

Model Development Phase Template

Date	15 March 2024
Team ID	SWTID1720440447
Project Title	Covid Vision: Advanced COVID-19 Detection from Lung X-rays with Deep Learning
Maximum Marks	10 Marks

Initial Model Training Code (5 marks):

```
[ ] from tensorflow.keras.applications.inception_v3 import InceptionV3
    from tensorflow.keras.layers import Dense, Flatten
    from tensorflow.keras.models import Model

[ ] InceptionV3 = InceptionV3(include_top=False, input_shape=(256, 256, 3))

[ ] Downloading data from https://storage.googleapis.com/tensorflow/keras-applications/inception_v3/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5
    87910968/87910968 [=====] - 1s 0us/step

[ ] x = Flatten()(InceptionV3.output)

[ ] output = Dense(1, activation='sigmoid')(x)

[ ] InceptionV3 = Model(InceptionV3.input, output)

[ ] InceptionV3.summary()

[ ] Show hidden output

[ ] InceptionV3.compile(loss='binary_crossentropy', optimizer='adam', metrics=['accuracy'])
```

Model Validation and Evaluation Report:

Model	Summary	Training and Validation Performance Metrics
VGG16	<pre> vgg.summary() Model: "vgg16" ----- Layer (type) Output Shape Param # ----- input_1 (InputLayer) [(None, 256, 256, 3)] 0 block1_conv1 (Conv2D) (None, 256, 256, 64) 1792 block1_conv2 (Conv2D) (None, 256, 256, 64) 36928 block1_pool (MaxPooling2D) (None, 128, 128, 64) 0 block2_conv1 (Conv2D) (None, 128, 128, 128) 73856 block2_conv2 (Conv2D) (None, 128, 128, 128) 147584 block2_pool (MaxPooling2D) (None, 64, 64, 128) 0 block3_conv1 (Conv2D) (None, 64, 64, 256) 295168 block3_conv2 (Conv2D) (None, 64, 64, 256) 590080 block3_conv3 (Conv2D) (None, 64, 64, 256) 590080 block3_pool (MaxPooling2D) (None, 32, 32, 256) 0 block4_conv1 (Conv2D) (None, 32, 32, 512) 1180160 block4_conv2 (Conv2D) (None, 32, 32, 512) 2359808 block4_conv3 (Conv2D) (None, 32, 32, 512) 2359808 block4_pool (MaxPooling2D) (None, 16, 16, 512) 0 block5_conv1 (Conv2D) (None, 16, 16, 512) 2359808 block5_conv2 (Conv2D) (None, 16, 16, 512) 2359808 block5_conv3 (Conv2D) (None, 16, 16, 512) 2359808 block5_pool (MaxPooling2D) (None, 8, 8, 512) 0 ----- Total params: 14714608 (56.13 MB) Trainable params: 14714608 (56.13 MB) Non-trainable params: 0 (0.00 Byte) </pre>	<pre> vgg16.fit(train_generator, validation_data=validation_generator, epochs=5) Epoch 1/5 312/312 [=====] - 1408s 4s/step - loss: 0.6234 - accuracy: 0.7345 - val_loss: 0.3295 - val_accuracy: 0.9546 Epoch 2/5 312/312 [=====] - 138s 43ms/step - loss: 0.4876 - accuracy: 0.7921 - val_loss: 0.2988 - val_accuracy: 0.9442 Epoch 3/5 312/312 [=====] - 137s 43ms/step - loss: 0.4318 - accuracy: 0.8182 - val_loss: 0.2754 - val_accuracy: 0.9347 Epoch 4/5 312/312 [=====] - 137s 43ms/step - loss: 0.3895 - accuracy: 0.8370 - val_loss: 0.2637 - val_accuracy: 0.9546 Epoch 5/5 312/312 [=====] - 136s 43ms/step - loss: 0.3529 - accuracy: 0.8555 - val_loss: 0.2543 - val_accuracy: 0.9549 keras.src.callbacks.History at 0x7f9012e7f8d0 keras.src.callbacks.History at 0x7f9080f51870 </pre>
RESNET 50	<pre> resnet50.summary() conv5_block2_2_bn (BatchNorm (None, 8, 8, 512) 2048 ['conv5_block2_2_conv[0][0]'] realization) conv5_block2_2_relu (Activ (None, 8, 8, 512) 0 ['conv5_block2_2_bn[0][0]'] ation) conv5_block2_3_conv (Conv2 (None, 8, 8, 2048) 1050624 ['conv5_block2_2_relu[0][0]'] D) conv5_block2_3_bn (BatchNorm (None, 8, 8, 2048) 8192 ['conv5_block2_3_conv[0][0]'] realization) conv5_block2_add (Add) (None, 8, 8, 2048) 0 ['conv5_block2_out[0][0]', conv5_block2_3_bn[0][0]'] conv5_block2_out (Activati (None, 8, 8, 2048) 0 ['conv5_block2_add[0][0]'] on) conv5_block3_1_conv (Conv2 (None, 8, 8, 512) 1049984 ['conv5_block2_out[0][0]'] D) conv5_block3_1_bn (BatchNorm (None, 8, 8, 512) 2048 ['conv5_block3_1_conv[0][0]'] realization) conv5_block3_1_relu (Activ (None, 8, 8, 512) 0 ['conv5_block3_1_bn[0][0]'] ation) conv5_block2_2_conv (Conv2 (None, 8, 8, 512) 2359808 ['conv5_block3_1_relu[0][0]'] D) conv5_block2_2_bn (BatchNorm (None, 8, 8, 512) 2048 ['conv5_block3_2_conv[0][0]'] realization) conv5_block2_2_relu (Activ (None, 8, 8, 512) 0 ['conv5_block3_2_bn[0][0]'] ation) conv5_block3_3_conv (Conv2 (None, 8, 8, 2048) 1050624 ['conv5_block3_2_relu[0][0]'] D) conv5_block3_3_bn (BatchNorm (None, 8, 8, 2048) 8192 ['conv5_block3_3_conv[0][0]'] realization) conv5_block3_add (Add) (None, 8, 8, 2048) 0 ['conv5_block2_out[0][0]', conv5_block3_3_bn[0][0]'] conv5_block3_out (Activati (None, 8, 8, 2048) 0 ['conv5_block3_add[0][0]'] on) </pre>	<pre> resnet50.fit(train_generator, validation_data=validation_generator, epochs=5) Epoch 1/5 312/312 [=====] - 5727s 18s/step - loss: 0.8494 - accuracy: 0.6487 - val_loss: 0.4821 - val_accuracy: 0.7847 Epoch 2/5 312/312 [=====] - 151s 478ms/step - loss: 0.6839 - accuracy: 0.7291 - val_loss: 0.4372 - val_accuracy: 0.8178 Epoch 3/5 312/312 [=====] - 150s 475ms/step - loss: 0.7834 - accuracy: 0.7818 - val_loss: 0.3838 - val_accuracy: 0.8729 Epoch 4/5 312/312 [=====] - 149s 473ms/step - loss: 0.7538 - accuracy: 0.7239 - val_loss: 0.6883 - val_accuracy: 0.7477 Epoch 5/5 312/312 [=====] - 149s 478ms/step - loss: 0.6616 - accuracy: 0.7518 - val_loss: 0.4179 - val_accuracy: 0.8335 keras.src.callbacks.History at 0x777912e7f8d0 </pre>

INCEP TION

```

InceptionV3.summary()
Model: "model"

```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	(None, 256, 256, 3)	0	[]
conv2d (Conv2D)	(None, 127, 127, 32)	864	['input_1[0][0]']
batch_normalization (Batch Normalization)	(None, 127, 127, 32)	96	['conv2d[0][0]']
activation (Activation)	(None, 127, 127, 32)	0	['batch_normalization[0][0]']
conv2d_1 (Conv2D)	(None, 125, 125, 32)	9216	['activation[0][0]']
batch_normalization_1 (Batch Normalization)	(None, 125, 125, 32)	96	['conv2d_1[0][0]']
activation_1 (Activation)	(None, 125, 125, 32)	0	['batch_normalization_1[0][0]']
conv2d_2 (Conv2D)	(None, 125, 125, 64)	18432	['activation_1[0][0]']
batch_normalization_2 (Batch Normalization)	(None, 125, 125, 64)	192	['conv2d_2[0][0]']
activation_2 (Activation)	(None, 125, 125, 64)	0	['batch_normalization_2[0][0]']
max_pooling2d (MaxPooling2D)	(None, 62, 62, 64)	0	['activation_2[0][0]']
conv2d_3 (Conv2D)	(None, 62, 62, 80)	5120	['max_pooling2d[0][0]']
batch_normalization_3 (Batch Normalization)	(None, 62, 62, 80)	240	['conv2d_3[0][0]']
activation_3 (Activation)	(None, 62, 62, 80)	0	['batch_normalization_3[0][0]']
conv2d_4 (Conv2D)	(None, 60, 60, 192)	138240	['activation_3[0][0]']
batch_normalization_4 (Batch Normalization)	(None, 60, 60, 192)	576	['conv2d_4[0][0]']
activation_4 (Activation)	(None, 60, 60, 192)	0	['batch_normalization_4[0][0]']

```

InceptionV3.fit(train_generator, validation_data=validation_generator, epochs=5)
Epoch 1/5
317/317 [=====] - 4230s 13s/step - loss: 0.5572 - accuracy: 0.8221 - val_loss: 0.3898 - val_accuracy: 0.9045
Epoch 2/5
317/317 [=====] - 3903s 12s/step - loss: 0.3359 - accuracy: 0.8841 - val_loss: 0.3479 - val_accuracy: 0.9451
Epoch 3/5
317/317 [=====] - 3806s 12s/step - loss: 0.2376 - accuracy: 0.9139 - val_loss: 0.4145 - val_accuracy: 0.9459
Epoch 4/5
317/317 [=====] - 3840s 12s/step - loss: 0.1881 - accuracy: 0.9327 - val_loss: 0.6839 - val_accuracy: 0.8252
Epoch 5/5
317/317 [=====] - 3843s 12s/step - loss: 0.7318 - accuracy: 0.7561 - val_loss: 11.8878 - val_accuracy: 0.5798
keras.src.callbacks.history at 0x7060bf187b9

```

XCEPTI ON

```

Xception.summary()
Model: "model"

```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	(None, 256, 256, 3)	0	[]
block1_conv1 (Conv2D)	(None, 127, 127, 32)	864	['input_1[0][0]']
block1_conv1_bn (Batch Normalization)	(None, 127, 127, 32)	128	['block1_conv1[0][0]']
block1_conv1_act (Activation)	(None, 127, 127, 32)	0	['block1_conv1_bn[0][0]']
block1_conv2 (Conv2D)	(None, 125, 125, 64)	18432	['block1_conv1_act[0][0]']
block1_conv2_bn (Batch Normalization)	(None, 125, 125, 64)	256	['block1_conv2[0][0]']
block1_conv2_act (Activation)	(None, 125, 125, 64)	0	['block1_conv2_bn[0][0]']
block2_sepconv1 (Separable Conv2D)	(None, 125, 125, 128)	8768	['block1_conv2_act[0][0]']
block2_sepconv1_bn (Batch Normalization)	(None, 125, 125, 128)	512	['block2_sepconv1[0][0]']
block2_sepconv2_act (Activation)	(None, 125, 125, 128)	0	['block2_sepconv1_bn[0][0]']
block2_sepconv2 (Separable Conv2D)	(None, 125, 125, 128)	17536	['block2_sepconv2_act[0][0]']
block2_sepconv2_bn (Batch Normalization)	(None, 125, 125, 128)	512	['block2_sepconv2[0][0]']
conv2d (Conv2D)	(None, 63, 63, 128)	8192	['block1_conv2_act[0][0]']
block3_pool (MaxPooling2D)	(None, 63, 63, 128)	0	['block2_sepconv2_bn[0][0]']
batch_normalization (Batch Normalization)	(None, 63, 63, 128)	512	['conv2d[0][0]']
add (Add)	(None, 63, 63, 128)	0	['block3_pool[0][0]', 'batch_normalization[0][0]']
block3_sepconv1_act (Activation)	(None, 63, 63, 128)	0	['add[0][0]']

```

Xception.fit(train_generator, validation_data=validation_generator, epochs=5)
Epoch 1/5
317/317 [=====] - 1880s 6s/step - loss: 0.7154 - accuracy: 0.7125 - val_loss: 0.3825 - val_accuracy: 0.9382
Epoch 2/5
317/317 [=====] - 195s 615ms/step - loss: 0.4983 - accuracy: 0.7914 - val_loss: 0.3387 - val_accuracy: 0.9288
Epoch 3/5
317/317 [=====] - 194s 612ms/step - loss: 0.4281 - accuracy: 0.8245 - val_loss: 0.3284 - val_accuracy: 0.9461
Epoch 4/5
317/317 [=====] - 194s 612ms/step - loss: 0.3512 - accuracy: 0.8397 - val_loss: 0.3389 - val_accuracy: 0.9123
Epoch 5/5
317/317 [=====] - 193s 608ms/step - loss: 0.3545 - accuracy: 0.8541 - val_loss: 0.2998 - val_accuracy: 0.9047
keras.src.callbacks.history at 0x777912ef48d0

```