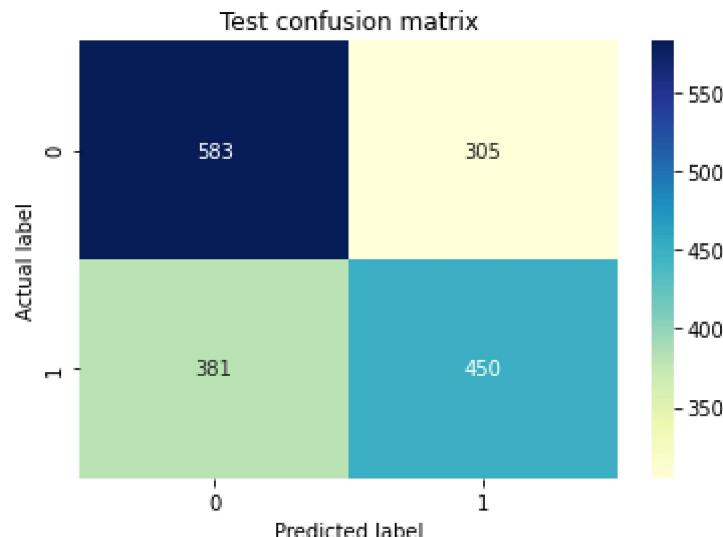
```
accuracy=accuracy_score(y_test,test_prediction)
print("Test accuracy_score",accuracy)
f1_test_score=f1_score(y_test,test_prediction)
print("Test F1_score",f1_test_score)
print("Test confusion matrix")
cnf_matrix2=confusion_matrix(y_test,test_prediction)
p = sns.heatmap(pd.DataFrame(cnf_matrix2), 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 0.6009307737056429

Test F1_score 0.5674653215636822

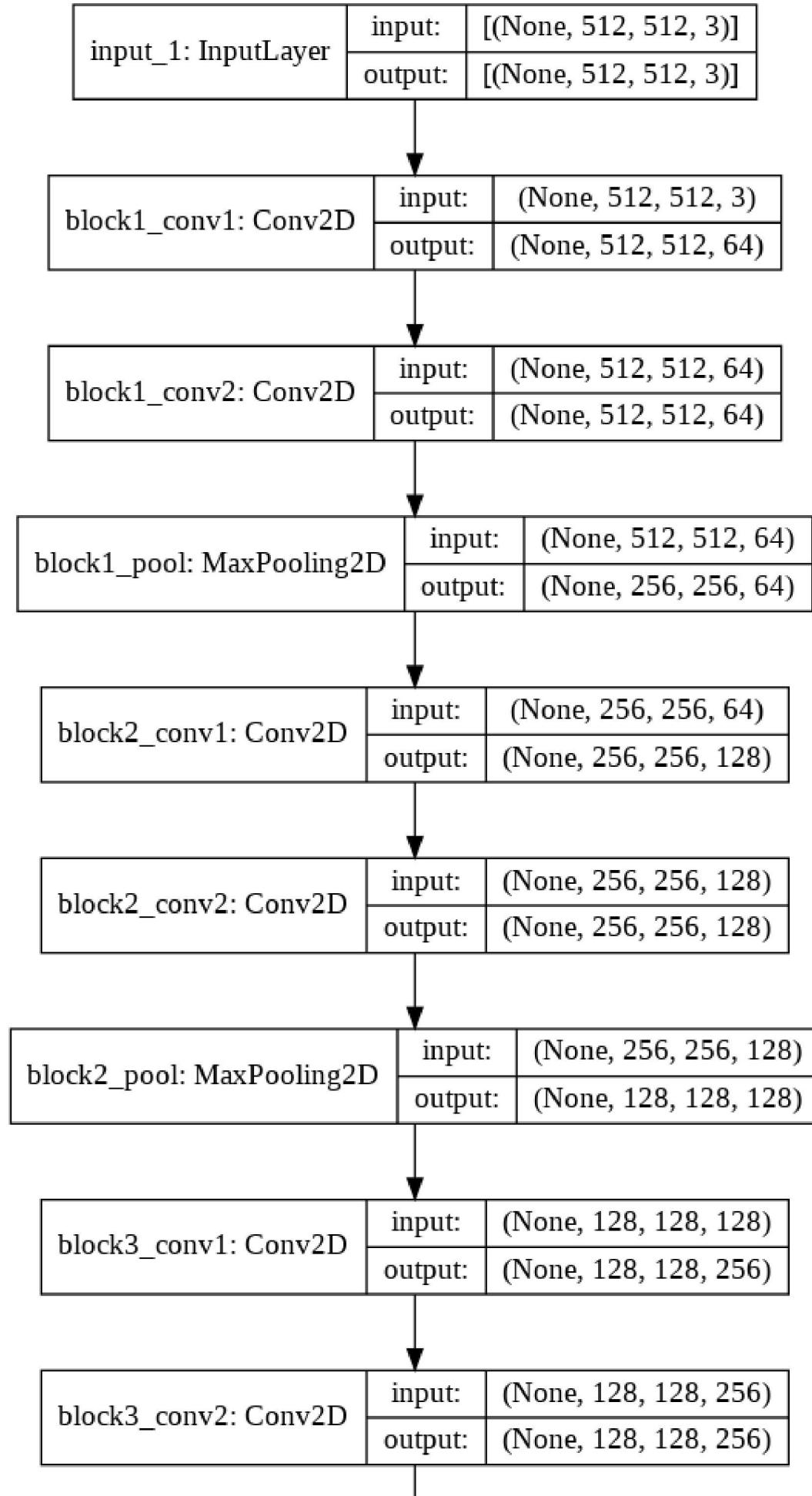
Test confusion matrix

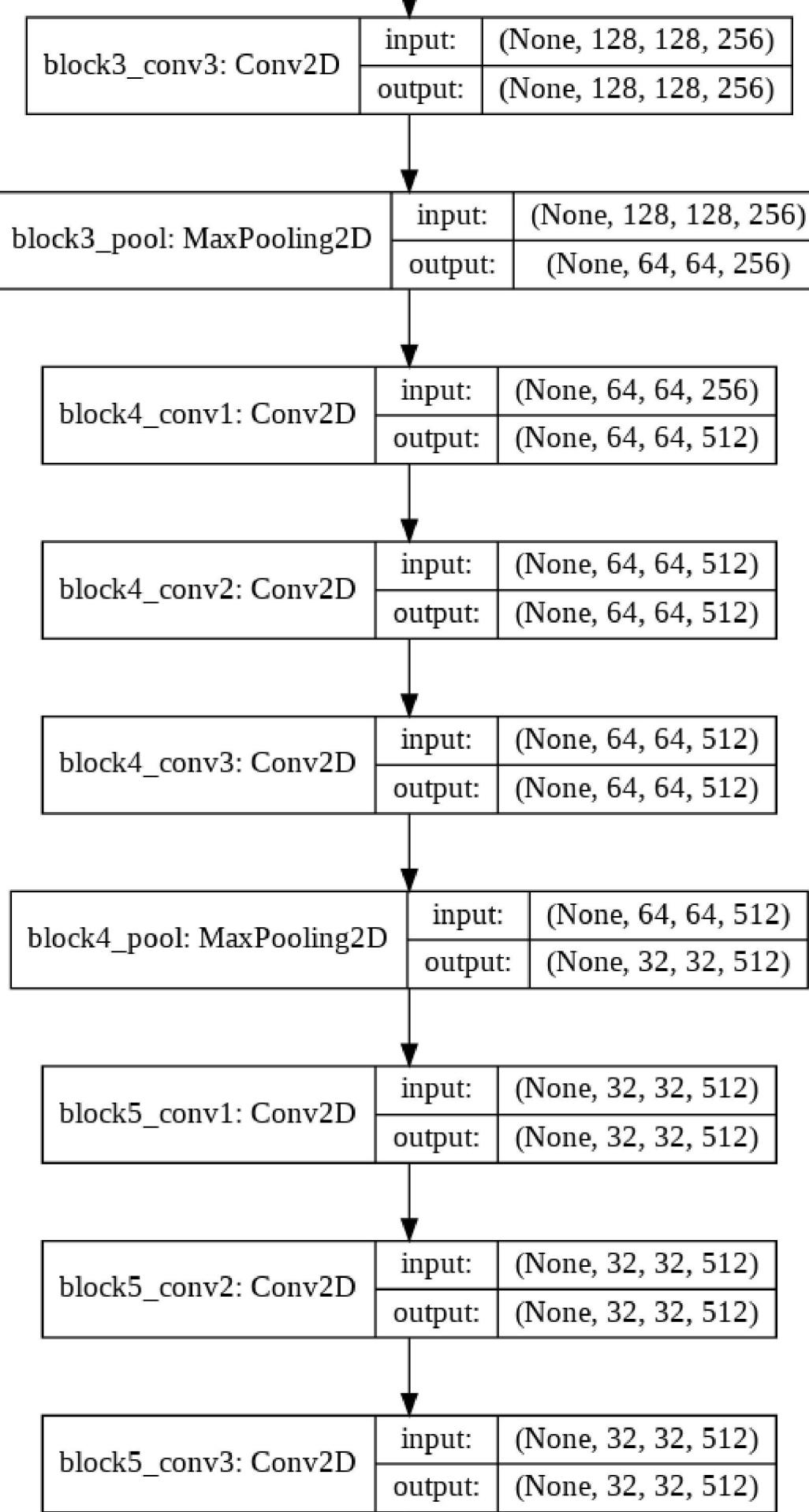
Out[20]: Text(0.5, 15.0, 'Predicted label')

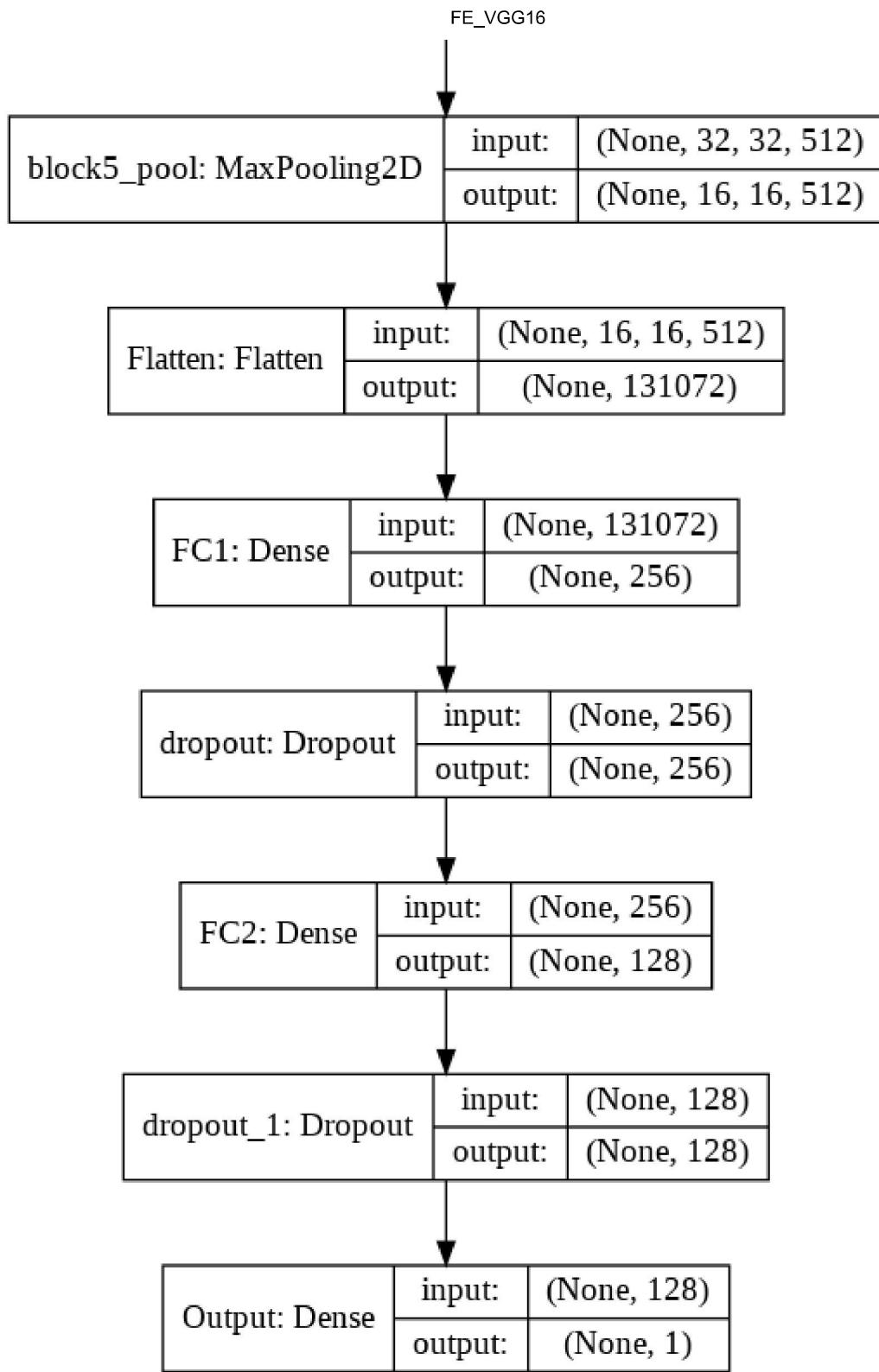


```
In [21]: file = '/content/model_1.png'  
tf.keras.utils.plot_model(model,to_file=file, show_shapes=True)
```

Out[21]:







Performance

simple convolution model - Accuracy : 0.5101 , F1_score :0.4028

Istm model - Accuracy : 0.5439 , F1_score :0.5037

simple conv with Istm model- Accuracy : 0.5107, F1_score : 0.0927

VGG16 with lstm : Accuracy :0.5340 , F1_score 0.3206

VGG19 with lstm: Accuracy :0.5340 , F1_score :0.1633

Resnet with lstm: Accuracy :0.5218 , F1_score: 0.0743

VGG16 with imagesize(299,299) : Accuracy: 0.4892, F1_score: 0.5378

VGG19 : Accuracy: 0.4863, F1_score: 0.4997

VGG16 with imagesize(156,156) : Accuracy: 0.5596 , F1_score: 0.5112

VGG16 with imagesize(256,256) : Accuracy: 0.5049, F1_score: 0.5020

VGG16 with imagesize(512,512) : Accuracy: 0.6009, F1_score: 0.5674

Conclusion

model with VGG16 image size (156,156) or (512,512) performs well than others models