

## Model Development Phase Template

Date	15 April 2024
Team ID	738181
Project Title	CRIME VISION: ADVANCED CRIME CLASSIFICATION WITH DEEP LEARNING.
Maximum Marks	10 Marks

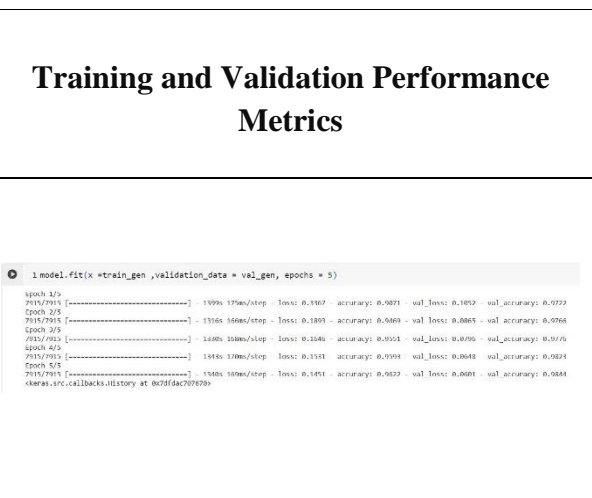
### Initial Model Training Code, Model Validation and Evaluation Report

The initial model training code will be showcased in the future through a screenshot. The model validation and evaluation report will include a summary and training and validation performance metrics for multiple models, presented through respective screenshots.

### Initial Model Training Code (5 marks):

Paste the screenshot of the model training code

### Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																											
DenseNet121	<p>Model: "sequential_3"</p> <table border="1"> <thead> <tr> <th>Layer (Type)</th> <th>Output Shape</th> <th>Param #</th> </tr> </thead> <tbody> <tr> <td>densenet121 (Functional)</td> <td>(None, 2, 2, 1024)</td> <td>7037504</td> </tr> <tr> <td>global_average_pooling2d_3 (GlobalAveragePooling2D)</td> <td>(None, 1024)</td> <td>0</td> </tr> <tr> <td>dense_12 (Dense)</td> <td>(None, 256)</td> <td>262400</td> </tr> <tr> <td>dropout_6 (Dropout)</td> <td>(None, 256)</td> <td>0</td> </tr> <tr> <td>dense_13 (Dense)</td> <td>(None, 512)</td> <td>131584</td> </tr> <tr> <td>dropout_7 (Dropout)</td> <td>(None, 512)</td> <td>0</td> </tr> <tr> <td>dense_14 (Dense)</td> <td>(None, 1024)</td> <td>525312</td> </tr> <tr> <td>dense_15 (Dense)</td> <td>(None, 14)</td> <td>14350</td> </tr> </tbody> </table> <p>             Total params: 7971150 (30.41 MB)              Trainable params: 933646 (3.56 MB)              Non-trainable params: 7037504 (26.85 MB)         </p>	Layer (Type)	Output Shape	Param #	densenet121 (Functional)	(None, 2, 2, 1024)	7037504	global_average_pooling2d_3 (GlobalAveragePooling2D)	(None, 1024)	0	dense_12 (Dense)	(None, 256)	262400	dropout_6 (Dropout)	(None, 256)	0	dense_13 (Dense)	(None, 512)	131584	dropout_7 (Dropout)	(None, 512)	0	dense_14 (Dense)	(None, 1024)	525312	dense_15 (Dense)	(None, 14)	14350	 <pre> 1 model.fit(x=train_gen, validation_data=val_gen, epochs=5)  Epoch 1/5 7915/7915 [-----] - 159s 179ms/step - loss: 0.5167 - accuracy: 0.9871 - val_loss: 0.1852 - val_accuracy: 0.9722 Epoch 2/5 7915/7915 [-----] - 134s 166ms/step - loss: 0.1803 - accuracy: 0.9869 - val_loss: 0.0865 - val_accuracy: 0.9768 Epoch 3/5 7915/7915 [-----] - 148s 168ms/step - loss: 0.1546 - accuracy: 0.9951 - val_loss: 0.0795 - val_accuracy: 0.9776 Epoch 4/5 7915/7915 [-----] - 148s 170ms/step - loss: 0.1331 - accuracy: 0.9998 - val_loss: 0.0641 - val_accuracy: 0.9824 Epoch 5/5 7915/7915 [-----] - 150s 169ms/step - loss: 0.1451 - accuracy: 0.9933 - val_loss: 0.0601 - val_accuracy: 0.9844 keras.src.callbacks.history at 0c79fdac707970         </pre>
Layer (Type)	Output Shape	Param #																											
densenet121 (Functional)	(None, 2, 2, 1024)	7037504																											
global_average_pooling2d_3 (GlobalAveragePooling2D)	(None, 1024)	0																											
dense_12 (Dense)	(None, 256)	262400																											
dropout_6 (Dropout)	(None, 256)	0																											
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dropout_7 (Dropout)	(None, 512)	0																											
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# Xception

```
[1] model = create_model()
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

Downloading data from https://storage.googleapis.com/keras-applications/xception_weights_tf_dim_ordering_tf_data_format.h5
Model: 'model'
```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	(None, 224, 224, 3)	0	[-]
block1_conv1 (Conv2D)	(None, 114, 114, 32)	864	['input_1[0][0]']
block1_conv1_bn (BatchNormalisation)	(None, 114, 114, 32)	128	['block1_conv1[0][0]']
block1_conv1_act (Activation)	(None, 114, 114, 32)	0	['block1_conv1_bn[0][0]']
block1_conv2 (Conv2D)	(None, 112, 112, 64)	18432	['block1_conv1_act[0]']
block1_conv2_bn (BatchNormalisation)	(None, 112, 112, 64)	256	['block1_conv2[0][0]']
block1_conv2_act (Activation)	(None, 112, 112, 64)	0	['block1_conv2_bn[0][0]']
block1_sepconv1 (Separable Conv2D)	(None, 112, 112, 128)	8704	['block1_conv2_act[0]']

```
[14] history = model.fit(x = train_gen, validation_data=val_gen, epochs = EPOCHS)

Epoch 1/5
7915/7915 [=====] - loss: 1.3526 - auc: 0.8975 - val_loss: 0.9683 - val_auc: 0.9518
Epoch 2/5
7915/7915 [=====] - loss: 1.0138 - auc: 0.9434 - val_loss: 0.8881 - val_auc: 0.9632
Epoch 3/5
7915/7915 [=====] - loss: 0.9272 - auc: 0.9531 - val_loss: 0.8346 - val_auc: 0.9679
Epoch 4/5
7915/7915 [=====] - loss: 0.8765 - auc: 0.9581 - val_loss: 0.8032 - val_auc: 0.9706
Epoch 5/5
7915/7915 [=====] - loss: 0.8419 - auc: 0.9627 - val_loss: 0.7792 - val_auc: 0.9725
```

# VGG16

```
vgg16.summary()
Model: 'model'
```

Layer (type)	Output Shape	Param #
input_1 (InputLayer)	(None, 224, 224, 3)	0
block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792
block1_conv2 (Conv2D)	(None, 224, 224, 64)	36832
block1_pool (MaxPooling2D)	(None, 112, 112, 64)	0
block2_conv1 (Conv2D)	(None, 112, 112, 128)	73856
block2_conv2 (Conv2D)	(None, 112, 112, 128)	147584
block2_pool (MaxPooling2D)	(None, 56, 56, 128)	0
block3_conv1 (Conv2D)	(None, 56, 56, 256)	293568
block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080
block3_conv3 (Conv2D)	(None, 56, 56, 256)	590080
block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0
block4_conv1 (Conv2D)	(None, 28, 28, 512)	1180160

```
model.fit(x = train_set, validation_data=val_set, epochs=1, callbacks=[early_stopping])

5066/5066 [=====] - 5809% 1s/step - loss: 0.2620 - accuracy: 0.9678 - val_loss: 0.2122 - val_accuracy: 0.9937
keras.src.callbacks.History at 0x7c0e6d1c70d0
```

# ResNet50

```
model1 = create_model_1()
model1.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

Model: 'model_1'
```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	(None, 224, 224, 3)	0	[-]
conv1_pad (ZeroPadding2D)	(None, 238, 238, 3)	0	['input_1[0][0]']
conv1_conv (Conv2D)	(None, 112, 112, 64)	9472	['conv1_pad[0][0]']
conv1_bn (BatchNormalisation)	(None, 112, 112, 64)	256	['conv1_conv[0][0]']
conv1_relu (Activation)	(None, 112, 112, 64)	0	['conv1_bn[0][0]']
pool1_pad (ZeroPadding2D)	(None, 114, 114, 64)	0	['conv1_relu[0][0]']
pool1_pool (MaxPooling2D)	(None, 56, 56, 64)	0	['pool1_pad[0][0]']
conv2_block1_1_conv (Conv2D)	(None, 56, 56, 64)	4160	['pool1_pool[0][0]']
conv2_block1_1_bn (BatchNormalisation)	(None, 56, 56, 64)	256	['conv2_block1_1_conv[0][0]']
conv2_block1_1_relu (Activation)	(None, 56, 56, 64)	0	['conv2_block1_1_bn[0][0]']

```
model1.fit(x = train_generator, validation_data=test_generator, epochs=5, callbacks = [early_stopping])

Epoch 1/5
118/315 [=====] - ETA: 3:38:37 - loss: 4.0115 - accuracy: 0.3672
```