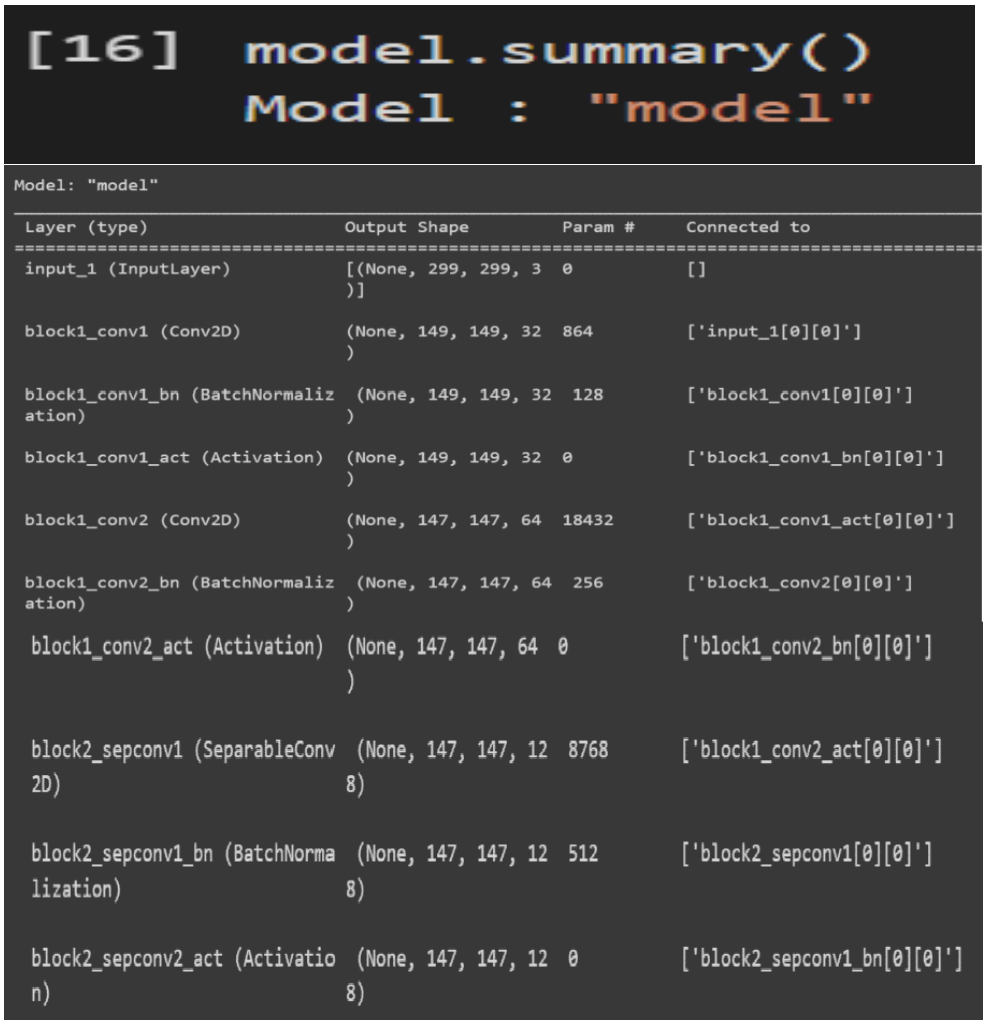
Project Development Phase
Model Performance Test

Date	17 November 2022
Team ID	PNT2022TMID37928
Project Name	Deep Learning Fundus Image Analysis for Early Detection of Diabetic Retinopathy
Maximum Marks	10 Marks

Model Performance Testing:

Project team shall fill the following information in model performance testing template.

S.No.	Parameter	Values	Screenshot
1.	Model Summary	-	

```
block2_sepconv2 (SeparableConv  (None, 147, 147, 12  17536      ['block2_sepconv2_act[0][0]']
2D)                             8)

block2_sepconv2_bn (BatchNorma  (None, 147, 147, 12  512        ['block2_sepconv2[0][0]']
lization)                       8)

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 (BatchNorm  (None, 74, 74, 128)  512        ['conv2d[0][0]']
alization)

add (Add)                       (None, 74, 74, 128)  0          ['block2_pool[0][0]',
                                                                 'batch_normalization[0][0]']

block3_sepconv1_act (Activatio  (None, 74, 74, 128)  0          ['add[0][0]']
n)

block3_sepconv1 (SeparableConv  (None, 74, 74, 256)  33920      ['block3_sepconv1_act[0][0]']
2D)

block3_sepconv1_bn (BatchNorma  (None, 74, 74, 256)  1024       ['block3_sepconv1[0][0]']
lization)

block3_sepconv2_act (Activatio  (None, 74, 74, 256)  0          ['block3_sepconv1_bn[0][0]']
n)

block3_sepconv2 (SeparableConv  (None, 74, 74, 256)  67840      ['block3_sepconv2_act[0][0]']
2D)

block3_sepconv2_bn (BatchNorma  (None, 74, 74, 256)  1024       ['block3_sepconv2[0][0]']
lization)

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 (BatchNo  (None, 37, 37, 256)  1024       ['conv2d_1[0][0]']
rmalization)
```

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add_1 (Add)                    (None, 37, 37, 256)  0           ['block3_pool[0][0]',
                                                                 'batch_normalization_1[0][0]']

block4_sepconv1_act (Activatio  (None, 37, 37, 256)  0          ['add_1[0][0]']
n)

block4_sepconv1 (SeparableConv  (None, 37, 37, 728)  188672     ['block4_sepconv1_act[0][0]']
2D)

block4_sepconv1_bn (BatchNorma  (None, 37, 37, 728)  2912       ['block4_sepconv1[0][0]']
lization)

block4_sepconv2_act (Activatio  (None, 37, 37, 728)  0          ['block4_sepconv1_bn[0][0]']
n)

block4_sepconv2 (SeparableConv  (None, 37, 37, 728)  536536     ['block4_sepconv2_act[0][0]']
2D)

block4_sepconv2_bn (BatchNorma  (None, 37, 37, 728)  2912       ['block4_sepconv2[0][0]']
lization)

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 (BatchNo  (None, 19, 19, 728)  2912      ['conv2d_2[0][0]']
rmalization)

add_2 (Add)                    (None, 19, 19, 728)  0          ['block4_pool[0][0]',
                                                                 'batch_normalization_2[0][0]']

block5_sepconv1_act (Activatio  (None, 19, 19, 728)  0          ['add_2[0][0]']
n)

block5_sepconv1 (SeparableConv  (None, 19, 19, 728)  536536     ['block5_sepconv1_act[0][0]']
2D)

block5_sepconv1_bn (BatchNorma  (None, 19, 19, 728)  2912       ['block5_sepconv1[0][0]']
lization)

block5_sepconv2_act (Activatio  (None, 19, 19, 728)  0          ['block5_sepconv1_bn[0][0]']
n)

block5_sepconv2 (SeparableConv  (None, 19, 19, 728)  536536     ['block5_sepconv2_act[0][0]']
2D)
```

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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]']
```

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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)
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```
 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
__________________________________________________________________________________________________
```

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
```

```
Epoch 12/30
3/3 [==============================] - 48s 14s/step - loss: 2.5951 - accuracy: 0.7188
Epoch 13/30
3/3 [==============================] - 51s 15s/step - loss: 3.6282 - accuracy: 0.7083
Epoch 14/30
3/3 [==============================] - 47s 14s/step - loss: 3.2756 - accuracy: 0.7083
Epoch 15/30
3/3 [==============================] - 40s 15s/step - loss: 4.7868 - accuracy: 0.6795
Epoch 16/30
3/3 [==============================] - 49s 14s/step - loss: 2.7478 - accuracy: 0.7604
Epoch 17/30
3/3 [==============================] - 47s 14s/step - loss: 4.2101 - accuracy: 0.5417
Epoch 18/30
3/3 [==============================] - 48s 14s/step - loss: 4.3796 - accuracy: 0.6875
Epoch 19/30
3/3 [==============================] - 54s 17s/step - loss: 5.3032 - accuracy: 0.5312
Epoch 20/30
3/3 [==============================] - 50s 15s/step - loss: 3.7652 - accuracy: 0.7083
Epoch 21/30
3/3 [==============================] - 48s 14s/step - loss: 2.8421 - accuracy: 0.7812
Epoch 22/30
3/3 [==============================] - 48s 15s/step - loss: 2.7402 - accuracy: 0.6979
Epoch 23/30
3/3 [==============================] - 49s 15s/step - loss: 2.7817 - accuracy: 0.6771
Epoch 24/30
3/3 [==============================] - 49s 15s/step - loss: 3.3278 - accuracy: 0.7083
Epoch 25/30
3/3 [==============================] - 49s 14s/step - loss: 3.9974 - accuracy: 0.6354
Epoch 26/30
3/3 [==============================] - 48s 14s/step - loss: 2.6000 - accuracy: 0.6979
Epoch 27/30
3/3 [==============================] - 48s 15s/step - loss: 3.0479 - accuracy: 0.6979
Epoch 28/30
3/3 [==============================] - 47s 14s/step - loss: 1.9773 - accuracy: 0.7708
Epoch 29/30
3/3 [==============================] - 49s 14s/step - loss: 2.6960 - accuracy: 0.7292
Epoch 30/30
3/3 [==============================] - 47s 14s/step - loss: 2.5824 - accuracy: 0.7708
```