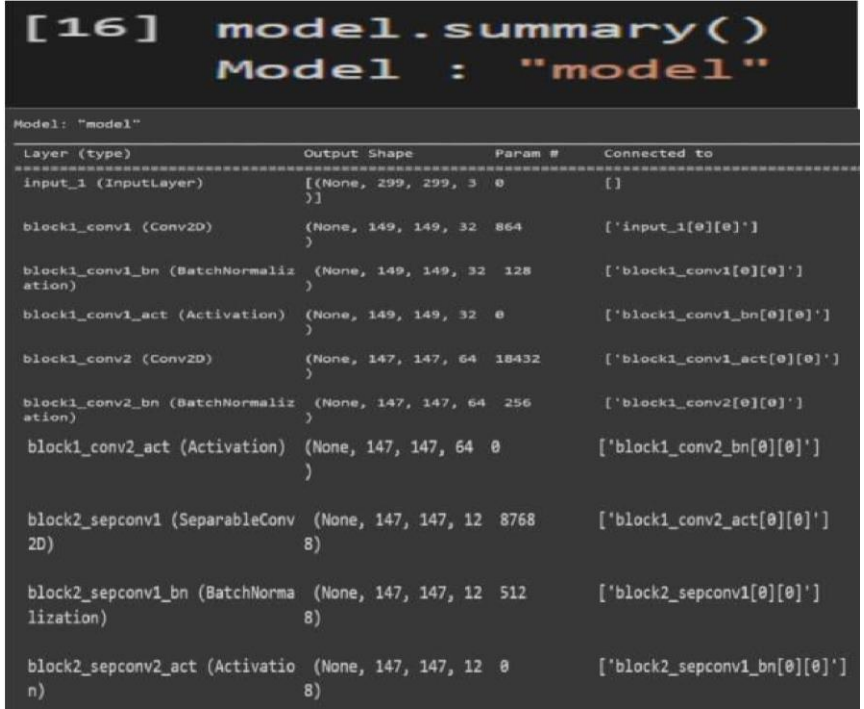


Project Development Phase
Model Performance Test

Date	17 November
Team ID	PNT2022TMID17540
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		 <pre>[16] model.summary() Model : "model"</pre> <table border="1"> <thead> <tr> <th>Layer (type)</th> <th>Output Shape</th> <th>Param #</th> <th>Connected to</th> </tr> </thead> <tbody> <tr> <td>input_1 (InputLayer)</td> <td>[(None, 299, 299, 3)]</td> <td>0</td> <td>[]</td> </tr> <tr> <td>block1_conv1 (Conv2D)</td> <td>(None, 149, 149, 32)</td> <td>864</td> <td>['input_1[0][0]']</td> </tr> <tr> <td>block1_conv1_bn (BatchNormalization)</td> <td>(None, 149, 149, 32)</td> <td>128</td> <td>['block1_conv1[0][0]']</td> </tr> <tr> <td>block1_conv1_act (Activation)</td> <td>(None, 149, 149, 32)</td> <td>0</td> <td>['block1_conv1_bn[0][0]']</td> </tr> <tr> <td>block1_conv2 (Conv2D)</td> <td>(None, 147, 147, 64)</td> <td>18432</td> <td>['block1_conv1_act[0][0]']</td> </tr> <tr> <td>block1_conv2_bn (BatchNormalization)</td> <td>(None, 147, 147, 64)</td> <td>256</td> <td>['block1_conv2[0][0]']</td> </tr> <tr> <td>block1_conv2_act (Activation)</td> <td>(None, 147, 147, 64)</td> <td>0</td> <td>['block1_conv2_bn[0][0]']</td> </tr> <tr> <td>block2_sepconv1 (SeparableConv2D)</td> <td>(None, 147, 147, 12)</td> <td>8768</td> <td>['block1_conv2_act[0][0]']</td> </tr> <tr> <td>block2_sepconv1_bn (BatchNormalization)</td> <td>(None, 147, 147, 12)</td> <td>512</td> <td>['block2_sepconv1[0][0]']</td> </tr> <tr> <td>block2_sepconv2_act (Activation)</td> <td>(None, 147, 147, 12)</td> <td>0</td> <td>['block2_sepconv1_bn[0][0]']</td> </tr> </tbody> </table>	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 (BatchNormalization)	(None, 149, 149, 32)	128	['block1_conv1[0][0]']	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 (BatchNormalization)	(None, 147, 147, 64)	256	['block1_conv2[0][0]']	block1_conv2_act (Activation)	(None, 147, 147, 64)	0	['block1_conv2_bn[0][0]']	block2_sepconv1 (SeparableConv2D)	(None, 147, 147, 12)	8768	['block1_conv2_act[0][0]']	block2_sepconv1_bn (BatchNormalization)	(None, 147, 147, 12)	512	['block2_sepconv1[0][0]']	block2_sepconv2_act (Activation)	(None, 147, 147, 12)	0	['block2_sepconv1_bn[0][0]']
Layer (type)	Output Shape	Param #	Connected to																																												
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block1_conv1_bn (BatchNormalization)	(None, 149, 149, 32)	128	['block1_conv1[0][0]']																																												
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			block2_sepconv2 (SeparableConv 2D)	(None, 147, 147, 12 8)	17536	['block2_sepconv2_act[0][0]']
			block2_sepconv2_bn (BatchNormalization)	(None, 147, 147, 12 8)	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]']

			<div> <div>add_1 (Add)</div> <div>(None, 37, 37, 256) 0</div> <div>['block3_pool[0][0]', 'batch_normalization_1[0][0]']</div> </div> <div> <div>block4_sepconv1_act (Activation)</div> <div>(None, 37, 37, 256) 0</div> <div>['add_1[0][0]']</div> </div> <div> <div>block4_sepconv1 (SeparableConv2D)</div> <div>(None, 37, 37, 728) 188672</div> <div>['block4_sepconv1_act[0][0]']</div> </div> <div> <div>block4_sepconv1_bn (BatchNormalization)</div> <div>(None, 37, 37, 728) 2912</div> <div>['block4_sepconv1[0][0]']</div> </div> <div> <div>block4_sepconv2_act (Activation)</div> <div>(None, 37, 37, 728) 0</div> <div>['block4_sepconv1_bn[0][0]']</div> </div> <div> <div>block4_sepconv2 (SeparableConv2D)</div> <div>(None, 37, 37, 728) 536536</div> <div>['block4_sepconv2_act[0][0]']</div> </div> <div> <div>block4_sepconv2_bn (BatchNormalization)</div> <div>(None, 37, 37, 728) 2912</div> <div>['block4_sepconv2[0][0]']</div> </div> <div> <div>conv2d_2 (Conv2D)</div> <div>(None, 19, 19, 728) 186368</div> <div>['add_1[0][0]']</div> </div> <div> <div>block4_pool (MaxPooling2D)</div> <div>(None, 19, 19, 728) 0</div> <div>['block4_sepconv2_bn[0][0]']</div> </div> <div> <div>batch_normalization_2 (BatchNormalization)</div> <div>(None, 19, 19, 728) 2912</div> <div>['conv2d_2[0][0]']</div> </div> <div> <div>add_2 (Add)</div> <div>(None, 19, 19, 728) 0</div> <div>['block4_pool[0][0]', 'batch_normalization_2[0][0]']</div> </div> <div> <div>block5_sepconv1_act (Activation)</div> <div>(None, 19, 19, 728) 0</div> <div>['add_2[0][0]']</div> </div> <div> <div>block5_sepconv1 (SeparableConv2D)</div> <div>(None, 19, 19, 728) 536536</div> <div>['block5_sepconv1_act[0][0]']</div> </div> <div> <div>block5_sepconv1_bn (BatchNormalization)</div> <div>(None, 19, 19, 728) 2912</div> <div>['block5_sepconv1[0][0]']</div> </div> <div> <div>block5_sepconv2_act (Activation)</div> <div>(None, 19, 19, 728) 0</div> <div>['block5_sepconv1_bn[0][0]']</div> </div> <div> <div>block5_sepconv2 (SeparableConv2D)</div> <div>(None, 19, 19, 728) 536536</div> <div>['block5_sepconv2_act[0][0]']</div> </div>
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			<div>block5_sepconv2_bn (BatchNorma (None, 19, 19, 728) 2912 ['block5_sepconv2[0][0]'] lization)</div> <div>block5_sepconv3_act (Activatio (None, 19, 19, 728) 0 ['block5_sepconv2_bn[0][0]'] n)</div> <div>block5_sepconv3 (SeparableConv (None, 19, 19, 728) 536536 ['block5_sepconv3_act[0][0]'] 2D)</div> <div>block5_sepconv3_bn (BatchNorma (None, 19, 19, 728) 2912 ['block5_sepconv3[0][0]'] lization)</div> <div>add_3 (Add) (None, 19, 19, 728) 0 ['block5_sepconv3_bn[0][0]', 'add_2[0][0]']</div> <div>block6_sepconv1_act (Activatio (None, 19, 19, 728) 0 ['add_3[0][0]'] n)</div> <div>block6_sepconv1 (SeparableConv (None, 19, 19, 728) 536536 ['block6_sepconv1_act[0][0]'] 2D)</div> <div>block6_sepconv1_bn (BatchNorma (None, 19, 19, 728) 2912 ['block6_sepconv1[0][0]'] lization)</div> <div>block6_sepconv2_act (Activatio (None, 19, 19, 728) 0 ['block6_sepconv1_bn[0][0]'] n)</div> <div>block6_sepconv2 (SeparableConv (None, 19, 19, 728) 536536 ['block6_sepconv2_act[0][0]'] 2D)</div> <div>block6_sepconv2_bn (BatchNorma (None, 19, 19, 728) 2912 ['block6_sepconv2[0][0]'] lization)</div> <div>block6_sepconv3_act (Activatio (None, 19, 19, 728) 0 ['block6_sepconv2_bn[0][0]'] n)</div> <div>block6_sepconv3 (SeparableConv (None, 19, 19, 728) 536536 ['block6_sepconv3_act[0][0]'] 2D)</div>
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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]']

			<pre>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</pre>
			<pre>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)</pre>

2.	Accuracy	Training Accuracy - Validation Accuracy -	<pre># 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)</pre> <p>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</p>
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			<pre> 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 </pre>
3.	Confidence Score(Only Yolo Projects)	Class Detected - Confidence Score -	NA

