

Model Development Phase Template

Date	16 March 2024
Team ID	SWTID1720418653
Project Title	Crystal Clear Vision: Revolutionizing Cataract Prediction through Transfer Learning Mastery
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):

Model code:

VGG16:

```
vgg = VGG16(include_top=False, input_shape=(224,224,3))

for layer in vgg.layers:
    layer.trainable = False

x= Flatten()(vgg.output)
x = Dense(1024,activation='relu')(x)
x = Dropout(0.5)(x)
output = Dense(1, activation='sigmoid')(x)
vgg16 = Model(inputs=vgg.input,outputs=output)

vgg16.compile(loss='binary_crossentropy',optimizer='adam',metrics=['accuracy'])

vgg16.summary()
```

VGG19:

```

vgg = VGG19(include_top=False, input_shape=(224,224,3))

for layer in vgg.layers:
    layer.trainable = False

x= Flatten()(vgg.output)
x = Dense(1024,activation='relu')(x)
x = Dropout(0.5)(x)
output = Dense(1, activation='sigmoid')(x)
vgg19 = Model(inputs=vgg.input,outputs=output)

vgg19.compile(loss='binary_crossentropy',optimizer='adam',metrics=[ 'accuracy'])

vgg19.summary()
    
```

XceptionNet:

```

# Load the pre-trained Xception model without the top (fully connected) layers
base_model = Xception(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Freeze the layers in the base model
for layer in base_model.layers:
    layer.trainable = False

# Add custom layers on top of the base model
x = base_model.output
x = Flatten()(x)
x = Dense(1024, activation='relu')(x)
x = Dropout(0.5)(x)
predictions = Dense(1, activation='sigmoid')(x)

# Create the final model
model = Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model.compile(optimizer=Adam(learning_rate=0.0001), loss='binary_crossentropy', metrics=['accuracy'])

# Print the model summary
model.summary()
    
```

InceptionNet:

```

base_model = InceptionV3(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Freeze the layers in the base model
for layer in base_model.layers:
    layer.trainable = False

# Add custom layers on top of the base model
x = base_model.output
x = Flatten()(x)
x = Dense(1024, activation='relu')(x)
x = Dropout(0.5)(x)
predictions = Dense(1, activation='sigmoid')(x)

# Create the final model
model = Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model.compile(optimizer=Adam(learning_rate=0.0001), loss='binary_crossentropy', metrics=['accuracy'])

# Print the model summary
model.summary()

```

resNet:

```

# Load pre-trained ResNet50 model + higher level layers
base_model = ResNet50(weights='imagenet', include_top=False)

# Global spatial average pooling layer
x = base_model.output
x = GlobalAveragePooling2D()(x)

# Fully-connected layer
x = Dense(1024, activation='relu')(x)

# Logistic layer (assuming we have 10 classes)
predictions = Dense(1, activation='softmax')(x)

# Model to be trained
model = Model(inputs=base_model.input, outputs=predictions)

# Freeze the layers of ResNet50 (optional, for transfer learning)
for layer in base_model.layers:
    layer.trainable = False

```

MobileNet:

```
# Load the pre-trained MobileNetV2 model without the top (fully connected) layers
base_model = MobileNetV2(weights='imagenet', include_top=False, input_shape=(224, 224, 3))

# Freeze the layers in the base model
for layer in base_model.layers:
    layer.trainable = False

# Add custom layers on top of the base model
x = base_model.output
x = Flatten()(x)
x = Dense(128, activation='relu')(x)
x = Dropout(0.5)(x)
predictions = Dense(1, activation='sigmoid')(x)

# Create the final model
model = Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model.compile(optimizer=Adam(learning_rate=0.0001), loss='binary_crossentropy', metrics=['accuracy'])

# Print the model summary
model.summary()
```

Training code:

For InceptionNet,XceptionNet,resNet50,MobileNet

```
# Train the model
history = model.fit([
    training_set,
    steps_per_epoch=training_set.samples // training_set.batch_size,
    epochs=20,
    validation_data=test_set,
    validation_steps=test_set.samples // test_set.batch_size,
])
```

For VGG16

```
vgg16.fit(training_set, validation_data=test_set, epochs=20)
```

For VGG19

```
vgg19.fit(training_set, validation_data=test_set, epochs=10)
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics																														
VGG16	<p>Model: "model_1"</p> <table border="1"> <thead> <tr> <th data-bbox="262 762 376 794">Layer (type)</th> <th data-bbox="474 762 605 794">Output Shape</th> <th data-bbox="719 762 784 794">Param #</th> </tr> </thead> <tbody> <tr> <td data-bbox="262 815 458 846">input_2 (InputLayer)</td><td data-bbox="474 815 654 846">[(None, 224, 224, 3)]</td><td data-bbox="719 815 744 846">0</td></tr> <tr> <td data-bbox="262 868 458 899">block1_conv1 (Conv2D)</td><td data-bbox="474 868 654 899">(None, 224, 224, 64)</td><td data-bbox="719 868 768 899">1792</td></tr> <tr> <td data-bbox="262 920 458 952">block1_conv2 (Conv2D)</td><td data-bbox="474 920 654 952">(None, 224, 224, 64)</td><td data-bbox="719 920 776 952">36928</td></tr> <tr> <td data-bbox="262 973 458 1005">block1_pool (MaxPooling2D)</td><td data-bbox="474 973 654 1005">(None, 112, 112, 64)</td><td data-bbox="719 973 744 1005">0</td></tr> <tr> <td data-bbox="262 1026 458 1058">block2_conv1 (Conv2D)</td><td data-bbox="474 1026 654 1058">(None, 112, 112, 128)</td><td data-bbox="719 1026 776 1058">73856</td></tr> <tr> <td data-bbox="262 1079 458 1110">block2_conv2 (Conv2D)</td><td data-bbox="474 1079 654 1110">(None, 112, 112, 128)</td><td data-bbox="719 1079 784 1110">147584</td></tr> <tr> <td data-bbox="262 1132 458 1163">block2_pool (MaxPooling2D)</td><td data-bbox="474 1132 654 1163">(None, 56, 56, 128)</td><td data-bbox="719 1132 744 1163">0</td></tr> <tr> <td data-bbox="262 1184 458 1216">block3_conv1 (Conv2D)</td><td data-bbox="474 1184 654 1216">(None, 56, 56, 256)</td><td data-bbox="719 1184 784 1216">295168</td></tr> <tr> <td data-bbox="262 1237 458 1269">block3_conv2 (Conv2D)</td><td data-bbox="474 1237 654 1269">(None, 56, 56, 256)</td><td data-bbox="719 1237 784 1269">590080</td></tr> </tbody> </table>	Layer (type)	Output Shape	Param #	input_2 (InputLayer)	[(None, 224, 224, 3)]	0	block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792	block1_conv2 (Conv2D)	(None, 224, 224, 64)	36928	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)	295168	block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080	<pre>Epoch 1/20 31/31 [=====] - 884s 26s/step - loss: 3.1086 - accuracy: 0.6360 - val_loss: 0.3872 - val_accuracy: 0.8676 Epoch 2/20 31/31 [=====] - 771s 25s/step - loss: 0.4996 - accuracy: 0.8415 - val_loss: 0.1426 - val_accuracy: 0.9504 Epoch 3/20 31/31 [=====] - 772s 25s/step - loss: 0.2987 - accuracy: 0.8732 - val_loss: 0.2118 - val_accuracy: 0.9008 Epoch 4/20 31/31 [=====] - 766s 25s/step - loss: 0.2399 - accuracy: 0.8805 - val_loss: 0.1391 - val_accuracy: 0.9421 Epoch 5/20 31/31 [=====] - 757s 24s/step - loss: 0.2352 - accuracy: 0.8978 - val_loss: 0.1124 - val_accuracy: 0.9587 Epoch 6/20 31/31 [=====] - 756s 24s/step - loss: 0.1976 - accuracy: 0.9192 - val_loss: 0.1164 - val_accuracy: 0.9587 Epoch 7/20 31/31 [=====] - 756s 24s/step - loss: 0.1976 - accuracy: 0.9192 - val_loss: 0.1164 - val_accuracy: 0.9587 Epoch 8/20 31/31 [=====] - 752s 24s/step - loss: 0.1285 - accuracy: 0.9172 - val_loss: 0.1159 - val_accuracy: 0.9587 Epoch 9/20 31/31 [=====] - 751s 24s/step - loss: 0.1924 - accuracy: 0.9202 - val_loss: 0.0823 - val_accuracy: 0.9504 Epoch 10/20 31/31 [=====] - 812s 26s/step - loss: 0.1801 - accuracy: 0.9233 - val_loss: 0.0873 - val_accuracy: 0.9587 31/31 [=====] - 758s 24s/step - loss: 0.1842 - accuracy: 0.9233 - val_loss: 0.1114 - val_accuracy: 0.9669 keras.callbacks.History at 0x0defcf1de9e0</pre>
Layer (type)	Output Shape	Param #																														
input_2 (InputLayer)	[(None, 224, 224, 3)]	0																														
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	<pre> block4_conv1 (Conv2D) (None, 28, 28, 512) block4_conv2 (Conv2D) (None, 28, 28, 512) block4_conv3 (Conv2D) (None, 28, 28, 512) block4_pool (MaxPooling2D) (None, 14, 14, 512) block5_conv1 (Conv2D) (None, 14, 14, 512) block5_conv2 (Conv2D) (None, 14, 14, 512) block5_conv3 (Conv2D) (None, 14, 14, 512) block5_pool (MaxPooling2D) (None, 7, 7, 512) flatten_1 (Flatten) (None, 25088) dense_2 (Dense) (None, 1024) dropout (Dropout) (None, 1024) dense_3 (Dense) (None, 1) ===== Total params: 40406849 (154.14 MB) Trainable params: 25692161 (98.01 MB) Non-trainable params: 14714688 (56.13 MB) </pre>																																														
VGG19	<p>Model: "model"</p> <table border="1"> <thead> <tr> <th>Layer (type)</th> <th>Output Shape</th> <th>Param #</th> </tr> </thead> <tbody> <tr><td>input_2 (InputLayer)</td><td>[None, 224, 224, 3]</td><td>0</td></tr> <tr><td>block1_conv1 (Conv2D)</td><td>(None, 224, 224, 64)</td><td>1792</td></tr> <tr><td>block1_conv2 (Conv2D)</td><td>(None, 224, 224, 64)</td><td>36928</td></tr> <tr><td>block1_pool (MaxPooling2D)</td><td>(None, 112, 112, 64)</td><td>0</td></tr> <tr><td>block2_conv1 (Conv2D)</td><td>(None, 112, 112, 128)</td><td>73856</td></tr> <tr><td>block2_conv2 (Conv2D)</td><td>(None, 112, 112, 128)</td><td>147584</td></tr> <tr><td>block2_pool (MaxPooling2D)</td><td>(None, 56, 56, 128)</td><td>0</td></tr> <tr><td>block3_conv1 (Conv2D)</td><td>(None, 56, 56, 256)</td><td>295168</td></tr> <tr><td>block3_conv2 (Conv2D)</td><td>(None, 56, 56, 256)</td><td>590080</td></tr> <tr><td>block3_conv3 (Conv2D)</td><td>(None, 56, 56, 256)</td><td>590080</td></tr> <tr><td>block3_conv4 (Conv2D)</td><td>(None, 56, 56, 256)</td><td>590080</td></tr> <tr><td>block3_pool (MaxPooling2D)</td><td>(None, 28, 28, 256)</td><td>0</td></tr> <tr><td>block4_conv1 (Conv2D)</td><td>(None, 28, 28, 512)</td><td>1180160</td></tr> <tr><td>block4_conv2 (Conv2D)</td><td>(None, 28, 28, 512)</td><td>2359808</td></tr> </tbody> </table>	Layer (type)	Output Shape	Param #	input_2 (InputLayer)	[None, 224, 224, 3]	0	block1_conv1 (Conv2D)	(None, 224, 224, 64)	1792	block1_conv2 (Conv2D)	(None, 224, 224, 64)	36928	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)	295168	block3_conv2 (Conv2D)	(None, 56, 56, 256)	590080	block3_conv3 (Conv2D)	(None, 56, 56, 256)	590080	block3_conv4 (Conv2D)	(None, 56, 56, 256)	590080	block3_pool (MaxPooling2D)	(None, 28, 28, 256)	0	block4_conv1 (Conv2D)	(None, 28, 28, 512)	1180160	block4_conv2 (Conv2D)	(None, 28, 28, 512)	2359808	<pre> Epoch 1/10 31/31 [=====] - 985s 1s/step - loss: 0.9598 - accuracy: 0.7597 - val_loss: 0.1956 - val_accuracy: 0.9174 31/31 [=====] - 990s 1s/step - loss: 0.4371 - accuracy: 0.8260 - val_loss: 0.2415 - val_accuracy: 0.9296 Epoch 3/10 31/31 [=====] - 948s 30s/step - loss: 0.3294 - accuracy: 0.8722 - val_loss: 0.1845 - val_accuracy: 0.9421 31/31 [=====] - 928s 30s/step - loss: 0.2961 - accuracy: 0.8722 - val_loss: 0.1518 - val_accuracy: 0.9421 31/31 [=====] - 941s 30s/step - loss: 0.2842 - accuracy: 0.8845 - val_loss: 0.1492 - val_accuracy: 0.9421 Epoch 6/10 31/31 [=====] - 925s 30s/step - loss: 0.2696 - accuracy: 0.8957 - val_loss: 0.1799 - val_accuracy: 0.9596 Epoch 7/10 31/31 [=====] - 961s 1s/step - loss: 0.2548 - accuracy: 0.8967 - val_loss: 0.1414 - val_accuracy: 0.9421 31/31 [=====] - 976s 1s/step - loss: 0.2664 - accuracy: 0.8967 - val_loss: 0.1787 - val_accuracy: 0.9174 Epoch 9/10 31/31 [=====] - 988s 1s/step - loss: 0.2450 - accuracy: 0.9080 - val_loss: 0.1244 - val_accuracy: 0.9421 Epoch 10/10 31/31 [=====] - 962s 1s/step - loss: 0.2070 - accuracy: 0.9182 - val_loss: 0.2755 - val_accuracy: 0.8926 </pre>
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input_2 (InputLayer)	[None, 224, 224, 3]	0																																													
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	<pre> block4_conv2 (Conv2D) (None, 28, 28, 512) 2359808 block4_conv3 (Conv2D) (None, 28, 28, 512) 2359808 block4_conv4 (Conv2D) (None, 28, 28, 512) 2359808 block4_pool (MaxPooling2D) (None, 14, 14, 512) 0 block5_conv1 (Conv2D) (None, 14, 14, 512) 2359808 block5_conv2 (Conv2D) (None, 14, 14, 512) 2359808 block5_conv3 (Conv2D) (None, 14, 14, 512) 2359808 block5_conv4 (Conv2D) (None, 14, 14, 512) 2359808 block5_pool (MaxPooling2D) (None, 7, 7, 512) 0 flatten_1 (Flatten) (None, 25088) 0 dense_2 (Dense) (None, 1024) 25691136 dropout_1 (Dropout) (None, 1024) 0 dense_3 (Dense) (None, 1) 1025 ===== Total params: 45716545 (174.39 MB) Trainable params: 25692161 (98.01 MB) Non-trainable params: 20024384 (76.39 MB) </pre>	
ResNet	<pre> Model: "model_1" ----- Layer (type) Output Shape Param # Connected to ----- input_3 (InputLayer) [(None, None, None, 3)] 0 [] conv1_pad (ZeroPadding2D) (None, None, None, 3) 0 ['input_3[0][0]'] conv1_conv (Conv2D) (None, None, None, 64) 9472 ['conv1_pad[0][0]'] conv1_bn (BatchNormalizati (None, None, None, 64) 256 ['conv1_conv[0][0]'] on) conv1_relu (Activation) (None, None, None, 64) 0 ['conv1_bn[0][0]'] pool1_pad (ZeroPadding2D) (None, None, None, 64) 0 ['conv1_relu[0][0]'] pool1_pool (MaxPooling2D) (None, None, None, 64) 0 ['pool1_pad[0][0]'] conv2_block1_1_conv (Conv2 (None, None, None, 64) 4160 ['pool1_pool[0][0]']) conv2_block1_1_bn (BatchNo (None, None, None, 64) 256 ['conv2_block1_1_conv[0][0]']) rmalization) conv2_block1_1_relu (Activ (None, None, None, 64) 0 ['conv2_block1_1_bn[0][0]']) ation) conv2_block1_2_conv (Conv2 (None, None, None, 64) 36928 ['conv2_block1_1_relu[0]']) conv2_block1_2_bn (BatchNo (None, None, None, 64) 256 ['conv2_block1_2_conv[0][0]']) rmalization) conv2_block1_2_relu (Activ (None, None, None, 64) 0 ['conv2_block1_2_bn[0][0]']) ation) conv2_block1_0_conv (Conv2 (None, None, None, 256) 16640 ['pool1_pool[0][0]']) conv2_block1_0_bn (BatchNo (None, None, None, 256) 1024 ['conv2_block1_0_conv[0][0]']) rmalization) conv2_block1_3_bn (BatchNo (None, None, None, 256) 1024 ['conv2_block1_0_bn[0][0]']) rmalization) conv2_block1_add (Add) (None, None, None, 256) 0 ['conv2_block1_0_bn[0][0]', 'conv2_block1_3_bn[0][0]'] conv2_block1_out (Activati (None, None, None, 256) 0 ['conv2_block1_add[0][0]']) on) conv2_block2_2_conv (Conv2 (None, None, None, 64) 36928 ['conv2_block1_1_relu[0]']) conv2_block2_2_bn (BatchNo (None, None, None, 64) 256 ['conv2_block2_2_conv[0][0]']) rmalization) conv2_block2_2_relu (Activ (None, None, None, 64) 0 ['conv2_block2_2_bn[0][0]']) ation) conv2_block2_3_conv (Conv2 (None, None, None, 256) 16640 ['conv2_block2_2_relu[0]']) conv2_block2_3_bn (BatchNo (None, None, None, 256) 1024 ['conv2_block2_3_conv[0][0]']) rmalization) conv2_block2_3_add (Add) (None, None, None, 256) 0 ['conv2_block1_out[0][0]', 'conv2_block2_3_bn[0][0]'] conv2_block2_out (Activati (None, None, None, 256) 0 ['conv2_block2_3_add[0][0]']) on) conv2_block3_1_conv (Conv2 (None, None, None, 64) 16448 ['conv2_block2_out[0][0]']) conv2_block3_1_bn (BatchNo (None, None, None, 64) 256 ['conv2_block3_1_conv[0][0]']) rmalization) conv2_block3_1_relu (Activ (None, None, None, 64) 0 ['conv2_block3_1_bn[0][0]']) </pre> <p>...*</p>	<pre> Epoch 1/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 2/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 3/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 4/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 5/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 6/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 7/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 8/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 9/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 10/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 11/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 12/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 13/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 14/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 15/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 16/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 17/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 18/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 19/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 Epoch 20/20 3/1/31 [=====] - 365 1s/step - loss: 0.0000e+00 - accuracy: 0.5031 - val_loss: 0.0000e+00 - accuracy: 0.4959 </pre>

	<pre> conv5_block3_3_bn (BatchNorm (None, None, None, 2048) 8192 ['conv5_block3_3_conv[0][0]'] conv5_block3_add (Add) (None, None, None, 2048) 0 ['conv5_block2_out[0][0]', 'conv5_block3_3_bn[0][0]'] conv5_block3_out (Activation (None, None, None, 2048) 0 ['conv5_block3_add[0][0]'] global_average_pooling2d_1 (None, 2048) 0 ['conv5_block3_out[0][0]'] dense_2 (Dense) (None, 1024) 2098176 ['global_average_pooling2d_1[0][0]'] dense_3 (Dense) (None, 1) 1025 ['dense_2[0][0]'] ===== total params: 25686913 (97.99 MB) trainable params: 2099201 (8.01 MB) non-trainable params: 23587712 (89.98 MB) </pre>																																																																																					
XceptionNet	<p>Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/xception/xception83683744/83683744 [=====] - 0us/step</p> <p>Model: "model"</p> <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, 224, 224, 3]</td> <td>0</td> <td>[]</td> </tr> <tr> <td>block1_conv1 (Conv2D)</td> <td>(None, 111, 111, 32)</td> <td>864</td> <td>['input_1[0][0]']</td> </tr> <tr> <td>block1_conv1_bn (BatchNorm (None, 111, 111, 32) alization)</td> <td></td> <td>128</td> <td>['block1_conv1[0][0]']</td> </tr> <tr> <td>block1_conv1_act (Activation (None, 111, 111, 32) on)</td> <td></td> <td>0</td> <td>['block1_conv1_bn[0][0]']</td> </tr> <tr> <td>block1_conv2 (Conv2D)</td> <td>(None, 109, 109, 64)</td> <td>18432</td> <td>['block1_conv1_act[0][0]']</td> </tr> <tr> <td>block1_conv2_bn (BatchNorm (None, 109, 109, 64) alization)</td> <td></td> <td>256</td> <td>['block1_conv2[0][0]']</td> </tr> <tr> <td>block1_conv2_act (Activation (None, 109, 109, 64) on)</td> <td></td> <td>0</td> <td>['block1_conv2_bn[0][0]']</td> </tr> <tr> <td>block2_sepconv1 (Separable Conv2D)</td> <td>(None, 109, 109, 128)</td> <td>8768</td> <td>['block1_conv2_act[0][0]']</td> </tr> <tr> <td>block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)</td> <td></td> <td>512</td> <td>['block2_sepconv1[0][0]']</td> </tr> <tr> <td>block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)</td> <td></td> <td>512</td> <td>['block2_sepconv1[0][0]']</td> </tr> <tr> <td>block2_sepconv2_act (Activ (None, 109, 109, 128) ation)</td> <td></td> <td>0</td> <td>['block2_sepconv1_bn[0][0]']</td> </tr> <tr> <td>block2_sepconv2 (Separable Conv2D)</td> <td>(None, 109, 109, 128)</td> <td>17536</td> <td>['block2_sepconv2_act[0][0]']</td> </tr> <tr> <td>block2_sepconv2_bn (BatchN (None, 109, 109, 128) ormalization)</td> <td></td> <td>512</td> <td>['block2_sepconv2[0][0]']</td> </tr> <tr> <td>conv2d (Conv2D)</td> <td>(None, 55, 55, 128)</td> <td>8192</td> <td>['block1_conv2_act[0][0]']</td> </tr> <tr> <td>block2_pool (MaxPooling2D)</td> <td>(None, 55, 55, 128)</td> <td>0</td> <td>['block2_sepconv2_bn[0][0]']</td> </tr> <tr> <td>batch_normalization (Batch Normalization)</td> <td></td> <td>512</td> <td>['conv2d[0][0]']</td> </tr> <tr> <td>add (Add)</td> <td>(None, 55, 55, 128)</td> <td>0</td> <td>['block2_pool[0][0]', 'batch_normalization[0][0]']</td> </tr> <tr> <td>block3_sepconv1_act (Activ (None, 55, 55, 128) ation)</td> <td></td> <td>0</td> <td>['add[0][0]']</td> </tr> <tr> <td>block3_sepconv1 (Separable Conv2D)</td> <td>(None, 55, 55, 256)</td> <td>33920</td> <td>['block3_sepconv1_act[0][0]']</td> </tr> <tr> <td>block3_sepconv1_bn (BatchN (None, 55, 55, 256) ormalization)</td> <td></td> <td>1024</td> <td>['block3_sepconv1[0][0]']</td> </tr> </tbody> </table>	Layer (type)	Output Shape	Param #	Connected to	input_1 (InputLayer)	[None, 224, 224, 3]	0	[]	block1_conv1 (Conv2D)	(None, 111, 111, 32)	864	['input_1[0][0]']	block1_conv1_bn (BatchNorm (None, 111, 111, 32) alization)		128	['block1_conv1[0][0]']	block1_conv1_act (Activation (None, 111, 111, 32) on)		0	['block1_conv1_bn[0][0]']	block1_conv2 (Conv2D)	(None, 109, 109, 64)	18432	['block1_conv1_act[0][0]']	block1_conv2_bn (BatchNorm (None, 109, 109, 64) alization)		256	['block1_conv2[0][0]']	block1_conv2_act (Activation (None, 109, 109, 64) on)		0	['block1_conv2_bn[0][0]']	block2_sepconv1 (Separable Conv2D)	(None, 109, 109, 128)	8768	['block1_conv2_act[0][0]']	block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv1[0][0]']	block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv1[0][0]']	block2_sepconv2_act (Activ (None, 109, 109, 128) ation)		0	['block2_sepconv1_bn[0][0]']	block2_sepconv2 (Separable Conv2D)	(None, 109, 109, 128)	17536	['block2_sepconv2_act[0][0]']	block2_sepconv2_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv2[0][0]']	conv2d (Conv2D)	(None, 55, 55, 128)	8192	['block1_conv2_act[0][0]']	block2_pool (MaxPooling2D)	(None, 55, 55, 128)	0	['block2_sepconv2_bn[0][0]']	batch_normalization (Batch Normalization)		512	['conv2d[0][0]']	add (Add)	(None, 55, 55, 128)	0	['block2_pool[0][0]', 'batch_normalization[0][0]']	block3_sepconv1_act (Activ (None, 55, 55, 128) ation)		0	['add[0][0]']	block3_sepconv1 (Separable Conv2D)	(None, 55, 55, 256)	33920	['block3_sepconv1_act[0][0]']	block3_sepconv1_bn (BatchN (None, 55, 55, 256) ormalization)		1024	['block3_sepconv1[0][0]']	<pre> Epoch 1/20 30/30 [=====] - 303s 10s/step - loss: 1.0027 - accuracy: 0.7844 - val_loss: 0.3743 - val_accuracy: 0.8954 Epoch 2/20 30/30 [=====] - 294s 10s/step - loss: 0.3770 - accuracy: 0.8721 - val_loss: 0.2000 - val_accuracy: 0.9271 Epoch 3/20 30/30 [=====] - 308s 10s/step - loss: 0.2697 - accuracy: 0.9040 - val_loss: 0.1740 - val_accuracy: 0.9271 Epoch 4/20 30/30 [=====] - 310s 11s/step - loss: 0.2315 - accuracy: 0.9121 - val_loss: 0.1617 - val_accuracy: 0.9375 Epoch 5/20 30/30 [=====] - 309s 10s/step - loss: 0.2732 - accuracy: 0.8989 - val_loss: 0.1340 - val_accuracy: 0.9175 Epoch 6/20 30/30 [=====] - 317s 11s/step - loss: 0.2153 - accuracy: 0.9129 - val_loss: 0.0986 - val_accuracy: 0.9583 Epoch 7/20 30/30 [=====] - 307s 10s/step - loss: 0.1781 - accuracy: 0.9268 - val_loss: 0.1482 - val_accuracy: 0.9271 Epoch 8/20 30/30 [=====] - 306s 10s/step - loss: 0.2490 - accuracy: 0.9112 - val_loss: 0.1512 - val_accuracy: 0.9583 Epoch 9/20 30/30 [=====] - 304s 10s/step - loss: 0.1672 - accuracy: 0.9260 - val_loss: 0.0957 - val_accuracy: 0.9479 Epoch 10/20 30/30 [=====] - 307s 10s/step - loss: 0.1600 - accuracy: 0.9429 - val_loss: 0.1732 - val_accuracy: 0.9375 </pre> <pre> Epoch 11/20 30/30 [=====] - 285s 9s/step - loss: 0.1291 - accuracy: 0.9556 - val_loss: 0.1147 - val_accuracy: 0.9479 Epoch 12/20 30/30 [=====] - 287s 9s/step - loss: 0.1286 - accuracy: 0.9514 - val_loss: 0.1533 - val_accuracy: 0.8958 Epoch 13/20 30/30 [=====] - 2966 10s/step - loss: 0.1410 - accuracy: 0.9471 - val_loss: 0.0789 - val_accuracy: 0.9688 Epoch 14/20 30/30 [=====] - 307s 10s/step - loss: 0.1665 - accuracy: 0.9306 - val_loss: 0.1452 - val_accuracy: 0.9479 Epoch 15/20 30/30 [=====] - 313s 10s/step - loss: 0.1370 - accuracy: 0.9514 - val_loss: 0.1132 - val_accuracy: 0.9479 Epoch 16/20 30/30 [=====] - 305s 10s/step - loss: 0.0986 - accuracy: 0.9609 - val_loss: 0.1265 - val_accuracy: 0.9375 Epoch 17/20 30/30 [=====] - 2899 9s/step - loss: 0.1147 - accuracy: 0.9545 - val_loss: 0.0867 - val_accuracy: 0.9688 Epoch 18/20 30/30 [=====] - 306s 10s/step - loss: 0.1236 - accuracy: 0.9480 - val_loss: 0.2045 - val_accuracy: 0.9271 Epoch 19/20 30/30 [=====] - 306s 10s/step - loss: 0.1207 - accuracy: 0.9556 - val_loss: 0.1923 - val_accuracy: 0.9167 Epoch 20/20 30/30 [=====] - 304s 10s/step - loss: 0.1132 - accuracy: 0.9535 - val_loss: 0.0839 - val_accuracy: 0.9583 </pre>
Layer (type)	Output Shape	Param #	Connected to																																																																																			
input_1 (InputLayer)	[None, 224, 224, 3]	0	[]																																																																																			
block1_conv1 (Conv2D)	(None, 111, 111, 32)	864	['input_1[0][0]']																																																																																			
block1_conv1_bn (BatchNorm (None, 111, 111, 32) alization)		128	['block1_conv1[0][0]']																																																																																			
block1_conv1_act (Activation (None, 111, 111, 32) on)		0	['block1_conv1_bn[0][0]']																																																																																			
block1_conv2 (Conv2D)	(None, 109, 109, 64)	18432	['block1_conv1_act[0][0]']																																																																																			
block1_conv2_bn (BatchNorm (None, 109, 109, 64) alization)		256	['block1_conv2[0][0]']																																																																																			
block1_conv2_act (Activation (None, 109, 109, 64) on)		0	['block1_conv2_bn[0][0]']																																																																																			
block2_sepconv1 (Separable Conv2D)	(None, 109, 109, 128)	8768	['block1_conv2_act[0][0]']																																																																																			
block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv1[0][0]']																																																																																			
block2_sepconv1_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv1[0][0]']																																																																																			
block2_sepconv2_act (Activ (None, 109, 109, 128) ation)		0	['block2_sepconv1_bn[0][0]']																																																																																			
block2_sepconv2 (Separable Conv2D)	(None, 109, 109, 128)	17536	['block2_sepconv2_act[0][0]']																																																																																			
block2_sepconv2_bn (BatchN (None, 109, 109, 128) ormalization)		512	['block2_sepconv2[0][0]']																																																																																			
conv2d (Conv2D)	(None, 55, 55, 128)	8192	['block1_conv2_act[0][0]']																																																																																			
block2_pool (MaxPooling2D)	(None, 55, 55, 128)	0	['block2_sepconv2_bn[0][0]']																																																																																			
batch_normalization (Batch Normalization)		512	['conv2d[0][0]']																																																																																			
add (Add)	(None, 55, 55, 128)	0	['block2_pool[0][0]', 'batch_normalization[0][0]']																																																																																			
block3_sepconv1_act (Activ (None, 55, 55, 128) ation)		0	['add[0][0]']																																																																																			
block3_sepconv1 (Separable Conv2D)	(None, 55, 55, 256)	33920	['block3_sepconv1_act[0][0]']																																																																																			
block3_sepconv1_bn (BatchN (None, 55, 55, 256) ormalization)		1024	['block3_sepconv1[0][0]']																																																																																			

	<pre> block3_sepconv2 (Separable (None, 55, 55, 256) Conv2D) 67840 ['block3_sepconv2_act[0][0]'] block3_sepconv2_bn (BatchN (None, 55, 55, 256) ormalization) 1024 ['block3_sepconv2[0][0]'] conv2d_1 (Conv2D) (None, 28, 28, 256) 32768 ['add[0][0]'] block3_pool (MaxPooling2D) (None, 28, 28, 256) 0 ['block3_sepconv2_bn[0][0]'] batch_normalization_1 (Batch Normalization) (None, 28, 28, 256) 1024 ['conv2d_1[0][0]'] add_1 (Add) (None, 28, 28, 256) 0 ['block3_pool[0][0]', 'batch_normalization_1[0][0]'] block4_sepconv1_act (Activation) (None, 28, 28, 256) 0 ['add_1[0][0]'] block4_sepconv1 (Separable (None, 28, 28, 728) Conv2D) 188672 ['block4_sepconv1_act[0][0]'] block4_sepconv1_bn (BatchN (None, 28, 28, 728) ormalization) 2912 ['block4_sepconv1[0][0]'] block4_sepconv2_act (Activation) (None, 28, 28, 728) 0 ['block4_sepconv1_bn[0][0]'] block5_sepconv1_act (Activation) (None, 14, 14, 728) 0 ['add_2[0][0]'] block5_sepconv1 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block5_sepconv1_act[0][0]'] block5_sepconv1_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block5_sepconv1[0][0]'] block5_sepconv2_act (Activation) (None, 14, 14, 728) 0 ['block5_sepconv1_bn[0][0]'] block5_sepconv2 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block5_sepconv2_act[0][0]'] block5_sepconv2_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block5_sepconv2[0][0]'] block5_sepconv3_act (Activation) (None, 14, 14, 728) 0 ['block5_sepconv2_bn[0][0]'] block5_sepconv3 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block5_sepconv3_act[0][0]'] block5_sepconv3_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block5_sepconv3[0][0]'] add_3 (Add) (None, 14, 14, 728) 0 ['block5_sepconv3_bn[0][0]', 'add_2[0][0]'] block6_sepconv1_act (Activation) (None, 14, 14, 728) 0 ['add_3[0][0]'] block6_sepconv1 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block6_sepconv1_act[0][0]'] block6_sepconv1_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block6_sepconv1[0][0]'] block6_sepconv2_act (Activation) (None, 14, 14, 728) 0 ['block6_sepconv1_bn[0][0]'] block6_sepconv2 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block6_sepconv2_act[0][0]'] block6_sepconv2_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block6_sepconv2[0][0]'] block6_sepconv3_act (Activation) (None, 14, 14, 728) 0 ['block6_sepconv2_bn[0][0]'] block6_sepconv3 (Separable (None, 14, 14, 728) Conv2D) 536536 ['block6_sepconv3_act[0][0]'] block6_sepconv3_bn (BatchN (None, 14, 14, 728) ormalization) 2912 ['block6_sepconv3[0][0]'] add_4 (Add) (None, 14, 14, 728) 0 ['block6_sepconv3_bn[0][0]', 'add_3[0][0]'] </pre>	
	...so on layers	

	<pre> block14_sepconv1 (SeparableConv2D) 1582080 ['add_11[0][0]'] block14_sepconv1_bn (BatchNormalization) 6144 ['block14_sepconv1[0][0]'] block14_sepconv1_act (Activation) 0 ['block14_sepconv1_bn[0][0]'] block14_sepconv2 (SeparableConv2D) 3159552 ['block14_sepconv1_act[0][0]'] block14_sepconv2_bn (BatchNormalization) 8192 ['block14_sepconv2[0][0]'] block14_sepconv2_act (Activation) 0 ['block14_sepconv2_bn[0][0]'] flatten (Flatten) (None, 100352) 0 ['block14_sepconv2_act[0][0]'] dense (Dense) (None, 1024) 1027614 ['flatten[0][0]'] dropout (Dropout) (None, 1024) 0 ['dense[0][0]'] dense_1 (Dense) (None, 1) 1025 ['dropout[0][0]'] ===== total params: 123623977 (471.59 MB) trainable params: 102762497 (392.01 MB) non-trainable params: 20861480 (79.58 MB) </pre>																																																																												
InceptionNet	<p>Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/inception_v3/inception_v3_weights_tf_dim_ordering_tf_kernels.h5 [=====] - 0s 0us/step</p> <p>Model: "model_1"</p> <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_2 (InputLayer)</td> <td>[None, 224, 224, 3]</td> <td>0</td> <td>[]</td> </tr> <tr> <td>conv2d_4 (Conv2D)</td> <td>(None, 111, 111, 32)</td> <td>864</td> <td>['input_2[0][0]']</td> </tr> <tr> <td>batch_normalization_4 (BatchNormalization)</td> <td>(None, 111, 111, 32)</td> <td>96</td> <td>['conv2d_4[0][0]']</td> </tr> <tr> <td>activation (Activation)</td> <td>(None, 111, 111, 32)</td> <td>0</td> <td>['batch_normalization_4[0][0]']</td> </tr> <tr> <td>conv2d_5 (Conv2D)</td> <td>(None, 109, 109, 32)</td> <td>9216</td> <td>['activation[0][0]']</td> </tr> <tr> <td>batch_normalization_5 (BatchNormalization)</td> <td>(None, 109, 109, 32)</td> <td>96</td> <td>['conv2d_5[0][0]']</td> </tr> <tr> <td>activation_1 (Activation)</td> <td>(None, 109, 109, 32)</td> <td>0</td> <td>['batch_normalization_5[0][0]']</td> </tr> <tr> <td>conv2d_6 (Conv2D)</td> <td>(None, 109, 109, 64)</td> <td>18432</td> <td>['activation_1[0][0]']</td> </tr> <tr> <td>batch_normalization_6 (BatchNormalization)</td> <td>(None, 109, 109, 64)</td> <td>192</td> <td>['conv2d_6[0][0]']</td> </tr> <tr> <td>activation_2 (Activation)</td> <td>(None, 109, 109, 64)</td> <td>0</td> <td>['batch_normalization_6[0][0]']</td> </tr> <tr> <td>max_pooling2d (MaxPooling2D)</td> <td>(None, 54, 54, 64)</td> <td>0</td> <td>['activation_2[0][0]']</td> </tr> <tr> <td>conv2d_7 (Conv2D)</td> <td>(None, 54, 54, 80)</td> <td>5120</td> <td>['max_pooling2d[0][0]']</td> </tr> <tr> <td>batch_normalization_7 (BatchNormalization)</td> <td>(None, 54, 54, 80)</td> <td>240</td> <td>['conv2d_7[0][0]']</td> </tr> <tr> <td>activation_3 (Activation)</td> <td>(None, 54, 54, 80)</td> <td>0</td> <td>['batch_normalization_7[0][0]']</td> </tr> <tr> <td>conv2d_8 (Conv2D)</td> <td>(None, 52, 52, 192)</td> <td>138240</td> <td>['activation_3[0][0]']</td> </tr> <tr> <td>batch_normalization_8 (BatchNormalization)</td> <td>(None, 52, 52, 192)</td> <td>576</td> <td>['conv2d_8[0][0]']</td> </tr> <tr> <td>activation_4 (Activation)</td> <td>(None, 52, 52, 192)</td> <td>0</td> <td>['batch_normalization_8[0][0]']</td> </tr> <tr> <td>max_pooling2d_1 (MaxPooling2D)</td> <td>(None, 25, 25, 192)</td> <td>0</td> <td>['activation_4[0][0]']</td> </tr> </tbody> </table> <p>Epoch 1/20 31/31 [=====] - 95s 1s/step - loss: 0.1877 - accuracy: 0.7290 - val_loss: 0.2117 - val_accuracy: 0.9256 Epoch 2/20 31/31 [=====] - 41s 1s/step - loss: 0.3082 - accuracy: 0.8773 - val_loss: 0.1585 - val_accuracy: 0.9421 Epoch 3/20 31/31 [=====] - 36s 1s/step - loss: 0.2471 - accuracy: 0.9080 - val_loss: 0.1655 - val_accuracy: 0.9339 Epoch 4/20 31/31 [=====] - 34s 1s/step - loss: 0.1993 - accuracy: 0.9202 - val_loss: 0.1486 - val_accuracy: 0.9584 Epoch 5/20 31/31 [=====] - 35s 1s/step - loss: 0.1849 - accuracy: 0.9294 - val_loss: 0.1829 - val_accuracy: 0.9174 Epoch 6/20 31/31 [=====] - 36s 1s/step - loss: 0.1687 - accuracy: 0.9356 - val_loss: 0.1810 - val_accuracy: 0.9174 Epoch 7/20 31/31 [=====] - 36s 1s/step - loss: 0.1941 - accuracy: 0.9284 - val_loss: 0.1288 - val_accuracy: 0.9669 Epoch 8/20 31/31 [=====] - 36s 1s/step - loss: 0.1623 - accuracy: 0.9315 - val_loss: 0.2153 - val_accuracy: 0.9091 Epoch 9/20 31/31 [=====] - 35s 1s/step - loss: 0.1785 - accuracy: 0.9243 - val_loss: 0.1036 - val_accuracy: 0.9669 Epoch 10/20 31/31 [=====] - 34s 1s/step - loss: 0.1550 - accuracy: 0.9346 - val_loss: 0.1259 - val_accuracy: 0.9421</p> <p>Epoch 11/20 31/31 [=====] - 36s 1s/step - loss: 0.1383 - accuracy: 0.9468 - val_loss: 0.1051 - val_accuracy: 0.9669 Epoch 12/20 31/31 [=====] - 35s 1s/step - loss: 0.1252 - accuracy: 0.9530 - val_loss: 0.1653 - val_accuracy: 0.9339 Epoch 13/20 31/31 [=====] - 36s 1s/step - loss: 0.1050 - accuracy: 0.9591 - val_loss: 0.1266 - val_accuracy: 0.9669 Epoch 14/20 31/31 [=====] - 36s 1s/step - loss: 0.0942 - accuracy: 0.9601 - val_loss: 0.1104 - val_accuracy: 0.9587 Epoch 15/20 31/31 [=====] - 34s 1s/step - loss: 0.1722 - accuracy: 0.9447 - val_loss: 0.1166 - val_accuracy: 0.9504 Epoch 16/20 31/31 [=====] - 35s 1s/step - loss: 0.1546 - accuracy: 0.9213 - val_loss: 0.1151 - val_accuracy: 0.9504 Epoch 17/20 31/31 [=====] - 37s 1s/step - loss: 0.1077 - accuracy: 0.9591 - val_loss: 0.1191 - val_accuracy: 0.9587 Epoch 18/20 31/31 [=====] - 34s 1s/step - loss: 0.1179 - accuracy: 0.9571 - val_loss: 0.1385 - val_accuracy: 0.9421 Epoch 19/20 31/31 [=====] - 35s 1s/step - loss: 0.1121 - accuracy: 0.9581 - val_loss: 0.1439 - val_accuracy: 0.9587 Epoch 20/20 31/31 [=====] - 36s 1s/step - loss: 0.0940 - accuracy: 0.9642 - val_loss: 0.1272 - val_accuracy: 0.9587</p>	Layer (type)	Output Shape	Param #	Connected to	input_2 (InputLayer)	[None, 224, 224, 3]	0	[]	conv2d_4 (Conv2D)	(None, 111, 111, 32)	864	['input_2[0][0]']	batch_normalization_4 (BatchNormalization)	(None, 111, 111, 32)	96	['conv2d_4[0][0]']	activation (Activation)	(None, 111, 111, 32)	0	['batch_normalization_4[0][0]']	conv2d_5 (Conv2D)	(None, 109, 109, 32)	9216	['activation[0][0]']	batch_normalization_5 (BatchNormalization)	(None, 109, 109, 32)	96	['conv2d_5[0][0]']	activation_1 (Activation)	(None, 109, 109, 32)	0	['batch_normalization_5[0][0]']	conv2d_6 (Conv2D)	(None, 109, 109, 64)	18432	['activation_1[0][0]']	batch_normalization_6 (BatchNormalization)	(None, 109, 109, 64)	192	['conv2d_6[0][0]']	activation_2 (Activation)	(None, 109, 109, 64)	0	['batch_normalization_6[0][0]']	max_pooling2d (MaxPooling2D)	(None, 54, 54, 64)	0	['activation_2[0][0]']	conv2d_7 (Conv2D)	(None, 54, 54, 80)	5120	['max_pooling2d[0][0]']	batch_normalization_7 (BatchNormalization)	(None, 54, 54, 80)	240	['conv2d_7[0][0]']	activation_3 (Activation)	(None, 54, 54, 80)	0	['batch_normalization_7[0][0]']	conv2d_8 (Conv2D)	(None, 52, 52, 192)	138240	['activation_3[0][0]']	batch_normalization_8 (BatchNormalization)	(None, 52, 52, 192)	576	['conv2d_8[0][0]']	activation_4 (Activation)	(None, 52, 52, 192)	0	['batch_normalization_8[0][0]']	max_pooling2d_1 (MaxPooling2D)	(None, 25, 25, 192)	0	['activation_4[0][0]']
Layer (type)	Output Shape	Param #	Connected to																																																																										
input_2 (InputLayer)	[None, 224, 224, 3]	0	[]																																																																										
conv2d_4 (Conv2D)	(None, 111, 111, 32)	864	['input_2[0][0]']																																																																										
batch_normalization_4 (BatchNormalization)	(None, 111, 111, 32)	96	['conv2d_4[0][0]']																																																																										
activation (Activation)	(None, 111, 111, 32)	0	['batch_normalization_4[0][0]']																																																																										
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activation_2 (Activation)	(None, 109, 109, 64)	0	['batch_normalization_6[0][0]']																																																																										
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conv2d_7 (Conv2D)	(None, 54, 54, 80)	5120	['max_pooling2d[0][0]']																																																																										
batch_normalization_7 (BatchNormalization)	(None, 54, 54, 80)	240	['conv2d_7[0][0]']																																																																										
activation_3 (Activation)	(None, 54, 54, 80)	0	['batch_normalization_7[0][0]']																																																																										
conv2d_8 (Conv2D)	(None, 52, 52, 192)	138240	['activation_3[0][0]']																																																																										
batch_normalization_8 (BatchNormalization)	(None, 52, 52, 192)	576	['conv2d_8[0][0]']																																																																										
activation_4 (Activation)	(None, 52, 52, 192)	0	['batch_normalization_8[0][0]']																																																																										
max_pooling2d_1 (MaxPooling2D)	(None, 25, 25, 192)	0	['activation_4[0][0]']																																																																										

	<pre> conv2d_12 (Conv2D) (None, 25, 25, 64) 12288 ['max_pooling2d_1[0][0]'] batch_normalization_12 (BatchNormalization) 192 ['conv2d_12[0][0]'] activation_8 (Activation) (None, 25, 25, 64) 0 ['batch_normalization_12[0][0]'] conv2d_10 (Conv2D) (None, 25, 25, 48) 9216 ['max_pooling2d_1[0][0]'] conv2d_13 (Conv2D) (None, 25, 25, 96) 55296 ['activation_8[0][0]'] batch_normalization_10 (BatchNormalization) 144 ['conv2d_10[0][0]'] batch_normalization_13 (BatchNormalization) 288 ['conv2d_13[0][0]'] activation_6 (Activation) (None, 25, 25, 48) 0 ['batch_normalization_10[0][0]'] activation_9 (Activation) (None, 25, 25, 96) 0 ['batch_normalization_13[0][0]'] average_pooling2d (AveragePooling2D) (None, 25, 25, 192) 0 ['max_pooling2d_1[0][0]'] conv2d_9 (Conv2D) (None, 25, 25, 64) 12288 ['max_pooling2d_1[0][0]'] </pre>																																									
	<p>..so on layers</p> <pre> mixed9_1 (Concatenate) (None, 5, 5, 768) 0 ['activation_87[0][0]', 'activation_88[0][0]'] concatenate_1 (Concatenate) (None, 5, 5, 768) 0 ['activation_92[0][0]', 'activation_92[0][0]'] activation_93 (Activation) (None, 5, 5, 192) 0 ['batch_normalization_97[0][0]'] mixed10 (Concatenate) (None, 5, 5, 2048) 0 ['activation_85[0][0]', 'mixed9_1[0][0]', 'concatenate_1[0][0]', 'activation_93[0][0]'] flatten_1 (Flatten) (None, 51200) 0 ['mixed10[0][0]'] dense_2 (Dense) (None, 1024) 5242982 ['flatten_1[0][0]'] dropout_1 (Dropout) (None, 1024) 0 ['dense_2[0][0]'] dense_3 (Dense) (None, 1) 1025 ['dropout_1[0][0]'] ===== Total params: 74233633 (283.18 MB) Trainable params: 52430849 (206.01 MB) Non-trainable params: 21802784 (83.17 MB) </pre>																																									
MobileNet	<p>Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/mobilenet_v2/mobilenet_v2_weights_tf_dim_ordering_tf_kernels.h5 [=====] - 0s 0us/step</p> <pre> 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, 224, 224, 3]</td> <td>0</td> <td>[]</td> </tr> <tr> <td>Conv1 (Conv2D)</td> <td>(None, 112, 112, 32)</td> <td>864</td> <td>['input_1[0][0]']</td> </tr> <tr> <td>bn_conv1 (BatchNormalizati on)</td> <td>(None, 112, 112, 32)</td> <td>128</td> <td>['Conv1[0][0]']</td> </tr> <tr> <td>Conv1_relu (ReLU)</td> <td>(None, 112, 112, 32)</td> <td>0</td> <td>['bn_conv1[0][0]']</td> </tr> <tr> <td>expanded_conv_depthwise (DepthwiseConv2D)</td> <td>(None, 112, 112, 32)</td> <td>288</td> <td>['Conv1_relu[0][0]']</td> </tr> <tr> <td>expanded_conv_depthwise_BN (BatchNormalization)</td> <td>(None, 112, 112, 32)</td> <td>128</td> <td>['expanded_conv_depthwise[0][0]']</td> </tr> <tr> <td>expanded_conv_depthwise_re lu (ReLU)</td> <td>(None, 112, 112, 32)</td> <td>0</td> <td>['expanded_conv_depthwise_BN[0][0]']</td> </tr> <tr> <td>expanded_conv_project (Conv2D)</td> <td>(None, 112, 112, 16)</td> <td>512</td> <td>['expanded_conv_depthwise_relu[0][0]']</td> </tr> <tr> <td>expanded_conv_project_BN (BatchNormalization)</td> <td>(None, 112, 112, 16)</td> <td>64</td> <td>['expanded_conv_project[0][0]']</td> </tr> </tbody> </table>	Layer (type)	Output Shape	Param #	Connected to	input_1 (Inputlayer)	[None, 224, 224, 3]	0	[]	Conv1 (Conv2D)	(None, 112, 112, 32)	864	['input_1[0][0]']	bn_conv1 (BatchNormalizati on)	(None, 112, 112, 32)	128	['Conv1[0][0]']	Conv1_relu (ReLU)	(None, 112, 112, 32)	0	['bn_conv1[0][0]']	expanded_conv_depthwise (DepthwiseConv2D)	(None, 112, 112, 32)	288	['Conv1_relu[0][0]']	expanded_conv_depthwise_BN (BatchNormalization)	(None, 112, 112, 32)	128	['expanded_conv_depthwise[0][0]']	expanded_conv_depthwise_re lu (ReLU)	(None, 112, 112, 32)	0	['expanded_conv_depthwise_BN[0][0]']	expanded_conv_project (Conv2D)	(None, 112, 112, 16)	512	['expanded_conv_depthwise_relu[0][0]']	expanded_conv_project_BN (BatchNormalization)	(None, 112, 112, 16)	64	['expanded_conv_project[0][0]']	<pre> Epoch 1/15 30/30 [=====] - 400s 13s/step - loss: 0.5267 - accuracy: 0.8097 - val_loss: 0.1454 - val_accuracy: 0.9479 Epoch 2/15 30/30 [=====] - 89s 3s/step - loss: 0.2933 - accuracy: 0.9123 - val_loss: 0.0961 - val_accuracy: 0.9688 Epoch 3/15 30/30 [=====] - 78s 3s/step - loss: 0.1954 - accuracy: 0.9228 - val_loss: 0.1251 - val_accuracy: 0.9479 Epoch 4/15 30/30 [=====] - 78s 3s/step - loss: 0.1545 - accuracy: 0.9408 - val_loss: 0.1229 - val_accuracy: 0.9271 Epoch 5/15 30/30 [=====] - 81s 3s/step - loss: 0.1496 - accuracy: 0.9501 - val_loss: 0.1229 - val_accuracy: 0.9479 Epoch 6/15 30/30 [=====] - 75s 3s/step - loss: 0.1447 - accuracy: 0.9471 - val_loss: 0.0928 - val_accuracy: 0.9688 Epoch 7/15 30/30 [=====] - 79s 3s/step - loss: 0.1426 - accuracy: 0.9419 - val_loss: 0.1082 - val_accuracy: 0.9479 Epoch 8/15 30/30 [=====] - 78s 3s/step - loss: 0.1253 - accuracy: 0.9514 - val_loss: 0.1474 - val_accuracy: 0.9479 Epoch 9/15 30/30 [=====] - 81s 3s/step - loss: 0.0822 - accuracy: 0.9602 - val_loss: 0.1378 - val_accuracy: 0.9583 Epoch 10/15 30/30 [=====] - 87s 3s/step - loss: 0.0475 - accuracy: 0.9757 - val_loss: 0.1498 - val_accuracy: 0.9583 Epoch 11/15 30/30 [=====] - 76s 3s/step - loss: 0.0712 - accuracy: 0.9704 - val_loss: 0.1345 - val_accuracy: 0.9479 Epoch 12/15 30/30 [=====] - 78s 3s/step - loss: 0.0471 - accuracy: 0.9683 - val_loss: 0.1812 - val_accuracy: 0.9583 Epoch 13/15 30/30 [=====] - 74s 2s/step - loss: 0.0488 - accuracy: 0.9662 - val_loss: 0.1361 - val_accuracy: 0.9583 Epoch 14/15 30/30 [=====] - 76s 2s/step - loss: 0.0604 - accuracy: 0.9746 - val_loss: 0.1611 - val_accuracy: 0.9583 Epoch 15/15 30/30 [=====] - 74s 2s/step - loss: 0.0638 - accuracy: 0.9736 - val_loss: 0.1545 - val_accuracy: 0.9583 </pre>
Layer (type)	Output Shape	Param #	Connected to																																							
input_1 (Inputlayer)	[None, 224, 224, 3]	0	[]																																							
Conv1 (Conv2D)	(None, 112, 112, 32)	864	['input_1[0][0]']																																							
bn_conv1 (BatchNormalizati on)	(None, 112, 112, 32)	128	['Conv1[0][0]']																																							
Conv1_relu (ReLU)	(None, 112, 112, 32)	0	['bn_conv1[0][0]']																																							
expanded_conv_depthwise (DepthwiseConv2D)	(None, 112, 112, 32)	288	['Conv1_relu[0][0]']																																							
expanded_conv_depthwise_BN (BatchNormalization)	(None, 112, 112, 32)	128	['expanded_conv_depthwise[0][0]']																																							
expanded_conv_depthwise_re lu (ReLU)	(None, 112, 112, 32)	0	['expanded_conv_depthwise_BN[0][0]']																																							
expanded_conv_project (Conv2D)	(None, 112, 112, 16)	512	['expanded_conv_depthwise_relu[0][0]']																																							
expanded_conv_project_BN (BatchNormalization)	(None, 112, 112, 16)	64	['expanded_conv_project[0][0]']																																							

	<pre> block_1_expand (Conv2D) (None, 112, 112, 96) 1536 ['expanded_conv_project_BN[0][0]'] block_1_expand_BN (BatchNorm (None, 112, 112, 96) 384 ['block_1_expand[0][0]'] block_1_expand_relu (ReLU) (None, 112, 112, 96) 0 ['block_1_expand_BN[0][0]'] block_1_pad (ZeroPadding2D (None, 113, 113, 96) 0 ['block_1_expand_relu[0][0]'] block_1_depthwise (DepthwiseConv2D (None, 56, 56, 96) 864 ['block_1_pad[0][0]'] block_1_depthwise_BN (BatchNormalization (None, 56, 56, 96) 384 ['block_1_depthwise[0][0]'] block_1_depthwise_relu (ReLU) (None, 56, 56, 96) 0 ['block_1_depthwise_BN[0][0]'] block_1_project (Conv2D) (None, 56, 56, 24) 2304 ['block_1_depthwise_relu[0][0]'] block_1_project_BN (BatchNormalization (None, 56, 56, 24) 96 ['block_1_project[0][0]'] block_2_expand (Conv2D) (None, 56, 56, 144) 3456 ['block_1_project_BN[0][0]'] block_2_expand_BN (BatchNorm (None, 56, 56, 144) 576 ['block_2_expand[0][0]'] block_2_depthwise_relu (ReLU) (None, 56, 56, 144) 0 ['block_2_expand_BN[0][0]'] block_2_depthwise (DepthwiseConv2D (None, 56, 56, 144) 1296 ['block_2_depthwise[0][0]'] block_2_depthwise_BN (BatchNormalization (None, 56, 56, 144) 576 ['block_2_depthwise_BN[0][0]'] block_2_depthwise_relu (ReLU) (None, 56, 56, 144) 0 ['block_2_depthwise_BN[0][0]'] block_2_project (Conv2D) (None, 56, 56, 24) 3456 ['block_2_depthwise[0][0]'] block_2_project_BN (BatchNormalization (None, 56, 56, 24) 96 ['block_2_project[0][0]'] block_2_add (Add) (None, 56, 56, 24) 0 ['block_2_project_BN[0][0]', 'block_2_project_BN[0][0]'] block_3_expand (Conv2D) (None, 56, 56, 144) 3456 ['block_2_add[0][0]'] block_3_expand_BN (BatchNorm (None, 56, 56, 144) 576 ['block_3_expand[0][0]'] block_3_depthwise_relu (ReLU) (None, 56, 56, 144) 0 ['block_3_expand_BN[0][0]'] block_3_pad (ZeroPadding2D (None, 57, 57, 144) 0 ['block_3_depthwise_relu[0][0]'] block_3_depthwise (DepthwiseConv2D (None, 28, 28, 144) 1296 ['block_3_pad[0][0]'] block_3_depthwise_BN (BatchNormalization (None, 28, 28, 144) 576 ['block_3_depthwise[0][0]'] </pre>	
	<pre> block_16_project_BN (BatchNormalization (None, 7, 7, 320) 1280 ['block_16_project[0][0]'] Conv_1 (Conv2D) (None, 7, 7, 1280) 409600 ['block_16_project_BN[0][0]'] conv_1_bn (BatchNormaliz ion) (None, 7, 7, 1280) 5120 ['Conv_1[0][0]'] out_relu (ReLU) (None, 7, 7, 1280) 0 ['conv_1_bn[0][0]'] flatten (Flatten) (None, 62720) 0 ['out_relu[0][0]'] dense (Dense) (None, 128) 8028288 ['flatten[0][0]'] dropout (Dropout) (None, 128) 0 ['dense[0][0]'] dense_1 (Dense) (None, 1) 129 ['dropout[0][0]'] ===== Total params: 10286480 (39.24 MB) Trainable params: 8028417 (30.63 MB) Non-trainable params: 2257984 (8.61 MB) </pre>	

