Model Development Phase Template

Date	23 fed 2026
Team ID	LTVIP2026TMIDS50689
Project Title	Dog Breed Identification using Transfer Learning
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):

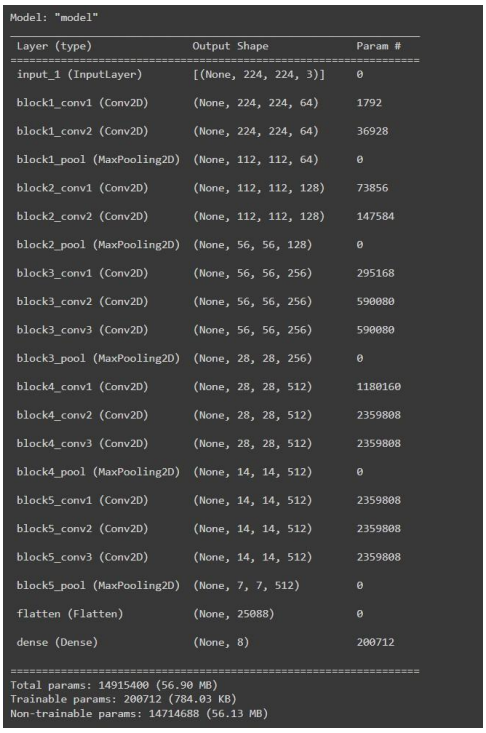
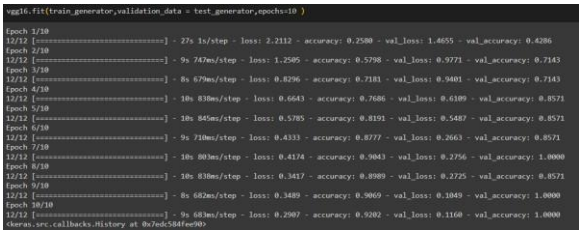
```
vgg16.fit(train_generator,validation_data = test_generator,epochs=10 )
```

```
resnet.fit(train_generator,validation_data = test_generator,epochs=10 )
```

```
inception.fit(train_generator,validation_data = test_generator,epochs=10 )
```

```
xception.fit(train_generator,validation_data = test_generator,epochs=10 )
```

Model Validation and Evaluation Report (5 marks):

Model	Summary	Training and Validation Performance Metrics
Model 1		

Model 2

```
conv5_block2_2_conv (Conv2D)    (None, 7, 7, 512)     2359808   ['conv5_block2_1_relu[0][0]']
conv5_block2_2_bn (BatchNormalization)  (None, 7, 7, 512)  2048  ['conv5_block2_2_conv[0][0]']
conv5_block2_2_relu (Activation)  (None, 7, 7, 512)   0         ['conv5_block2_2_bn[0][0]']
conv5_block2_3_conv (Conv2D)    (None, 7, 7, 2048)    1050624   ['conv5_block2_2_relu[0][0]']
conv5_block2_3_bn (BatchNormalization)  (None, 7, 7, 2048)  8192  ['conv5_block2_3_conv[0][0]']
conv5_block2_add (Add)          (None, 7, 7, 2048)    0         ['conv5_block1_out[0][0]',
                                                                 'conv5_block2_3_bn[0][0]']
conv5_block2_out (Activation)   (None, 7, 7, 2048)    0         ['conv5_block2_add[0][0]']
conv5_block3_1_conv (Conv2D)    (None, 7, 7, 512)     1049088   ['conv5_block2_out[0][0]']
conv5_block3_1_bn (BatchNormalization)  (None, 7, 7, 512)  2048  ['conv5_block3_1_conv[0][0]']
conv5_block3_1_relu (Activation)  (None, 7, 7, 512)   0         ['conv5_block3_1_bn[0][0]']
conv5_block3_2_conv (Conv2D)    (None, 7, 7, 512)     2359808   ['conv5_block3_1_relu[0][0]']
conv5_block3_2_bn (BatchNormalization)  (None, 7, 7, 512)  2048  ['conv5_block3_2_conv[0][0]']
conv5_block3_2_relu (Activation)  (None, 7, 7, 512)   0         ['conv5_block3_2_bn[0][0]']
conv5_block3_3_conv (Conv2D)    (None, 7, 7, 2048)    1050624   ['conv5_block3_2_relu[0][0]']
conv5_block3_3_bn (BatchNormalization)  (None, 7, 7, 2048)  8192  ['conv5_block3_3_conv[0][0]']
conv5_block3_add (Add)          (None, 7, 7, 2048)    0         ['conv5_block2_out[0][0]',
                                                                 'conv5_block3_3_bn[0][0]']
conv5_block3_out (Activation)   (None, 7, 7, 2048)    0         ['conv5_block3_add[0][0]']
flatten_1 (Flatten)             (None, 100352)        0         ['conv5_block3_out[0][0]']
dense_1 (Dense)                 (None, 8)             802824    ['flatten_1[0][0]']
==================================================================================================
Total params: 24300536 (93.04 MB)
Trainable params: 802824 (3.06 MB)
```

```
resnet.fit(train_generator,validation_data = test_generator,epochs=10 )

Epoch 1/10
12/12 [==============================] - 17s 941ms/step - loss: 8.6675 - accuracy: 0.1436 - val_loss: 6.0575 - val_accuracy: 0.1429
Epoch 2/10
12/12 [==============================] - 8s 647ms/step - loss: 6.9999 - accuracy: 0.1356 - val_loss: 3.4116 - val_accuracy: 0.4286
Epoch 3/10
12/12 [==============================] - 8s 636ms/step - loss: 4.2426 - accuracy: 0.1862 - val_loss: 2.2663 - val_accuracy: 0.1429
Epoch 4/10
12/12 [==============================] - 9s 778ms/step - loss: 2.8612 - accuracy: 0.2207 - val_loss: 2.5258 - val_accuracy: 0.2857
Epoch 5/10
12/12 [==============================] - 9s 750ms/step - loss: 2.5177 - accuracy: 0.2340 - val_loss: 1.5863 - val_accuracy: 0.2857
Epoch 6/10
12/12 [==============================] - 8s 652ms/step - loss: 2.2711 - accuracy: 0.2048 - val_loss: 1.5330 - val_accuracy: 0.5714
Epoch 7/10
12/12 [==============================] - 9s 774ms/step - loss: 2.2721 - accuracy: 0.2500 - val_loss: 1.4668 - val_accuracy: 0.4286
Epoch 8/10
12/12 [==============================] - 9s 776ms/step - loss: 2.0657 - accuracy: 0.2606 - val_loss: 1.5892 - val_accuracy: 0.4286
Epoch 9/10
12/12 [==============================] - 8s 646ms/step - loss: 1.9804 - accuracy: 0.2926 - val_loss: 1.5387 - val_accuracy: 0.4286
Epoch 10/10
12/12 [==============================] - 9s 766ms/step - loss: 2.7414 - accuracy: 0.1835 - val_loss: 2.1361 - val_accuracy: 0.4286
<keras.src.callbacks.History at 0x7edc5048e980>
```

Model 3

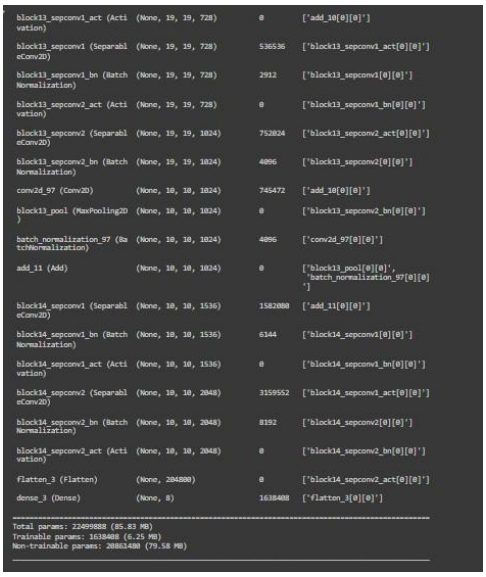
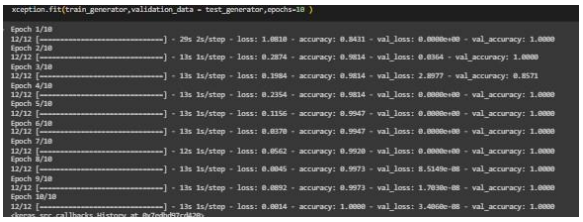
```
inception.summary()

 batch_normalization_87 (BatchNormalization)  (None, 8, 8, 384)  1152  ['conv2d_87[0][0]']
 batch_normalization_88 (BatchNormalization)  (None, 8, 8, 384)  1152  ['conv2d_88[0][0]']
 batch_normalization_91 (BatchNormalization)  (None, 8, 8, 384)  1152  ['conv2d_91[0][0]']
 batch_normalization_92 (BatchNormalization)  (None, 8, 8, 384)  1152  ['conv2d_92[0][0]']
 conv2d_93 (Conv2D)              (None, 8, 8, 192)     393216    ['average_pooling2d_8[0][0]']
 batch_normalization_85 (BatchNormalization)  (None, 8, 8, 320)  960  ['conv2d_85[0][0]']
 activation_87 (Activation)      (None, 8, 8, 384)     0         ['batch_normalization_87[0][0]']
 activation_88 (Activation)      (None, 8, 8, 384)     0         ['batch_normalization_88[0][0]']
 activation_91 (Activation)      (None, 8, 8, 384)     0         ['batch_normalization_91[0][0]']
 activation_92 (Activation)      (None, 8, 8, 384)     0         ['batch_normalization_92[0][0]']
 batch_normalization_93 (BatchNormalization)  (None, 8, 8, 192)  576  ['conv2d_93[0][0]']
 activation_85 (Activation)      (None, 8, 8, 320)     0         ['batch_normalization_85[0][0]']
 mixed9_1 (Concatenate)          (None, 8, 8, 768)     0         ['activation_87[0][0]',
                                                                  'activation_88[0][0]']
 concatenate_1 (Concatenate)     (None, 8, 8, 768)     0         ['activation_91[0][0]',
                                                                  'activation_92[0][0]']
 activation_93 (Activation)      (None, 8, 8, 192)     0         ['batch_normalization_93[0][0]']
 mixed10 (Concatenate)           (None, 8, 8, 2048)    0         ['activation_85[0][0]',
                                                                  'mixed9_1[0][0]',
                                                                  'concatenate_1[0][0]',
                                                                  'activation_93[0][0]']
 flatten_2 (Flatten)             (None, 131072)        0         ['mixed10[0][0]']
 dense_2 (Dense)                 (None, 8)             1048584   ['flatten_2[0][0]']
==================================================================================================
Total params: 22851368 (87.17 MB)
Trainable params: 22816936 (87.04 MB)
Non-trainable params: 34432 (134.50 KB)
```

...

```
inception.fit(train_generator,validation_data = test_generator,epochs=10 )

Epoch 1/10
12/12 [==============================] - 74s 2s/step - loss: 10.1741 - accuracy: 0.2128 - val_loss: 19216.6914 - val_accuracy: 0.1429
Epoch 2/10
12/12 [==============================] - 14s 1s/step - loss: 8.7789 - accuracy: 0.1941 - val_loss: 118563.7734 - val_accuracy: 0.1429
Epoch 3/10
12/12 [==============================] - 14s 1s/step - loss: 3.5277 - accuracy: 0.2181 - val_loss: 748522.1250 - val_accuracy: 0.1429
Epoch 4/10
12/12 [==============================] - 14s 1s/step - loss: 3.1099 - accuracy: 0.1889 - val_loss: 136493.8594 - val_accuracy: 0.1429
Epoch 5/10
12/12 [==============================] - 14s 1s/step - loss: 2.9712 - accuracy: 0.1755 - val_loss: 253621.9062 - val_accuracy: 0.2857
Epoch 6/10
12/12 [==============================] - 14s 1s/step - loss: 2.9888 - accuracy: 0.1622 - val_loss: 17096.1543 - val_accuracy: 0.1429
Epoch 7/10
12/12 [==============================] - 14s 1s/step - loss: 2.8311 - accuracy: 0.1489 - val_loss: 826.5386 - val_accuracy: 0.0000e+00
Epoch 8/10
12/12 [==============================] - 14s 1s/step - loss: 2.4929 - accuracy: 0.1941 - val_loss: 10529.5938 - val_accuracy: 0.1429
Epoch 9/10
12/12 [==============================] - 14s 1s/step - loss: 2.2347 - accuracy: 0.1888 - val_loss: 31282.3652 - val_accuracy: 0.1429
Epoch 10/10
12/12 [==============================] - 14s 1s/step - loss: 2.3498 - accuracy: 0.2287 - val_loss: 69.5367 - val_accuracy: 0.2857
<keras.src.callbacks.History at 0x7edbdbd898c8>
```

Model 4	 block13_sepconv1_act (Activation) (None, 19, 19, 728) 0 ['add_10[0][0]'] block13_sepconv1 (SeparableConv2D) (None, 19, 19, 728) 536536 ['block13_sepconv1_act[0][0]'] block13_sepconv1_bn (BatchNormalization) (None, 19, 19, 728) 2912 ['block13_sepconv1[0][0]'] block13_sepconv2_act (Activation) (None, 19, 19, 728) 0 ['block13_sepconv1_bn[0][0]'] block13_sepconv2 (SeparableConv2D) (None, 19, 19, 1024) 752024 ['block13_sepconv2_act[0][0]'] block13_sepconv2_bn (BatchNormalization) (None, 19, 19, 1024) 4096 ['block13_sepconv2[0][0]'] conv2d_97 (Conv2D) (None, 10, 10, 1024) 745472 ['add_10[0][0]'] block13_pool (MaxPooling2D) (None, 10, 10, 1024) 0 ['block13_sepconv2_bn[0][0]'] batch_normalization_97 (BatchNormalization) (None, 10, 10, 1024) 4096 ['conv2d_97[0][0]'] add_11 (Add) (None, 10, 10, 1024) 0 ['block13_pool[0][0]', 'batch_normalization_97[0][0]'] block14_sepconv1 (SeparableConv2D) (None, 10, 10, 1536) 1582080 ['add_11[0][0]'] block14_sepconv1_bn (BatchNormalization) (None, 10, 10, 1536) 6144 ['block14_sepconv1[0][0]'] block14_sepconv1_act (Activation) (None, 10, 10, 1536) 0 ['block14_sepconv1_bn[0][0]'] block14_sepconv2 (SeparableConv2D) (None, 10, 10, 2048) 3159552 ['block14_sepconv1_act[0][0]'] block14_sepconv2_bn (BatchNormalization) (None, 10, 10, 2048) 8192 ['block14_sepconv2[0][0]'] block14_sepconv2_act (Activation) (None, 10, 10, 2048) 0 ['block14_sepconv2_bn[0][0]'] flatten_3 (Flatten) (None, 204800) 0 ['block14_sepconv2_act[0][0]'] dense_3 (Dense) (None, 8) 1638408 ['flatten_3[0][0]'] Total params: 22409888 (85.83 MB) Trainable params: 1638408 (6.25 MB) Non-trainable params: 20863480 (79.58 MB)	 xception.fit(train_generator,validation_data = test_generator,epochs=10) Epoch 1/10 12/12 [==============================] - 29s 2s/step - loss: 1.0810 - accuracy: 0.8431 - val_loss: 0.0000e+00 - val_accuracy: 1.0000 Epoch 2/10 12/12 [==============================] - 13s 1s/step - loss: 0.2874 - accuracy: 0.9814 - val_loss: 0.0364 - val_accuracy: 1.0000 Epoch 3/10 12/12 [==============================] - 13s 1s/step - loss: 0.1984 - accuracy: 0.9814 - val_loss: 2.8977 - val_accuracy: 0.8571 Epoch 4/10 12/12 [==============================] - 13s 1s/step - loss: 0.2354 - accuracy: 0.9814 - val_loss: 0.0000e+00 - val_accuracy: 1.0000 Epoch 5/10 12/12 [==============================] - 13s 1s/step - loss: 0.1156 - accuracy: 0.9947 - val_loss: 0.0000e+00 - val_accuracy: 1.0000 Epoch 6/10 12/12 [==============================] - 13s 1s/step - loss: 0.0370 - accuracy: 0.9947 - val_loss: 0.0000e+00 - val_accuracy: 1.0000 Epoch 7/10 12/12 [==============================] - 12s 1s/step - loss: 0.0562 - accuracy: 0.9920 - val_loss: 0.0000e+00 - val_accuracy: 1.0000 Epoch 8/10 12/12 [==============================] - 13s 1s/step - loss: 0.0045 - accuracy: 0.9973 - val_loss: 8.5149e-08 - val_accuracy: 1.0000 Epoch 9/10 12/12 [==============================] - 13s 1s/step - loss: 0.0092 - accuracy: 0.9973 - val_loss: 1.7038e-08 - val_accuracy: 1.0000 Epoch 10/10 12/12 [==============================] - 13s 1s/step - loss: 0.0014 - accuracy: 1.0000 - val_loss: 3.4060e-08 - val_accuracy: 1.0000