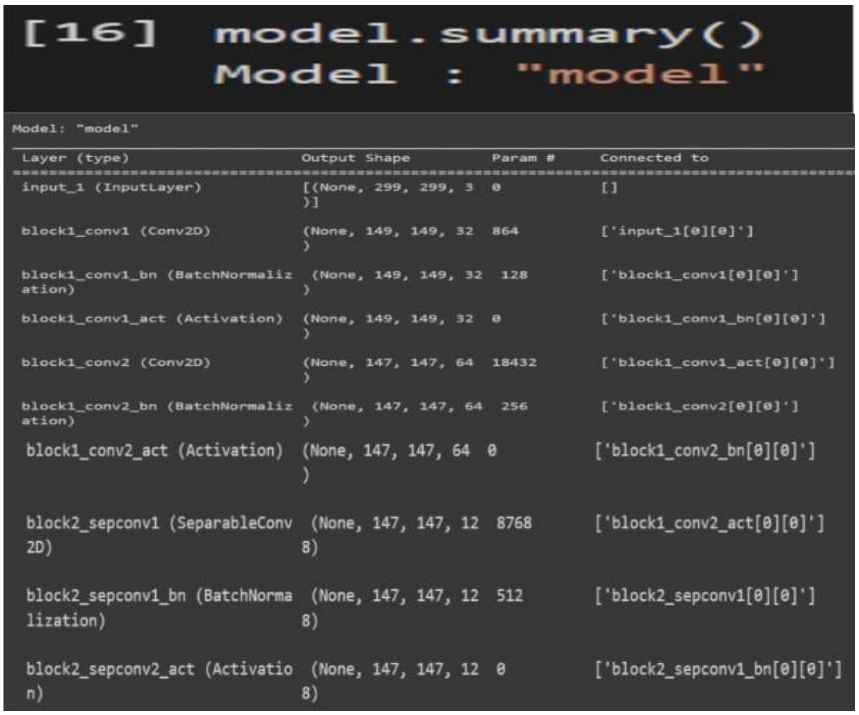
Project Development Phase
Model Performance Test

Date	17 November
Team ID	PNT2022TMID52149
Project Name	Deep learning fundus image analysis for early detection of diabetic retinopathy
Maximum Marks	10 marks

Model performance testing:

s.no	Parameter	values	screenshot
1.	Model summary		

```
[16] model.summary()
Model : "model"
```

```
Model: "model"
_________________________________________________________________
 Layer (type)                Output Shape              Param #   Connected to
=================================================================
 input_1 (InputLayer)        [(None, 299, 299, 3)]     0         []

 block1_conv1 (Conv2D)       (None, 149, 149, 32)      864       ['input_1[0][0]']

 block1_conv1_bn (BatchNormaliz  (None, 149, 149, 32)  128       ['block1_conv1[0][0]']
 ation)

 block1_conv1_act (Activation)  (None, 149, 149, 32)   0         ['block1_conv1_bn[0][0]']

 block1_conv2 (Conv2D)       (None, 147, 147, 64)      18432     ['block1_conv1_act[0][0]']

 block1_conv2_bn (BatchNormaliz  (None, 147, 147, 64)  256       ['block1_conv2[0][0]']
 ation)

 block1_conv2_act (Activation)  (None, 147, 147, 64)   0         ['block1_conv2_bn[0][0]']

 block2_sepconv1 (SeparableConv  (None, 147, 147, 128)  8768     ['block1_conv2_act[0][0]']
 2D)

 block2_sepconv1_bn (BatchNorma  (None, 147, 147, 128)  512       ['block2_sepconv1[0][0]']
 lization)

 block2_sepconv2_act (Activatio  (None, 147, 147, 128)  0         ['block2_sepconv1_bn[0][0]']
 n)
```

		-	block2_sepconv2 (SeparableConv 2D) (None, 147, 147, 128) 17536 ['block2_sepconv2_act[0][0]'] block2_sepconv2_bn (BatchNormalization) (None, 147, 147, 128) 512 ['block2_sepconv2[0][0]'] conv2d (Conv2D) (None, 74, 74, 128) 8192 ['block1_conv2_act[0][0]'] block2_pool (MaxPooling2D) (None, 74, 74, 128) 0 ['block2_sepconv2_bn[0][0]'] batch_normalization (BatchNormalization) (None, 74, 74, 128) 512 ['conv2d[0][0]'] add (Add) (None, 74, 74, 128) 0 ['block2_pool[0][0]', 'batch_normalization[0][0]'] block3_sepconv1_act (Activation) (None, 74, 74, 128) 0 ['add[0][0]'] block3_sepconv1 (SeparableConv 2D) (None, 74, 74, 256) 33920 ['block3_sepconv1_act[0][0]'] block3_sepconv1_bn (BatchNormalization) (None, 74, 74, 256) 1024 ['block3_sepconv1[0][0]'] block3_sepconv2_act (Activation) (None, 74, 74, 256) 0 ['block3_sepconv1_bn[0][0]'] block3_sepconv2 (SeparableConv 2D) (None, 74, 74, 256) 67840 ['block3_sepconv2_act[0][0]'] block3_sepconv2_bn (BatchNormalization) (None, 74, 74, 256) 1024 ['block3_sepconv2[0][0]'] conv2d_1 (Conv2D) (None, 37, 37, 256) 32768 ['add[0][0]'] block3_pool (MaxPooling2D) (None, 37, 37, 256) 0 ['block3_sepconv2_bn[0][0]'] batch_normalization_1 (BatchNormalization) (None, 37, 37, 256) 1024 ['conv2d_1[0][0]']

			add_1 (Add) (None, 37, 37, 256) 0 ['block3_pool[0][0]', 'batch_normalization_1[0][0]'] block4_sepconv1_act (Activation) (None, 37, 37, 256) 0 ['add_1[0][0]'] block4_sepconv1 (SeparableConv2D) (None, 37, 37, 728) 188672 ['block4_sepconv1_act[0][0]'] block4_sepconv1_bn (BatchNormalization) (None, 37, 37, 728) 2912 ['block4_sepconv1[0][0]'] block4_sepconv2_act (Activation) (None, 37, 37, 728) 0 ['block4_sepconv1_bn[0][0]'] block4_sepconv2 (SeparableConv2D) (None, 37, 37, 728) 536536 ['block4_sepconv2_act[0][0]'] block4_sepconv2_bn (BatchNormalization) (None, 37, 37, 728) 2912 ['block4_sepconv2[0][0]'] conv2d_2 (Conv2D) (None, 19, 19, 728) 186368 ['add_1[0][0]'] block4_pool (MaxPooling2D) (None, 19, 19, 728) 0 ['block4_sepconv2_bn[0][0]'] batch_normalization_2 (BatchNormalization) (None, 19, 19, 728) 2912 ['conv2d_2[0][0]'] add_2 (Add) (None, 19, 19, 728) 0 ['block4_pool[0][0]', 'batch_normalization_2[0][0]'] block5_sepconv1_act (Activation) (None, 19, 19, 728) 0 ['add_2[0][0]'] block5_sepconv1 (SeparableConv2D) (None, 19, 19, 728) 536536 ['block5_sepconv1_act[0][0]'] block5_sepconv1_bn (BatchNormalization) (None, 19, 19, 728) 2912 ['block5_sepconv1[0][0]'] block5_sepconv2_act (Activation) (None, 19, 19, 728) 0 ['block5_sepconv1_bn[0][0]'] block5_sepconv2 (SeparableConv2D) (None, 19, 19, 728) 536536 ['block5_sepconv2_act[0][0]']

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block5_sepconv2_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block5_sepconv2[0][0]']
lization)

block5_sepconv3_act (Activatio  (None, 19, 19, 728)  0         ['block5_sepconv2_bn[0][0]']
n)

block5_sepconv3 (SeparableConv  (None, 19, 19, 728)  536536    ['block5_sepconv3_act[0][0]']
2D)

block5_sepconv3_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block5_sepconv3[0][0]']
lization)

add_3 (Add)                     (None, 19, 19, 728)  0         ['block5_sepconv3_bn[0][0]',
                                                                'add_2[0][0]']

block6_sepconv1_act (Activatio  (None, 19, 19, 728)  0         ['add_3[0][0]']
n)

block6_sepconv1 (SeparableConv  (None, 19, 19, 728)  536536    ['block6_sepconv1_act[0][0]']
2D)

block6_sepconv1_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block6_sepconv1[0][0]']
lization)

block6_sepconv2_act (Activatio  (None, 19, 19, 728)  0         ['block6_sepconv1_bn[0][0]']
n)

block6_sepconv2 (SeparableConv  (None, 19, 19, 728)  536536    ['block6_sepconv2_act[0][0]']
2D)

block6_sepconv2_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block6_sepconv2[0][0]']
lization)

block6_sepconv3_act (Activatio  (None, 19, 19, 728)  0         ['block6_sepconv2_bn[0][0]']
n)

block6_sepconv3 (SeparableConv  (None, 19, 19, 728)  536536    ['block6_sepconv3_act[0][0]']
2D)
```

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block6_sepconv2_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block6_sepconv2[0][0]']
lization)

block6_sepconv3_act (Activatio  (None, 19, 19, 728)  0         ['block6_sepconv2_bn[0][0]']
n)

block6_sepconv3 (SeparableConv  (None, 19, 19, 728)  536536    ['block6_sepconv3_act[0][0]']
2D)

block6_sepconv3_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block6_sepconv3[0][0]']
lization)

add_4 (Add)                     (None, 19, 19, 728)  0         ['block6_sepconv3_bn[0][0]',
                                                                'add_3[0][0]']

block7_sepconv1_act (Activatio  (None, 19, 19, 728)  0         ['add_4[0][0]']
n)

block7_sepconv1 (SeparableConv  (None, 19, 19, 728)  536536    ['block7_sepconv1_act[0][0]']
2D)

block7_sepconv1_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block7_sepconv1[0][0]']
lization)

block7_sepconv2_act (Activatio  (None, 19, 19, 728)  0         ['block7_sepconv1_bn[0][0]']
n)

block7_sepconv2 (SeparableConv  (None, 19, 19, 728)  536536    ['block7_sepconv2_act[0][0]']
2D)

block7_sepconv2_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block7_sepconv2[0][0]']
lization)

block7_sepconv3_act (Activatio  (None, 19, 19, 728)  0         ['block7_sepconv2_bn[0][0]']
n)

block7_sepconv3 (SeparableConv  (None, 19, 19, 728)  536536    ['block7_sepconv3_act[0][0]']
2D)

block7_sepconv3_bn (BatchNorma  (None, 19, 19, 728)  2912      ['block7_sepconv3[0][0]']
lization)

add_5 (Add)                     (None, 19, 19, 728)  0         ['block7_sepconv3_bn[0][0]',
                                                                'add_4[0][0]']
```
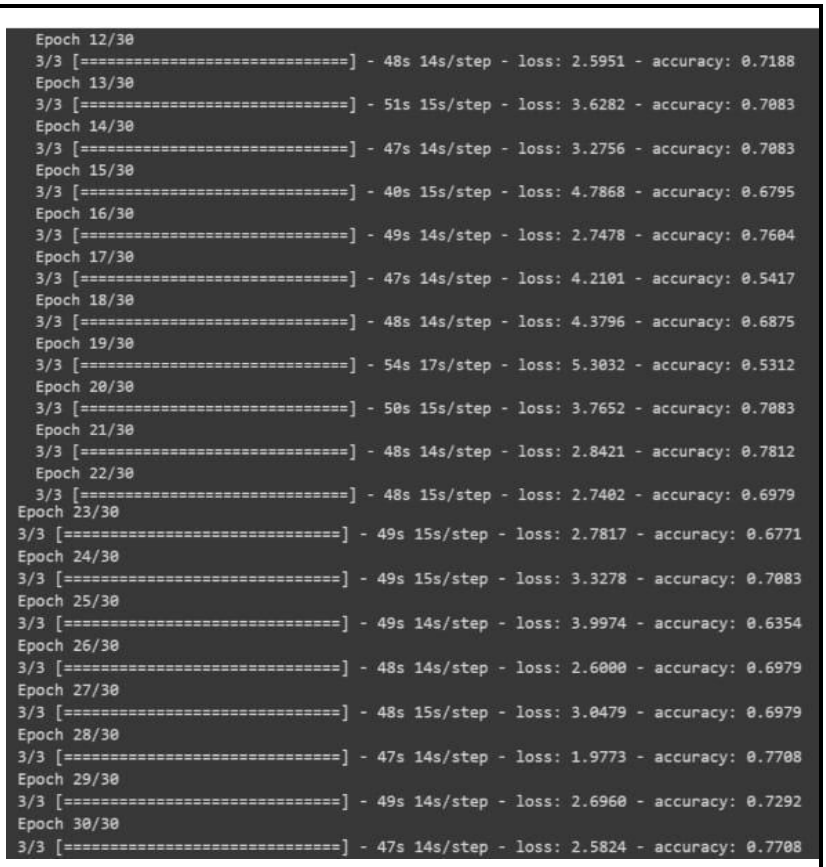

```
add_11 (Add)                    (None, 10, 10, 1024  0           ['block13_pool[0][0]',
                                )                                 'batch_normalization_3[0][0]']

block14_sepconv1 (SeparableCon  (None, 10, 10, 1536  1582080     ['add_11[0][0]']
v2D)                            )

block14_sepconv1_bn (BatchNorm  (None, 10, 10, 1536  6144        ['block14_sepconv1[0][0]']
alization)                      )

block14_sepconv1_act (Activati  (None, 10, 10, 1536  0           ['block14_sepconv1_bn[0][0]']
on)                             )

block14_sepconv2 (SeparableCon  (None, 10, 10, 2048  3159552     ['block14_sepconv1_act[0][0]']
v2D)                            )

block14_sepconv2_bn (BatchNorm  (None, 10, 10, 2048  8192        ['block14_sepconv2[0][0]']
alization)                      )

block14_sepconv2_act (Activati  (None, 10, 10, 2048  0           ['block14_sepconv2_bn[0][0]']
on)                             )

flatten (Flatten)               (None, 204800)       0           ['block14_sepconv2_act[0][0]']

dense (Dense)                   (None, 5)            1024005     ['flatten[0][0]']

==================================================================================================
Total params: 21,885,485
Trainable params: 1,024,005
Non-trainable params: 20,861,480
__________________________________________________________________________________________________
```

```
block8_sepconv1_act (Activatio  (None, 19, 19, 728)  0           ['add_5[0][0]']
n)

block8_sepconv1 (SeparableConv  (None, 19, 19, 728)  536536      ['block8_sepconv1_act[0][0]']
2D)

block8_sepconv1_bn (BatchNorma  (None, 19, 19, 728)  2912        ['block8_sepconv1[0][0]']
lization)

block8_sepconv2_act (Activatio  (None, 19, 19, 728)  0           ['block8_sepconv1_bn[0][0]']
n)

block8_sepconv2 (SeparableConv  (None, 19, 19, 728)  536536      ['block8_sepconv2_act[0][0]']
2D)

block8_sepconv2_bn (BatchNorma  (None, 19, 19, 728)  2912        ['block8_sepconv2[0][0]']
lization)

block8_sepconv3_act (Activatio  (None, 19, 19, 728)  0           ['block8_sepconv2_bn[0][0]']
n)
```

2.	Accuracy	Training Accuracy - Validation Accuracy -	

```
# fit the model

r = model.fit_generator(
  training_set,
  validation_data=test_set,
  epochs=30,
  steps_per_epoch=len (training_set)//32,
  validation_steps=len(test_set)//32
)
```

```
Epoch 1/30
3/3 [==============================] - 58s 17s/step - loss: 12.1428 - accuracy: 0.3229
Epoch 2/30
3/3 [==============================] - 50s 14s/step - loss: 10.8191 - accuracy: 0.5521
Epoch 3/30
3/3 [==============================] - 51s 16s/step - loss: 9.6766 - accuracy: 0.4688
Epoch 4/30
3/3 [==============================] - 51s 16s/step - loss: 7.3417 - accuracy: 0.5833
Epoch 5/30
3/3 [==============================] - 49s 14s/step - loss: 5.9892 - accuracy: 0.5208
Epoch 6/30
3/3 [==============================] - 47s 14s/step - loss: 4.0807 - accuracy: 0.6771
Epoch 7/30
3/3 [==============================] - 49s 15s/step - loss: 3.9948 - accuracy: 0.6562
Epoch 8/30
3/3 [==============================] - 49s 15s/step - loss: 4.0479 - accuracy: 0.6250
Epoch 9/30
3/3 [==============================] - 50s 15s/step - loss: 4.3574 - accuracy: 0.6458
Epoch 10/30
3/3 [==============================] - 50s 15s/step - loss: 3.7197 - accuracy: 0.6146
Epoch 11/30
3/3 [==============================] - 47s 14s/step - loss: 5.1180 - accuracy: 0.5625
```

			
3.	Confidence Score(Only Yolo Projects)	Class Detected - Confidence Score -	NA