In [1]:

```
# ATTENTION: Please do not alter any of the provided code in the exercise. Only add your own code
where indicated
# ATTENTION: Please do not add or remove any cells in the exercise. The grader will check specific
cells based on the cell position.
# ATTENTION: Please use the provided epoch values when training.

# Import all the necessary files!
import os
import tensorflow as tf
from tensorflow.keras import layers
from tensorflow.keras import Model
from os import getcwd
```

In [2]:

```
path_inception = f"{getcwd()}/../tmp2/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5"

# Import the inception model
from tensorflow.keras.applications.inception_v3 import InceptionV3

# Create an instance of the inception model from the local pre-trained weights
local_weights_file = path_inception

pre_trained_model = InceptionV3(input_shape=(150, 150, 3),
                                include_top = False,
                                weights = None)

pre_trained_model.load_weights(local_weights_file)

# Make all the layers in the pre-trained model non-trainable
for layer in pre_trained_model.layers:
    layer.trainable = False


# Print the model summary
pre_trained_model.summary()

# Expected Output is extremely large, but should end with:

#batch_normalization_v1_281 (Bat (None, 3, 3, 192)    576         conv2d_281[0][0]
#__________________________________________________________________________________________________

#activation_273 (Activation)     (None, 3, 3, 320)    0           batch_normalization_v1_273[0][0]
#__________________________________________________________________________________________________

#mixed9_1 (Concatenate)          (None, 3, 3, 768)    0           activation_275[0][0]
#                                                                 activation_276[0][0]
#__________________________________________________________________________________________________

#concatenate_5 (Concatenate)     (None, 3, 3, 768)    0           activation_279[0][0]
#                                                                 activation_280[0][0]
#__________________________________________________________________________________________________

#activation_281 (Activation)     (None, 3, 3, 192)    0           batch_normalization_v1_281[0][0]
#__________________________________________________________________________________________________

#mixed10 (Concatenate)           (None, 3, 3, 2048)   0           activation_273[0][0]
#                                                                 mixed9_1[0][0]
#                                                                 concatenate_5[0][0]
#                                                                 activation_281[0][0]
#==================================================================================================

#Total params: 21,802,784
#Trainable params: 0
#Non-trainable params: 21,802,784
```

```
Model: "inception_v3"
__________________________________________________________________________________________________
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            [(None, 150, 150, 3) 0
```

input_1 (InputLayer)	[(None, 150, 150, 3)	0	
conv2d (Conv2D)	(None, 74, 74, 32)	864	input_1[0][0]
batch_normalization (BatchNorma	(None, 74, 74, 32)	96	conv2d[0][0]
activation (Activation)	(None, 74, 74, 32)	0	batch_normalization[0][0]
conv2d_1 (Conv2D)	(None, 72, 72, 32)	9216	activation[0][0]
batch_normalization_1 (BatchNor	(None, 72, 72, 32)	96	conv2d_1[0][0]
activation_1 (Activation)	(None, 72, 72, 32)	0	batch_normalization_1[0][0]
conv2d_2 (Conv2D)	(None, 72, 72, 64)	18432	activation_1[0][0]
batch_normalization_2 (BatchNor	(None, 72, 72, 64)	192	conv2d_2[0][0]
activation_2 (Activation)	(None, 72, 72, 64)	0	batch_normalization_2[0][0]
max_pooling2d (MaxPooling2D)	(None, 35, 35, 64)	0	activation_2[0][0]
conv2d_3 (Conv2D)	(None, 35, 35, 80)	5120	max_pooling2d[0][0]
batch_normalization_3 (BatchNor	(None, 35, 35, 80)	240	conv2d_3[0][0]
activation_3 (Activation)	(None, 35, 35, 80)	0	batch_normalization_3[0][0]
conv2d_4 (Conv2D)	(None, 33, 33, 192)	138240	activation_3[0][0]
batch_normalization_4 (BatchNor	(None, 33, 33, 192)	576	conv2d_4[0][0]
activation_4 (Activation)	(None, 33, 33, 192)	0	batch_normalization_4[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 16, 16, 192)	0	activation_4[0][0]
conv2d_8 (Conv2D)	(None, 16, 16, 64)	12288	max_pooling2d_1[0][0]
batch_normalization_8 (BatchNor	(None, 16, 16, 64)	192	conv2d_8[0][0]
activation_8 (Activation)	(None, 16, 16, 64)	0	batch_normalization_8[0][0]
conv2d_6 (Conv2D)	(None, 16, 16, 48)	9216	max_pooling2d_1[0][0]
conv2d_9 (Conv2D)	(None, 16, 16, 96)	55296	activation_8[0][0]
batch_normalization_6 (BatchNor	(None, 16, 16, 48)	144	conv2d_6[0][0]
batch_normalization_9 (BatchNor	(None, 16, 16, 96)	288	conv2d_9[0][0]
activation_6 (Activation)	(None, 16, 16, 48)	0	batch_normalization_6[0][0]
activation_9 (Activation)	(None, 16, 16, 96)	0	batch_normalization_9[0][0]
average_pooling2d (AveragePooli	(None, 16, 16, 192)	0	max_pooling2d_1[0][0]
conv2d_5 (Conv2D)	(None, 16, 16, 64)	12288	max_pooling2d_1[0][0]
conv2d_7 (Conv2D)	(None, 16, 16, 64)	76800	activation_6[0][0]
conv2d_10 (Conv2D)	(None, 16, 16, 96)	82944	activation_9[0][0]
conv2d_11 (Conv2D)	(None, 16, 16, 32)	6144	average_pooling2d[0][0]
batch_normalization_5 (BatchNor	(None, 16, 16, 64)	192	conv2d_5[0][0]
batch_normalization_7 (BatchNor	(None, 16, 16, 64)	192	conv2d_7[0][0]
batch_normalization_10 (BatchNo	(None, 16, 16, 96)	288	conv2d_10[0][0]
batch_normalization_11 (BatchNo	(None, 16, 16, 32)	96	conv2d_11[0][0]
activation_5 (Activation)	(None, 16, 16, 64)	0	batch_normalization_5[0][0]
activation_7 (Activation)	(None, 16, 16, 64)	0	batch_normalization_7[0][0]
activation_10 (Activation)	(None, 16, 16, 96)	0	batch_normalization_10[0][0]

activation_11 (Activation)	(None, 16, 16, 32)	0	batch_normalization_11[0][0]
mixed0 (Concatenate)	(None, 16, 16, 256)	0	activation_5[0][0] activation_7[0][0] activation_10[0][0] activation_11[0][0]
conv2d_15 (Conv2D)	(None, 16, 16, 64)	16384	mixed0[0][0]
batch_normalization_15 (BatchNo	(None, 16, 16, 64)	192	conv2d_15[0][0]
activation_15 (Activation)	(None, 16, 16, 64)	0	batch_normalization_15[0][0]
conv2d_13 (Conv2D)	(None, 16, 16, 48)	12288	mixed0[0][0]
conv2d_16 (Conv2D)	(None, 16, 16, 96)	55296	activation_15[0][0]
batch_normalization_13 (BatchNo	(None, 16, 16, 48)	144	conv2d_13[0][0]
batch_normalization_16 (BatchNo	(None, 16, 16, 96)	288	conv2d_16[0][0]
activation_13 (Activation)	(None, 16, 16, 48)	0	batch_normalization_13[0][0]
activation_16 (Activation)	(None, 16, 16, 96)	0	batch_normalization_16[0][0]
average_pooling2d_1 (AveragePoo	(None, 16, 16, 256)	0	mixed0[0][0]
conv2d_12 (Conv2D)	(None, 16, 16, 64)	16384	mixed0[0][0]
conv2d_14 (Conv2D)	(None, 16, 16, 64)	76800	activation_13[0][0]
conv2d_17 (Conv2D)	(None, 16, 16, 96)	82944	activation_16[0][0]
conv2d_18 (Conv2D)	(None, 16, 16, 64)	16384	average_pooling2d_1[0][0]
batch_normalization_12 (BatchNo	(None, 16, 16, 64)	192	conv2d_12[0][0]
batch_normalization_14 (BatchNo	(None, 16, 16, 64)	192	conv2d_14[0][0]
batch_normalization_17 (BatchNo	(None, 16, 16, 96)	288	conv2d_17[0][0]
batch_normalization_18 (BatchNo	(None, 16, 16, 64)	192	conv2d_18[0][0]
activation_12 (Activation)	(None, 16, 16, 64)	0	batch_normalization_12[0][0]
activation_14 (Activation)	(None, 16, 16, 64)	0	batch_normalization_14[0][0]
activation_17 (Activation)	(None, 16, 16, 96)	0	batch_normalization_17[0][0]
activation_18 (Activation)	(None, 16, 16, 64)	0	batch_normalization_18[0][0]
mixed1 (Concatenate)	(None, 16, 16, 288)	0	activation_12[0][0] activation_14[0][0] activation_17[0][0] activation_18[0][0]
conv2d_22 (Conv2D)	(None, 16, 16, 64)	18432	mixed1[0][0]
batch_normalization_22 (BatchNo	(None, 16, 16, 64)	192	conv2d_22[0][0]
activation_22 (Activation)	(None, 16, 16, 64)	0	batch_normalization_22[0][0]
conv2d_20 (Conv2D)	(None, 16, 16, 48)	13824	mixed1[0][0]
conv2d_23 (Conv2D)	(None, 16, 16, 96)	55296	activation_22[0][0]
batch_normalization_20 (BatchNo	(None, 16, 16, 48)	144	conv2d_20[0][0]
batch_normalization_23 (BatchNo	(None, 16, 16, 96)	288	conv2d_23[0][0]
activation_20 (Activation)	(None, 16, 16, 48)	0	batch_normalization_20[0][0]
activation_23 (Activation)	(None, 16, 16, 96)	0	batch_normalization_23[0][0]
average_pooling2d_2 (AveragePoo	(None, 16, 16, 288)	0	mixed1[0][0]
[illegible]	[illegible]	[illegible]	[illegible]

conv2d_19 (Conv2D)	(None, 16, 16, 64)	18432	mixed1[0][0]
conv2d_21 (Conv2D)	(None, 16, 16, 64)	76800	activation_20[0][0]
conv2d_24 (Conv2D)	(None, 16, 16, 96)	82944	activation_23[0][0]
conv2d_25 (Conv2D)	(None, 16, 16, 64)	18432	average_pooling2d_2[0][0]
batch_normalization_19 (BatchNo	(None, 16, 16, 64)	192	conv2d_19[0][0]
batch_normalization_21 (BatchNo	(None, 16, 16, 64)	192	conv2d_21[0][0]
batch_normalization_24 (BatchNo	(None, 16, 16, 96)	288	conv2d_24[0][0]
batch_normalization_25 (BatchNo	(None, 16, 16, 64)	192	conv2d_25[0][0]
activation_19 (Activation)	(None, 16, 16, 64)	0	batch_normalization_19[0][0]
activation_21 (Activation)	(None, 16, 16, 64)	0	batch_normalization_21[0][0]
activation_24 (Activation)	(None, 16, 16, 96)	0	batch_normalization_24[0][0]
activation_25 (Activation)	(None, 16, 16, 64)	0	batch_normalization_25[0][0]
mixed2 (Concatenate)	(None, 16, 16, 288)	0	activation_19[0][0] activation_21[0][0] activation_24[0][0] activation_25[0][0]
conv2d_27 (Conv2D)	(None, 16, 16, 64)	18432	mixed2[0][0]
batch_normalization_27 (BatchNo	(None, 16, 16, 64)	192	conv2d_27[0][0]
activation_27 (Activation)	(None, 16, 16, 64)	0	batch_normalization_27[0][0]
conv2d_28 (Conv2D)	(None, 16, 16, 96)	55296	activation_27[0][0]
batch_normalization_28 (BatchNo	(None, 16, 16, 96)	288	conv2d_28[0][0]
activation_28 (Activation)	(None, 16, 16, 96)	0	batch_normalization_28[0][0]
conv2d_26 (Conv2D)	(None, 7, 7, 384)	995328	mixed2[0][0]
conv2d_29 (Conv2D)	(None, 7, 7, 96)	82944	activation_28[0][0]
batch_normalization_26 (BatchNo	(None, 7, 7, 384)	1152	conv2d_26[0][0]
batch_normalization_29 (BatchNo	(None, 7, 7, 96)	288	conv2d_29[0][0]
activation_26 (Activation)	(None, 7, 7, 384)	0	batch_normalization_26[0][0]
activation_29 (Activation)	(None, 7, 7, 96)	0	batch_normalization_29[0][0]
max_pooling2d_2 (MaxPooling2D)	(None, 7, 7, 288)	0	mixed2[0][0]
mixed3 (Concatenate)	(None, 7, 7, 768)	0	activation_26[0][0] activation_29[0][0] max_pooling2d_2[0][0]
conv2d_34 (Conv2D)	(None, 7, 7, 128)	98304	mixed3[0][0]
batch_normalization_34 (BatchNo	(None, 7, 7, 128)	384	conv2d_34[0][0]
activation_34 (Activation)	(None, 7, 7, 128)	0	batch_normalization_34[0][0]
conv2d_35 (Conv2D)	(None, 7, 7, 128)	114688	activation_34[0][0]
batch_normalization_35 (BatchNo	(None, 7, 7, 128)	384	conv2d_35[0][0]
activation_35 (Activation)	(None, 7, 7, 128)	0	batch_normalization_35[0][0]
conv2d_31 (Conv2D)	(None, 7, 7, 128)	98304	mixed3[0][0]
conv2d_36 (Conv2D)	(None, 7, 7, 128)	114688	activation_35[0][0]
batch_normalization_31 (BatchNo	(None, 7, 7, 128)	384	conv2d_31[0][0]

batch_normalization_36 (BatchNo	(None, 7, 7, 128)	384	conv2d_36[0][0]
activation_31 (Activation)	(None, 7, 7, 128)	0	batch_normalization_31[0][0]
activation_36 (Activation)	(None, 7, 7, 128)	0	batch_normalization_36[0][0]
conv2d_32 (Conv2D)	(None, 7, 7, 128)	114688	activation_31[0][0]
conv2d_37 (Conv2D)	(None, 7, 7, 128)	114688	activation_36[0][0]
batch_normalization_32 (BatchNo	(None, 7, 7, 128)	384	conv2d_32[0][0]
batch_normalization_37 (BatchNo	(None, 7, 7, 128)	384	conv2d_37[0][0]
activation_32 (Activation)	(None, 7, 7, 128)	0	batch_normalization_32[0][0]
activation_37 (Activation)	(None, 7, 7, 128)	0	batch_normalization_37[0][0]
average_pooling2d_3 (AveragePoo	(None, 7, 7, 768)	0	mixed3[0][0]
conv2d_30 (Conv2D)	(None, 7, 7, 192)	147456	mixed3[0][0]
conv2d_33 (Conv2D)	(None, 7, 7, 192)	172032	activation_32[0][0]
conv2d_38 (Conv2D)	(None, 7, 7, 192)	172032	activation_37[0][0]
conv2d_39 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_3[0][0]
batch_normalization_30 (BatchNo	(None, 7, 7, 192)	576	conv2d_30[0][0]
batch_normalization_33 (BatchNo	(None, 7, 7, 192)	576	conv2d_33[0][0]
batch_normalization_38 (BatchNo	(None, 7, 7, 192)	576	conv2d_38[0][0]
batch_normalization_39 (BatchNo	(None, 7, 7, 192)	576	conv2d_39[0][0]
activation_30 (Activation)	(None, 7, 7, 192)	0	batch_normalization_30[0][0]
activation_33 (Activation)	(None, 7, 7, 192)	0	batch_normalization_33[0][0]
activation_38 (Activation)	(None, 7, 7, 192)	0	batch_normalization_38[0][0]
activation_39 (Activation)	(None, 7, 7, 192)	0	batch_normalization_39[0][0]
mixed4 (Concatenate)	(None, 7, 7, 768)	0	activation_30[0][0] activation_33[0][0] activation_38[0][0] activation_39[0][0]
conv2d_44 (Conv2D)	(None, 7, 7, 160)	122880	mixed4[0][0]
batch_normalization_44 (BatchNo	(None, 7, 7, 160)	480	conv2d_44[0][0]
activation_44 (Activation)	(None, 7, 7, 160)	0	batch_normalization_44[0][0]
conv2d_45 (Conv2D)	(None, 7, 7, 160)	179200	activation_44[0][0]
batch_normalization_45 (BatchNo	(None, 7, 7, 160)	480	conv2d_45[0][0]
activation_45 (Activation)	(None, 7, 7, 160)	0	batch_normalization_45[0][0]
conv2d_41 (Conv2D)	(None, 7, 7, 160)	122880	mixed4[0][0]
conv2d_46 (Conv2D)	(None, 7, 7, 160)	179200	activation_45[0][0]
batch_normalization_41 (BatchNo	(None, 7, 7, 160)	480	conv2d_41[0][0]
batch_normalization_46 (BatchNo	(None, 7, 7, 160)	480	conv2d_46[0][0]
activation_41 (Activation)	(None, 7, 7, 160)	0	batch_normalization_41[0][0]
activation_46 (Activation)	(None, 7, 7, 160)	0	batch_normalization_46[0][0]
conv2d_42 (Conv2D)	(None, 7, 7, 160)	179200	activation_41[0][0]
conv2d_47 (Conv2D)	(None, 7, 7, 160)	179200	activation_46[0][0]

batch_normalization_42 (BatchNo	(None, 7, 7, 160)	480	conv2d_42[0][0]
batch_normalization_47 (BatchNo	(None, 7, 7, 160)	480	conv2d_47[0][0]
activation_42 (Activation)	(None, 7, 7, 160)	0	batch_normalization_42[0][0]
activation_47 (Activation)	(None, 7, 7, 160)	0	batch_normalization_47[0][0]
average_pooling2d_4 (AveragePoo	(None, 7, 7, 768)	0	mixed4[0][0]
conv2d_40 (Conv2D)	(None, 7, 7, 192)	147456	mixed4[0][0]
conv2d_43 (Conv2D)	(None, 7, 7, 192)	215040	activation_42[0][0]
conv2d_48 (Conv2D)	(None, 7, 7, 192)	215040	activation_47[0][0]
conv2d_49 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_4[0][0]
batch_normalization_40 (BatchNo	(None, 7, 7, 192)	576	conv2d_40[0][0]
batch_normalization_43 (BatchNo	(None, 7, 7, 192)	576	conv2d_43[0][0]
batch_normalization_48 (BatchNo	(None, 7, 7, 192)	576	conv2d_48[0][0]
batch_normalization_49 (BatchNo	(None, 7, 7, 192)	576	conv2d_49[0][0]
activation_40 (Activation)	(None, 7, 7, 192)	0	batch_normalization_40[0][0]
activation_43 (Activation)	(None, 7, 7, 192)	0	batch_normalization_43[0][0]
activation_48 (Activation)	(None, 7, 7, 192)	0	batch_normalization_48[0][0]
activation_49 (Activation)	(None, 7, 7, 192)	0	batch_normalization_49[0][0]
mixed5 (Concatenate)	(None, 7, 7, 768)	0	activation_40[0][0] activation_43[0][0] activation_48[0][0] activation_49[0][0]
conv2d_54 (Conv2D)	(None, 7, 7, 160)	122880	mixed5[0][0]
batch_normalization_54 (BatchNo	(None, 7, 7, 160)	480	conv2d_54[0][0]
activation_54 (Activation)	(None, 7, 7, 160)	0	batch_normalization_54[0][0]
conv2d_55 (Conv2D)	(None, 7, 7, 160)	179200	activation_54[0][0]
batch_normalization_55 (BatchNo	(None, 7, 7, 160)	480	conv2d_55[0][0]
activation_55 (Activation)	(None, 7, 7, 160)	0	batch_normalization_55[0][0]
conv2d_51 (Conv2D)	(None, 7, 7, 160)	122880	mixed5[0][0]
conv2d_56 (Conv2D)	(None, 7, 7, 160)	179200	activation_55[0][0]
batch_normalization_51 (BatchNo	(None, 7, 7, 160)	480	conv2d_51[0][0]
batch_normalization_56 (BatchNo	(None, 7, 7, 160)	480	conv2d_56[0][0]
activation_51 (Activation)	(None, 7, 7, 160)	0	batch_normalization_51[0][0]
activation_56 (Activation)	(None, 7, 7, 160)	0	batch_normalization_56[0][0]
conv2d_52 (Conv2D)	(None, 7, 7, 160)	179200	activation_51[0][0]
conv2d_57 (Conv2D)	(None, 7, 7, 160)	179200	activation_56[0][0]
batch_normalization_52 (BatchNo	(None, 7, 7, 160)	480	conv2d_52[0][0]
batch_normalization_57 (BatchNo	(None, 7, 7, 160)	480	conv2d_57[0][0]
activation_52 (Activation)	(None, 7, 7, 160)	0	batch_normalization_52[0][0]
activation_57 (Activation)	(None, 7, 7, 160)	0	batch_normalization_57[0][0]
average_pooling2d_5 (AveragePoo	(None, 7, 7, 768)	0	mixed5[0][0]

conv2d_50 (Conv2D)	(None, 7, 7, 192)	147456	mixed5[0][0]
conv2d_53 (Conv2D)	(None, 7, 7, 192)	215040	activation_52[0][0]
conv2d_58 (Conv2D)	(None, 7, 7, 192)	215040	activation_57[0][0]
conv2d_59 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_5[0][0]
batch_normalization_50 (BatchNo	(None, 7, 7, 192)	576	conv2d_50[0][0]
batch_normalization_53 (BatchNo	(None, 7, 7, 192)	576	conv2d_53[0][0]
batch_normalization_58 (BatchNo	(None, 7, 7, 192)	576	conv2d_58[0][0]
batch_normalization_59 (BatchNo	(None, 7, 7, 192)	576	conv2d_59[0][0]
activation_50 (Activation)	(None, 7, 7, 192)	0	batch_normalization_50[0][0]
activation_53 (Activation)	(None, 7, 7, 192)	0	batch_normalization_53[0][0]
activation_58 (Activation)	(None, 7, 7, 192)	0	batch_normalization_58[0][0]
activation_59 (Activation)	(None, 7, 7, 192)	0	batch_normalization_59[0][0]
mixed6 (Concatenate)	(None, 7, 7, 768)	0	activation_50[0][0] activation_53[0][0] activation_58[0][0] activation_59[0][0]
conv2d_64 (Conv2D)	(None, 7, 7, 192)	147456	mixed6[0][0]
batch_normalization_64 (BatchNo	(None, 7, 7, 192)	576	conv2d_64[0][0]
activation_64 (Activation)	(None, 7, 7, 192)	0	batch_normalization_64[0][0]
conv2d_65 (Conv2D)	(None, 7, 7, 192)	258048	activation_64[0][0]
batch_normalization_65 (BatchNo	(None, 7, 7, 192)	576	conv2d_65[0][0]
activation_65 (Activation)	(None, 7, 7, 192)	0	batch_normalization_65[0][0]
conv2d_61 (Conv2D)	(None, 7, 7, 192)	147456	mixed6[0][0]
conv2d_66 (Conv2D)	(None, 7, 7, 192)	258048	activation_65[0][0]
batch_normalization_61 (BatchNo	(None, 7, 7, 192)	576	conv2d_61[0][0]
batch_normalization_66 (BatchNo	(None, 7, 7, 192)	576	conv2d_66[0][0]
activation_61 (Activation)	(None, 7, 7, 192)	0	batch_normalization_61[0][0]
activation_66 (Activation)	(None, 7, 7, 192)	0	batch_normalization_66[0][0]
conv2d_62 (Conv2D)	(None, 7, 7, 192)	258048	activation_61[0][0]
conv2d_67 (Conv2D)	(None, 7, 7, 192)	258048	activation_66[0][0]
batch_normalization_62 (BatchNo	(None, 7, 7, 192)	576	conv2d_62[0][0]
batch_normalization_67 (BatchNo	(None, 7, 7, 192)	576	conv2d_67[0][0]
activation_62 (Activation)	(None, 7, 7, 192)	0	batch_normalization_62[0][0]
activation_67 (Activation)	(None, 7, 7, 192)	0	batch_normalization_67[0][0]
average_pooling2d_6 (AveragePoo	(None, 7, 7, 768)	0	mixed6[0][0]
conv2d_60 (Conv2D)	(None, 7, 7, 192)	147456	mixed6[0][0]
conv2d_63 (Conv2D)	(None, 7, 7, 192)	258048	activation_62[0][0]
conv2d_68 (Conv2D)	(None, 7, 7, 192)	258048	activation_67[0][0]
conv2d_69 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_6[0][0]
batch_normalization_60 (BatchNo	(None, 7, 7, 192)	576	conv2d_60[0][0]

```
batch_normalization_63 (BatchNo (None, 7, 7, 192)    576         conv2d_63[0][0]
__________________________________________________________________________________________________
batch_normalization_68 (BatchNo (None, 7, 7, 192)    576         conv2d_68[0][0]
__________________________________________________________________________________________________
batch_normalization_69 (BatchNo (None, 7, 7, 192)    576         conv2d_69[0][0]
__________________________________________________________________________________________________
activation_60 (Activation)      (None, 7, 7, 192)    0           batch_normalization_60[0][0]
__________________________________________________________________________________________________
activation_63 (Activation)      (None, 7, 7, 192)    0           batch_normalization_63[0][0]
__________________________________________________________________________________________________
activation_68 (Activation)      (None, 7, 7, 192)    0           batch_normalization_68[0][0]
__________________________________________________________________________________________________
activation_69 (Activation)      (None, 7, 7, 192)    0           batch_normalization_69[0][0]
__________________________________________________________________________________________________
mixed7 (Concatenate)            (None, 7, 7, 768)    0           activation_60[0][0]
                                                                 activation_63[0][0]
                                                                 activation_68[0][0]
                                                                 activation_69[0][0]
__________________________________________________________________________________________________
conv2d_72 (Conv2D)              (None, 7, 7, 192)    147456      mixed7[0][0]
__________________________________________________________________________________________________
batch_normalization_72 (BatchNo (None, 7, 7, 192)    576         conv2d_72[0][0]
__________________________________________________________________________________________________
activation_72 (Activation)      (None, 7, 7, 192)    0           batch_normalization_72[0][0]
__________________________________________________________________________________________________
conv2d_73 (Conv2D)              (None, 7, 7, 192)    258048      activation_72[0][0]
__________________________________________________________________________________________________
batch_normalization_73 (BatchNo (None, 7, 7, 192)    576         conv2d_73[0][0]
__________________________________________________________________________________________________
activation_73 (Activation)      (None, 7, 7, 192)    0           batch_normalization_73[0][0]
__________________________________________________________________________________________________
conv2d_70 (Conv2D)              (None, 7, 7, 192)    147456      mixed7[0][0]
__________________________________________________________________________________________________
conv2d_74 (Conv2D)              (None, 7, 7, 192)    258048      activation_73[0][0]
__________________________________________________________________________________________________
batch_normalization_70 (BatchNo (None, 7, 7, 192)    576         conv2d_70[0][0]
__________________________________________________________________________________________________
batch_normalization_74 (BatchNo (None, 7, 7, 192)    576         conv2d_74[0][0]
__________________________________________________________________________________________________
activation_70 (Activation)      (None, 7, 7, 192)    0           batch_normalization_70[0][0]
__________________________________________________________________________________________________
activation_74 (Activation)      (None, 7, 7, 192)    0           batch_normalization_74[0][0]
__________________________________________________________________________________________________
conv2d_71 (Conv2D)              (None, 3, 3, 320)    552960      activation_70[0][0]
__________________________________________________________________________________________________
conv2d_75 (Conv2D)              (None, 3, 3, 192)    331776      activation_74[0][0]
__________________________________________________________________________________________________
batch_normalization_71 (BatchNo (None, 3, 3, 320)    960         conv2d_71[0][0]
__________________________________________________________________________________________________
batch_normalization_75 (BatchNo (None, 3, 3, 192)    576         conv2d_75[0][0]
__________________________________________________________________________________________________
activation_71 (Activation)      (None, 3, 3, 320)    0           batch_normalization_71[0][0]
__________________________________________________________________________________________________
activation_75 (Activation)      (None, 3, 3, 192)    0           batch_normalization_75[0][0]
__________________________________________________________________________________________________
max_pooling2d_3 (MaxPooling2D)  (None, 3, 3, 768)    0           mixed7[0][0]
__________________________________________________________________________________________________
mixed8 (Concatenate)            (None, 3, 3, 1280)   0           activation_71[0][0]
                                                                 activation_75[0][0]
                                                                 max_pooling2d_3[0][0]
__________________________________________________________________________________________________
conv2d_80 (Conv2D)              (None, 3, 3, 448)    573440      mixed8[0][0]
__________________________________________________________________________________________________
batch_normalization_80 (BatchNo (None, 3, 3, 448)    1344        conv2d_80[0][0]
__________________________________________________________________________________________________
activation_80 (Activation)      (None, 3, 3, 448)    0           batch_normalization_80[0][0]
__________________________________________________________________________________________________
conv2d_77 (Conv2D)              (None, 3, 3, 384)    491520      mixed8[0][0]
__________________________________________________________________________________________________
conv2d_81 (Conv2D)              (None, 3, 3, 384)    1548288     activation_80[0][0]
__________________________________________________________________________________________________
batch_normalization_77 (BatchNo (None, 3, 3, 384)    1152        conv2d_77[0][0]
__________________________________________________________________________________________________
batch_normalization_81 (BatchNo (None, 3, 3, 384)    1152        conv2d_81[0][0]
__________________________________________________________________________________________________
activation_77 (Activation)      (None, 3, 3, 384)    0           batch_normalization_77[0][0]
__________________________________________________________________________________________________
```

activation_81 (Activation)	(None, 3, 3, 384)	0	batch_normalization_81[0][0]
conv2d_78 (Conv2D)	(None, 3, 3, 384)	442368	activation_77[0][0]
conv2d_79 (Conv2D)	(None, 3, 3, 384)	442368	activation_77[0][0]
conv2d_82 (Conv2D)	(None, 3, 3, 384)	442368	activation_81[0][0]
conv2d_83 (Conv2D)	(None, 3, 3, 384)	442368	activation_81[0][0]
average_pooling2d_7 (AveragePoo	(None, 3, 3, 1280)	0	mixed8[0][0]
conv2d_76 (Conv2D)	(None, 3, 3, 320)	409600	mixed8[0][0]
batch_normalization_78 (BatchNo	(None, 3, 3, 384)	1152	conv2d_78[0][0]
batch_normalization_79 (BatchNo	(None, 3, 3, 384)	1152	conv2d_79[0][0]
batch_normalization_82 (BatchNo	(None, 3, 3, 384)	1152	conv2d_82[0][0]
batch_normalization_83 (BatchNo	(None, 3, 3, 384)	1152	conv2d_83[0][0]
conv2d_84 (Conv2D)	(None, 3, 3, 192)	245760	average_pooling2d_7[0][0]
batch_normalization_76 (BatchNo	(None, 3, 3, 320)	960	conv2d_76[0][0]
activation_78 (Activation)	(None, 3, 3, 384)	0	batch_normalization_78[0][0]
activation_79 (Activation)	(None, 3, 3, 384)	0	batch_normalization_79[0][0]
activation_82 (Activation)	(None, 3, 3, 384)	0	batch_normalization_82[0][0]
activation_83 (Activation)	(None, 3, 3, 384)	0	batch_normalization_83[0][0]
batch_normalization_84 (BatchNo	(None, 3, 3, 192)	576	conv2d_84[0][0]
activation_76 (Activation)	(None, 3, 3, 320)	0	batch_normalization_76[0][0]
mixed9_0 (Concatenate)	(None, 3, 3, 768)	0	activation_78[0][0] activation_79[0][0]
concatenate (Concatenate)	(None, 3, 3, 768)	0	activation_82[0][0] activation_83[0][0]
activation_84 (Activation)	(None, 3, 3, 192)	0	batch_normalization_84[0][0]
mixed9 (Concatenate)	(None, 3, 3, 2048)	0	activation_76[0][0] mixed9_0[0][0] concatenate[0][0] activation_84[0][0]
conv2d_89 (Conv2D)	(None, 3, 3, 448)	917504	mixed9[0][0]
batch_normalization_89 (BatchNo	(None, 3, 3, 448)	1344	conv2d_89[0][0]
activation_89 (Activation)	(None, 3, 3, 448)	0	batch_normalization_89[0][0]
conv2d_86 (Conv2D)	(None, 3, 3, 384)	786432	mixed9[0][0]
conv2d_90 (Conv2D)	(None, 3, 3, 384)	1548288	activation_89[0][0]
batch_normalization_86 (BatchNo	(None, 3, 3, 384)	1152	conv2d_86[0][0]
batch_normalization_90 (BatchNo	(None, 3, 3, 384)	1152	conv2d_90[0][0]
activation_86 (Activation)	(None, 3, 3, 384)	0	batch_normalization_86[0][0]
activation_90 (Activation)	(None, 3, 3, 384)	0	batch_normalization_90[0][0]
conv2d_87 (Conv2D)	(None, 3, 3, 384)	442368	activation_86[0][0]
conv2d_88 (Conv2D)	(None, 3, 3, 384)	442368	activation_86[0][0]
conv2d_91 (Conv2D)	(None, 3, 3, 384)	442368	activation_90[0][0]
conv2d_92 (Conv2D)	(None, 3, 3, 384)	442368	activation_90[0][0]

```
average_pooling2d_8 (AveragePoo (None, 3, 3, 2048)   0           mixed9[0][0]
__________________________________________________________________________________________________
conv2d_85 (Conv2D)              (None, 3, 3, 320)    655360      mixed9[0][0]
__________________________________________________________________________________________________
batch_normalization_87 (BatchNo (None, 3, 3, 384)    1152        conv2d_87[0][0]
__________________________________________________________________________________________________
batch_normalization_88 (BatchNo (None, 3, 3, 384)    1152        conv2d_88[0][0]
__________________________________________________________________________________________________
batch_normalization_91 (BatchNo (None, 3, 3, 384)    1152        conv2d_91[0][0]
__________________________________________________________________________________________________
batch_normalization_92 (BatchNo (None, 3, 3, 384)    1152        conv2d_92[0][0]
__________________________________________________________________________________________________
conv2d_93 (Conv2D)              (None, 3, 3, 192)    393216      average_pooling2d_8[0][0]
__________________________________________________________________________________________________
batch_normalization_85 (BatchNo (None, 3, 3, 320)    960         conv2d_85[0][0]
__________________________________________________________________________________________________
activation_87 (Activation)      (None, 3, 3, 384)    0           batch_normalization_87[0][0]
__________________________________________________________________________________________________
activation_88 (Activation)      (None, 3, 3, 384)    0           batch_normalization_88[0][0]
__________________________________________________________________________________________________
activation_91 (Activation)      (None, 3, 3, 384)    0           batch_normalization_91[0][0]
__________________________________________________________________________________________________
activation_92 (Activation)      (None, 3, 3, 384)    0           batch_normalization_92[0][0]
__________________________________________________________________________________________________
batch_normalization_93 (BatchNo (None, 3, 3, 192)    576         conv2d_93[0][0]
__________________________________________________________________________________________________
activation_85 (Activation)      (None, 3, 3, 320)    0           batch_normalization_85[0][0]
__________________________________________________________________________________________________
mixed9_1 (Concatenate)          (None, 3, 3, 768)    0           activation_87[0][0]
                                                                 activation_88[0][0]
__________________________________________________________________________________________________
concatenate_1 (Concatenate)     (None, 3, 3, 768)    0           activation_91[0][0]
                                                                 activation_92[0][0]
__________________________________________________________________________________________________
activation_93 (Activation)      (None, 3, 3, 192)    0           batch_normalization_93[0][0]
__________________________________________________________________________________________________
mixed10 (Concatenate)           (None, 3, 3, 2048)   0           activation_85[0][0]
                                                                 mixed9_1[0][0]
                                                                 concatenate_1[0][0]
                                                                 activation_93[0][0]
==================================================================================================
Total params: 21,802,784
Trainable params: 0
Non-trainable params: 21,802,784
__________________________________________________________________________________________________
```

In [3]:

```
last_layer = pre_trained_model.get_layer("mixed7")
print('last layer output shape: ', last_layer.output_shape)
last_output = last_layer.output

# Expected Output:
# ('last layer output shape: ', (None, 7, 7, 768))
```

```
last layer output shape:  (None, 7, 7, 768)
```

In [4]:

```
# Define a Callback class that stops training once accuracy reaches 97.0%
class myCallback(tf.keras.callbacks.Callback):
    def on_epoch_end(self, epoch, logs={}):
        if(logs.get('acc')>0.97):
            print("\nReached 97.0% accuracy so cancelling training!")
            self.model.stop_training = True
```

In [5]:

```
from tensorflow.keras.optimizers import RMSprop

# Flatten the output layer to 1 dimension
x = layers.Flatten()(last_output)
# Add a fully connected layer with 1,024 hidden units and ReLU activation
```

```
x = layers.Dense(128, activation='relu')(x)
# Add a dropout rate of 0.2
x = layers.Dropout(0.2)(x)
# Add a final sigmoid layer for classification
x = layers.Dense(1, activation='sigmoid')(x)

model = Model(pre_trained_model.input, x)

model.compile(optimizer = RMSprop(lr=0.0001),
              loss = 'binary_crossentropy',
              metrics = ['acc'])

model.summary()

# Expected output will be large. Last few lines should be:

# mixed7 (Concatenate)            (None, 7, 7, 768)    0           activation_248[0][0]
#                                                                  activation_251[0][0]
#                                                                  activation_256[0][0]
#                                                                  activation_257[0][0]
#
__________________________________________________________________________________________________
# flatten_4 (Flatten)             (None, 37632)        0           mixed7[0][0]
#
__________________________________________________________________________________________________
# dense_8 (Dense)                 (None, 1024)         38536192    flatten_4[0][0]
#
__________________________________________________________________________________________________
# dropout_4 (Dropout)             (None, 1024)         0           dense_8[0][0]
#
__________________________________________________________________________________________________
# dense_9 (Dense)                 (None, 1)            1025        dropout_4[0][0]
#
==================================================================================================
# Total params: 47,512,481
# Trainable params: 38,537,217
# Non-trainable params: 8,975,264
```

Model: "model"

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	[(None, 150, 150, 3)	0	
conv2d (Conv2D)	(None, 74, 74, 32)	864	input_1[0][0]
batch_normalization (BatchNorma	(None, 74, 74, 32)	96	conv2d[0][0]
activation (Activation)	(None, 74, 74, 32)	0	batch_normalization[0][0]
conv2d_1 (Conv2D)	(None, 72, 72, 32)	9216	activation[0][0]
batch_normalization_1 (BatchNor	(None, 72, 72, 32)	96	conv2d_1[0][0]
activation_1 (Activation)	(None, 72, 72, 32)	0	batch_normalization_1[0][0]
conv2d_2 (Conv2D)	(None, 72, 72, 64)	18432	activation_1[0][0]
batch_normalization_2 (BatchNor	(None, 72, 72, 64)	192	conv2d_2[0][0]
activation_2 (Activation)	(None, 72, 72, 64)	0	batch_normalization_2[0][0]
max_pooling2d (MaxPooling2D)	(None, 35, 35, 64)	0	activation_2[0][0]
conv2d_3 (Conv2D)	(None, 35, 35, 80)	5120	max_pooling2d[0][0]
batch_normalization_3 (BatchNor	(None, 35, 35, 80)	240	conv2d_3[0][0]
activation_3 (Activation)	(None, 35, 35, 80)	0	batch_normalization_3[0][0]
conv2d_4 (Conv2D)	(None, 33, 33, 192)	138240	activation_3[0][0]
batch_normalization_4 (BatchNor	(None, 33, 33, 192)	576	conv2d_4[0][0]
activation_4 (Activation)	(None, 33, 33, 192)	0	batch_normalization_4[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 16, 16, 192)	0	activation_4[0][0]

max_pooling2d_1 (MaxPooling2D)	(None, 16, 16, 192)	0	activation_4[0][0]
conv2d_8 (Conv2D)	(None, 16, 16, 64)	12288	max_pooling2d_1[0][0]
batch_normalization_8 (BatchNor	(None, 16, 16, 64)	192	conv2d_8[0][0]
activation_8 (Activation)	(None, 16, 16, 64)	0	batch_normalization_8[0][0]
conv2d_6 (Conv2D)	(None, 16, 16, 48)	9216	max_pooling2d_1[0][0]
conv2d_9 (Conv2D)	(None, 16, 16, 96)	55296	activation_8[0][0]
batch_normalization_6 (BatchNor	(None, 16, 16, 48)	144	conv2d_6[0][0]
batch_normalization_9 (BatchNor	(None, 16, 16, 96)	288	conv2d_9[0][0]
activation_6 (Activation)	(None, 16, 16, 48)	0	batch_normalization_6[0][0]
activation_9 (Activation)	(None, 16, 16, 96)	0	batch_normalization_9[0][0]
average_pooling2d (AveragePooli	(None, 16, 16, 192)	0	max_pooling2d_1[0][0]
conv2d_5 (Conv2D)	(None, 16, 16, 64)	12288	max_pooling2d_1[0][0]
conv2d_7 (Conv2D)	(None, 16, 16, 64)	76800	activation_6[0][0]
conv2d_10 (Conv2D)	(None, 16, 16, 96)	82944	activation_9[0][0]
conv2d_11 (Conv2D)	(None, 16, 16, 32)	6144	average_pooling2d[0][0]
batch_normalization_5 (BatchNor	(None, 16, 16, 64)	192	conv2d_5[0][0]
batch_normalization_7 (BatchNor	(None, 16, 16, 64)	192	conv2d_7[0][0]
batch_normalization_10 (BatchNo	(None, 16, 16, 96)	288	conv2d_10[0][0]
batch_normalization_11 (BatchNo	(None, 16, 16, 32)	96	conv2d_11[0][0]
activation_5 (Activation)	(None, 16, 16, 64)	0	batch_normalization_5[0][0]
activation_7 (Activation)	(None, 16, 16, 64)	0	batch_normalization_7[0][0]
activation_10 (Activation)	(None, 16, 16, 96)	0	batch_normalization_10[0][0]
activation_11 (Activation)	(None, 16, 16, 32)	0	batch_normalization_11[0][0]
mixed0 (Concatenate)	(None, 16, 16, 256)	0	activation_5[0][0] activation_7[0][0] activation_10[0][0] activation_11[0][0]
conv2d_15 (Conv2D)	(None, 16, 16, 64)	16384	mixed0[0][0]
batch_normalization_15 (BatchNo	(None, 16, 16, 64)	192	conv2d_15[0][0]
activation_15 (Activation)	(None, 16, 16, 64)	0	batch_normalization_15[0][0]
conv2d_13 (Conv2D)	(None, 16, 16, 48)	12288	mixed0[0][0]
conv2d_16 (Conv2D)	(None, 16, 16, 96)	55296	activation_15[0][0]
batch_normalization_13 (BatchNo	(None, 16, 16, 48)	144	conv2d_13[0][0]
batch_normalization_16 (BatchNo	(None, 16, 16, 96)	288	conv2d_16[0][0]
activation_13 (Activation)	(None, 16, 16, 48)	0	batch_normalization_13[0][0]
activation_16 (Activation)	(None, 16, 16, 96)	0	batch_normalization_16[0][0]
average_pooling2d_1 (AveragePoo	(None, 16, 16, 256)	0	mixed0[0][0]
conv2d_12 (Conv2D)	(None, 16, 16, 64)	16384	mixed0[0][0]
conv2d_14 (Conv2D)	(None, 16, 16, 64)	76800	activation_13[0][0]
conv2d_17 (Conv2D)	(None, 16, 16, 96)	82944	activation_16[0][0]
conv2d_18 (Conv2D)	(None, 16, 16, 64)	16384	average_pooling2d_1[0][0]

conv2d_18 (Conv2D)	(None, 16, 16, 64)	16384	average_pooling2d_1[0][0]
batch_normalization_12 (BatchNo	(None, 16, 16, 64)	192	conv2d_12[0][0]
batch_normalization_14 (BatchNo	(None, 16, 16, 64)	192	conv2d_14[0][0]
batch_normalization_17 (BatchNo	(None, 16, 16, 96)	288	conv2d_17[0][0]
batch_normalization_18 (BatchNo	(None, 16, 16, 64)	192	conv2d_18[0][0]
activation_12 (Activation)	(None, 16, 16, 64)	0	batch_normalization_12[0][0]
activation_14 (Activation)	(None, 16, 16, 64)	0	batch_normalization_14[0][0]
activation_17 (Activation)	(None, 16, 16, 96)	0	batch_normalization_17[0][0]
activation_18 (Activation)	(None, 16, 16, 64)	0	batch_normalization_18[0][0]
mixed1 (Concatenate)	(None, 16, 16, 288)	0	activation_12[0][0] activation_14[0][0] activation_17[0][0] activation_18[0][0]
conv2d_22 (Conv2D)	(None, 16, 16, 64)	18432	mixed1[0][0]
batch_normalization_22 (BatchNo	(None, 16, 16, 64)	192	conv2d_22[0][0]
activation_22 (Activation)	(None, 16, 16, 64)	0	batch_normalization_22[0][0]
conv2d_20 (Conv2D)	(None, 16, 16, 48)	13824	mixed1[0][0]
conv2d_23 (Conv2D)	(None, 16, 16, 96)	55296	activation_22[0][0]
batch_normalization_20 (BatchNo	(None, 16, 16, 48)	144	conv2d_20[0][0]
batch_normalization_23 (BatchNo	(None, 16, 16, 96)	288	conv2d_23[0][0]
activation_20 (Activation)	(None, 16, 16, 48)	0	batch_normalization_20[0][0]
activation_23 (Activation)	(None, 16, 16, 96)	0	batch_normalization_23[0][0]
average_pooling2d_2 (AveragePoo	(None, 16, 16, 288)	0	mixed1[0][0]
conv2d_19 (Conv2D)	(None, 16, 16, 64)	18432	mixed1[0][0]
conv2d_21 (Conv2D)	(None, 16, 16, 64)	76800	activation_20[0][0]
conv2d_24 (Conv2D)	(None, 16, 16, 96)	82944	activation_23[0][0]
conv2d_25 (Conv2D)	(None, 16, 16, 64)	18432	average_pooling2d_2[0][0]
batch_normalization_19 (BatchNo	(None, 16, 16, 64)	192	conv2d_19[0][0]
batch_normalization_21 (BatchNo	(None, 16, 16, 64)	192	conv2d_21[0][0]
batch_normalization_24 (BatchNo	(None, 16, 16, 96)	288	conv2d_24[0][0]
batch_normalization_25 (BatchNo	(None, 16, 16, 64)	192	conv2d_25[0][0]
activation_19 (Activation)	(None, 16, 16, 64)	0	batch_normalization_19[0][0]
activation_21 (Activation)	(None, 16, 16, 64)	0	batch_normalization_21[0][0]
activation_24 (Activation)	(None, 16, 16, 96)	0	batch_normalization_24[0][0]
activation_25 (Activation)	(None, 16, 16, 64)	0	batch_normalization_25[0][0]
mixed2 (Concatenate)	(None, 16, 16, 288)	0	activation_19[0][0] activation_21[0][0] activation_24[0][0] activation_25[0][0]
conv2d_27 (Conv2D)	(None, 16, 16, 64)	18432	mixed2[0][0]
batch_normalization_27 (BatchNo	(None, 16, 16, 64)	192	conv2d_27[0][0]
activation_27 (Activation)	(None, 16, 16, 64)	0	batch_normalization_27[0][0]

conv2d_28 (Conv2D)	(None, 16, 16, 96)	55296	activation_27[0][0]
batch_normalization_28 (BatchNo	(None, 16, 16, 96)	288	conv2d_28[0][0]
activation_28 (Activation)	(None, 16, 16, 96)	0	batch_normalization_28[0][0]
conv2d_26 (Conv2D)	(None, 7, 7, 384)	995328	mixed2[0][0]
conv2d_29 (Conv2D)	(None, 7, 7, 96)	82944	activation_28[0][0]
batch_normalization_26 (BatchNo	(None, 7, 7, 384)	1152	conv2d_26[0][0]
batch_normalization_29 (BatchNo	(None, 7, 7, 96)	288	conv2d_29[0][0]
activation_26 (Activation)	(None, 7, 7, 384)	0	batch_normalization_26[0][0]
activation_29 (Activation)	(None, 7, 7, 96)	0	batch_normalization_29[0][0]
max_pooling2d_2 (MaxPooling2D)	(None, 7, 7, 288)	0	mixed2[0][0]
mixed3 (Concatenate)	(None, 7, 7, 768)	0	activation_26[0][0] activation_29[0][0] max_pooling2d_2[0][0]
conv2d_34 (Conv2D)	(None, 7, 7, 128)	98304	mixed3[0][0]
batch_normalization_34 (BatchNo	(None, 7, 7, 128)	384	conv2d_34[0][0]
activation_34 (Activation)	(None, 7, 7, 128)	0	batch_normalization_34[0][0]
conv2d_35 (Conv2D)	(None, 7, 7, 128)	114688	activation_34[0][0]
batch_normalization_35 (BatchNo	(None, 7, 7, 128)	384	conv2d_35[0][0]
activation_35 (Activation)	(None, 7, 7, 128)	0	batch_normalization_35[0][0]
conv2d_31 (Conv2D)	(None, 7, 7, 128)	98304	mixed3[0][0]
conv2d_36 (Conv2D)	(None, 7, 7, 128)	114688	activation_35[0][0]
batch_normalization_31 (BatchNo	(None, 7, 7, 128)	384	conv2d_31[0][0]
batch_normalization_36 (BatchNo	(None, 7, 7, 128)	384	conv2d_36[0][0]
activation_31 (Activation)	(None, 7, 7, 128)	0	batch_normalization_31[0][0]
activation_36 (Activation)	(None, 7, 7, 128)	0	batch_normalization_36[0][0]
conv2d_32 (Conv2D)	(None, 7, 7, 128)	114688	activation_31[0][0]
conv2d_37 (Conv2D)	(None, 7, 7, 128)	114688	activation_36[0][0]
batch_normalization_32 (BatchNo	(None, 7, 7, 128)	384	conv2d_32[0][0]
batch_normalization_37 (BatchNo	(None, 7, 7, 128)	384	conv2d_37[0][0]
activation_32 (Activation)	(None, 7, 7, 128)	0	batch_normalization_32[0][0]
activation_37 (Activation)	(None, 7, 7, 128)	0	batch_normalization_37[0][0]
average_pooling2d_3 (AveragePoo	(None, 7, 7, 768)	0	mixed3[0][0]
conv2d_30 (Conv2D)	(None, 7, 7, 192)	147456	mixed3[0][0]
conv2d_33 (Conv2D)	(None, 7, 7, 192)	172032	activation_32[0][0]
conv2d_38 (Conv2D)	(None, 7, 7, 192)	172032	activation_37[0][0]
conv2d_39 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_3[0][0]
batch_normalization_30 (BatchNo	(None, 7, 7, 192)	576	conv2d_30[0][0]
batch_normalization_33 (BatchNo	(None, 7, 7, 192)	576	conv2d_33[0][0]
batch_normalization_38 (BatchNo	(None, 7, 7, 192)	576	conv2d_38[0][0]
batch_normalization_39 (BatchNo	(None, 7, 7, 192)	576	conv2d_39[0][0]

batch_normalization_39 (BatchNo	(None, 7, 7, 192)	576	conv2d_39[0][0]
activation_30 (Activation)	(None, 7, 7, 192)	0	batch_normalization_30[0][0]
activation_33 (Activation)	(None, 7, 7, 192)	0	batch_normalization_33[0][0]
activation_38 (Activation)	(None, 7, 7, 192)	0	batch_normalization_38[0][0]
activation_39 (Activation)	(None, 7, 7, 192)	0	batch_normalization_39[0][0]
mixed4 (Concatenate)	(None, 7, 7, 768)	0	activation_30[0][0] activation_33[0][0] activation_38[0][0] activation_39[0][0]
conv2d_44 (Conv2D)	(None, 7, 7, 160)	122880	mixed4[0][0]
batch_normalization_44 (BatchNo	(None, 7, 7, 160)	480	conv2d_44[0][0]
activation_44 (Activation)	(None, 7, 7, 160)	0	batch_normalization_44[0][0]
conv2d_45 (Conv2D)	(None, 7, 7, 160)	179200	activation_44[0][0]
batch_normalization_45 (BatchNo	(None, 7, 7, 160)	480	conv2d_45[0][0]
activation_45 (Activation)	(None, 7, 7, 160)	0	batch_normalization_45[0][0]
conv2d_41 (Conv2D)	(None, 7, 7, 160)	122880	mixed4[0][0]
conv2d_46 (Conv2D)	(None, 7, 7, 160)	179200	activation_45[0][0]
batch_normalization_41 (BatchNo	(None, 7, 7, 160)	480	conv2d_41[0][0]
batch_normalization_46 (BatchNo	(None, 7, 7, 160)	480	conv2d_46[0][0]
activation_41 (Activation)	(None, 7, 7, 160)	0	batch_normalization_41[0][0]
activation_46 (Activation)	(None, 7, 7, 160)	0	batch_normalization_46[0][0]
conv2d_42 (Conv2D)	(None, 7, 7, 160)	179200	activation_41[0][0]
conv2d_47 (Conv2D)	(None, 7, 7, 160)	179200	activation_46[0][0]
batch_normalization_42 (BatchNo	(None, 7, 7, 160)	480	conv2d_42[0][0]
batch_normalization_47 (BatchNo	(None, 7, 7, 160)	480	conv2d_47[0][0]
activation_42 (Activation)	(None, 7, 7, 160)	0	batch_normalization_42[0][0]
activation_47 (Activation)	(None, 7, 7, 160)	0	batch_normalization_47[0][0]
average_pooling2d_4 (AveragePoo	(None, 7, 7, 768)	0	mixed4[0][0]
conv2d_40 (Conv2D)	(None, 7, 7, 192)	147456	mixed4[0][0]
conv2d_43 (Conv2D)	(None, 7, 7, 192)	215040	activation_42[0][0]
conv2d_48 (Conv2D)	(None, 7, 7, 192)	215040	activation_47[0][0]
conv2d_49 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_4[0][0]
batch_normalization_40 (BatchNo	(None, 7, 7, 192)	576	conv2d_40[0][0]
batch_normalization_43 (BatchNo	(None, 7, 7, 192)	576	conv2d_43[0][0]
batch_normalization_48 (BatchNo	(None, 7, 7, 192)	576	conv2d_48[0][0]
batch_normalization_49 (BatchNo	(None, 7, 7, 192)	576	conv2d_49[0][0]
activation_40 (Activation)	(None, 7, 7, 192)	0	batch_normalization_40[0][0]
activation_43 (Activation)	(None, 7, 7, 192)	0	batch_normalization_43[0][0]
activation_48 (Activation)	(None, 7, 7, 192)	0	batch_normalization_48[0][0]
activation_49 (Activation)	(None, 7, 7, 192)	0	batch_normalization_49[0][0]
mixed5 (Concatenate)	(None, 7, 7, 768)	0	activation_40[0][0]

mixed5 (Concatenate)	(None, 7, 7, 768)	0	activation_40[0][0] activation_43[0][0] activation_48[0][0] activation_49[0][0]
conv2d_54 (Conv2D)	(None, 7, 7, 160)	122880	mixed5[0][0]
batch_normalization_54 (BatchNo	(None, 7, 7, 160)	480	conv2d_54[0][0]
activation_54 (Activation)	(None, 7, 7, 160)	0	batch_normalization_54[0][0]
conv2d_55 (Conv2D)	(None, 7, 7, 160)	179200	activation_54[0][0]
batch_normalization_55 (BatchNo	(None, 7, 7, 160)	480	conv2d_55[0][0]
activation_55 (Activation)	(None, 7, 7, 160)	0	batch_normalization_55[0][0]
conv2d_51 (Conv2D)	(None, 7, 7, 160)	122880	mixed5[0][0]
conv2d_56 (Conv2D)	(None, 7, 7, 160)	179200	activation_55[0][0]
batch_normalization_51 (BatchNo	(None, 7, 7, 160)	480	conv2d_51[0][0]
batch_normalization_56 (BatchNo	(None, 7, 7, 160)	480	conv2d_56[0][0]
activation_51 (Activation)	(None, 7, 7, 160)	0	batch_normalization_51[0][0]
activation_56 (Activation)	(None, 7, 7, 160)	0	batch_normalization_56[0][0]
conv2d_52 (Conv2D)	(None, 7, 7, 160)	179200	activation_51[0][0]
conv2d_57 (Conv2D)	(None, 7, 7, 160)	179200	activation_56[0][0]
batch_normalization_52 (BatchNo	(None, 7, 7, 160)	480	conv2d_52[0][0]
batch_normalization_57 (BatchNo	(None, 7, 7, 160)	480	conv2d_57[0][0]
activation_52 (Activation)	(None, 7, 7, 160)	0	batch_normalization_52[0][0]
activation_57 (Activation)	(None, 7, 7, 160)	0	batch_normalization_57[0][0]
average_pooling2d_5 (AveragePoo	(None, 7, 7, 768)	0	mixed5[0][0]
conv2d_50 (Conv2D)	(None, 7, 7, 192)	147456	mixed5[0][0]
conv2d_53 (Conv2D)	(None, 7, 7, 192)	215040	activation_52[0][0]
conv2d_58 (Conv2D)	(None, 7, 7, 192)	215040	activation_57[0][0]
conv2d_59 (Conv2D)	(None, 7, 7, 192)	147456	average_pooling2d_5[0][0]
batch_normalization_50 (BatchNo	(None, 7, 7, 192)	576	conv2d_50[0][0]
batch_normalization_53 (BatchNo	(None, 7, 7, 192)	576	conv2d_53[0][0]
batch_normalization_58 (BatchNo	(None, 7, 7, 192)	576	conv2d_58[0][0]
batch_normalization_59 (BatchNo	(None, 7, 7, 192)	576	conv2d_59[0][0]
activation_50 (Activation)	(None, 7, 7, 192)	0	batch_normalization_50[0][0]
activation_53 (Activation)	(None, 7, 7, 192)	0	batch_normalization_53[0][0]
activation_58 (Activation)	(None, 7, 7, 192)	0	batch_normalization_58[0][0]
activation_59 (Activation)	(None, 7, 7, 192)	0	batch_normalization_59[0][0]
mixed6 (Concatenate)	(None, 7, 7, 768)	0	activation_50[0][0] activation_53[0][0] activation_58[0][0] activation_59[0][0]
conv2d_64 (Conv2D)	(None, 7, 7, 192)	147456	mixed6[0][0]
batch_normalization_64 (BatchNo	(None, 7, 7, 192)	576	conv2d_64[0][0]
activation_64 (Activation)	(None, 7, 7, 192)	0	batch_normalization_64[0][0]

```
__________________________________________________________________________________________________
conv2d_65 (Conv2D)              (None, 7, 7, 192)    258048      activation_64[0][0]
__________________________________________________________________________________________________
batch_normalization_65 (BatchNo (None, 7, 7, 192)    576         conv2d_65[0][0]
__________________________________________________________________________________________________
activation_65 (Activation)      (None, 7, 7, 192)    0           batch_normalization_65[0][0]
__________________________________________________________________________________________________
conv2d_61 (Conv2D)              (None, 7, 7, 192)    147456      mixed6[0][0]
__________________________________________________________________________________________________
conv2d_66 (Conv2D)              (None, 7, 7, 192)    258048      activation_65[0][0]
__________________________________________________________________________________________________
batch_normalization_61 (BatchNo (None, 7, 7, 192)    576         conv2d_61[0][0]
__________________________________________________________________________________________________
batch_normalization_66 (BatchNo (None, 7, 7, 192)    576         conv2d_66[0][0]
__________________________________________________________________________________________________
activation_61 (Activation)      (None, 7, 7, 192)    0           batch_normalization_61[0][0]
__________________________________________________________________________________________________
activation_66 (Activation)      (None, 7, 7, 192)    0           batch_normalization_66[0][0]
__________________________________________________________________________________________________
conv2d_62 (Conv2D)              (None, 7, 7, 192)    258048      activation_61[0][0]
__________________________________________________________________________________________________
conv2d_67 (Conv2D)              (None, 7, 7, 192)    258048      activation_66[0][0]
__________________________________________________________________________________________________
batch_normalization_62 (BatchNo (None, 7, 7, 192)    576         conv2d_62[0][0]
__________________________________________________________________________________________________
batch_normalization_67 (BatchNo (None, 7, 7, 192)    576         conv2d_67[0][0]
__________________________________________________________________________________________________
activation_62 (Activation)      (None, 7, 7, 192)    0           batch_normalization_62[0][0]
__________________________________________________________________________________________________
activation_67 (Activation)      (None, 7, 7, 192)    0           batch_normalization_67[0][0]
__________________________________________________________________________________________________
average_pooling2d_6 (AveragePoo (None, 7, 7, 768)    0           mixed6[0][0]
__________________________________________________________________________________________________
conv2d_60 (Conv2D)              (None, 7, 7, 192)    147456      mixed6[0][0]
__________________________________________________________________________________________________
conv2d_63 (Conv2D)              (None, 7, 7, 192)    258048      activation_62[0][0]
__________________________________________________________________________________________________
conv2d_68 (Conv2D)              (None, 7, 7, 192)    258048      activation_67[0][0]
__________________________________________________________________________________________________
conv2d_69 (Conv2D)              (None, 7, 7, 192)    147456      average_pooling2d_6[0][0]
__________________________________________________________________________________________________
batch_normalization_60 (BatchNo (None, 7, 7, 192)    576         conv2d_60[0][0]
__________________________________________________________________________________________________
batch_normalization_63 (BatchNo (None, 7, 7, 192)    576         conv2d_63[0][0]
__________________________________________________________________________________________________
batch_normalization_68 (BatchNo (None, 7, 7, 192)    576         conv2d_68[0][0]
__________________________________________________________________________________________________
batch_normalization_69 (BatchNo (None, 7, 7, 192)    576         conv2d_69[0][0]
__________________________________________________________________________________________________
activation_60 (Activation)      (None, 7, 7, 192)    0           batch_normalization_60[0][0]
__________________________________________________________________________________________________
activation_63 (Activation)      (None, 7, 7, 192)    0           batch_normalization_63[0][0]
__________________________________________________________________________________________________
activation_68 (Activation)      (None, 7, 7, 192)    0           batch_normalization_68[0][0]
__________________________________________________________________________________________________
activation_69 (Activation)      (None, 7, 7, 192)    0           batch_normalization_69[0][0]
__________________________________________________________________________________________________
mixed7 (Concatenate)            (None, 7, 7, 768)    0           activation_60[0][0]
                                                                 activation_63[0][0]
                                                                 activation_68[0][0]
                                                                 activation_69[0][0]
__________________________________________________________________________________________________
flatten (Flatten)               (None, 37632)        0           mixed7[0][0]
__________________________________________________________________________________________________
dense (Dense)                   (None, 128)          4817024     flatten[0][0]
__________________________________________________________________________________________________
dropout (Dropout)               (None, 128)          0           dense[0][0]
__________________________________________________________________________________________________
dense_1 (Dense)                 (None, 1)            129         dropout[0][0]
==================================================================================================
Total params: 13,792,417
Trainable params: 4,817,153
Non-trainable params: 8,975,264
__________________________________________________________________________________________________
```

In [6]:

```
# Get the Horse or Human dataset
path_horse_or_human = f"{getcwd()}/../tmp2/horse-or-human.zip"
# Get the Horse or Human Validation dataset
path_validation_horse_or_human = f"{getcwd()}/../tmp2/validation-horse-or-human.zip"
from tensorflow.keras.preprocessing.image import ImageDataGenerator

import os
import zipfile
import shutil

shutil.rmtree('/tmp')
local_zip = path_horse_or_human
zip_ref = zipfile.ZipFile(local_zip, 'r')
zip_ref.extractall('/tmp/training')
zip_ref.close()

local_zip = path_validation_horse_or_human
zip_ref = zipfile.ZipFile(local_zip, 'r')
zip_ref.extractall('/tmp/validation')
zip_ref.close()
```

In [7]:

```
# Define our example directories and files
train_dir = '/tmp/training'
validation_dir = '/tmp/validation'

train_horses_dir = os.path.join(train_dir, 'horses')
train_humans_dir = os.path.join(train_dir, 'humans')
validation_horses_dir = os.path.join(validation_dir, 'horses')
validation_humans_dir = os.path.join(validation_dir, 'humans')

train_horses_fnames = os.listdir(train_horses_dir)
train_humans_fnames = os.listdir(train_humans_dir)
validation_horses_fnames = os.listdir(validation_horses_dir)
validation_humans_fnames = os.listdir(validation_humans_dir)

print(len(train_horses_fnames))
print(len(train_humans_fnames))
print(len(validation_horses_fnames))
print(len(validation_humans_fnames))

# Expected Output:
# 500
# 527
# 128
# 128
```

```
500
527
128
128
```

In [8]:

```
# Add our data-augmentation parameters to ImageDataGenerator
train_datagen = ImageDataGenerator(
    rescale=1./255,
    rotation_range=40,
    width_shift_range=0.2,
    height_shift_range=0.2,
    shear_range=0.2,
    zoom_range=0.2,
    horizontal_flip=True,
    fill_mode='nearest')

# Note that the validation data should not be augmented!
test_datagen = ImageDataGenerator(rescale=1./255)

# Flow training images in batches of 20 using train_datagen generator
train_generator = train_datagen.flow_from_directory(
    train_dir,
    target_size=(150, 150),
    batch_size=20
```

```
    batch_size=20,
    class_mode='binary')

# Flow validation images in batches of 20 using test_datagen generator
validation_generator =  test_datagen.flow_from_directory(
    validation_dir,
    target_size=(150, 150),
    batch_size=20,
    class_mode='binary')

# Expected Output:
# Found 1027 images belonging to 2 classes.
# Found 256 images belonging to 2 classes.
```

```
Found 1027 images belonging to 2 classes.
Found 256 images belonging to 2 classes.
```

In [9]:

```
# Run this and see how many epochs it should take before the callback
# fires, and stops training at 97% accuracy

callbacks = myCallback()
history = model.fit_generator(
    train_generator,
    validation_data=validation_generator,
    epochs=3,
    steps_per_epoch=20,
    validation_steps=10,
    callbacks=[callbacks])
```

```
Epoch 1/3
20/20 [==============================] - 41s 2s/step - loss: 0.4154 - acc: 0.8075 - val_loss: 0.02
93 - val_acc: 0.9950
Epoch 2/3
20/20 [==============================] - 25s 1s/step - loss: 0.2220 - acc: 0.9251 - val_loss: 0.01
73 - val_acc: 1.0000
Epoch 3/3
20/20 [==============================] - 19s 944ms/step - loss: 0.1390 - acc: 0.9525 - val_loss: 0
.0238 - val_acc: 0.9900
```

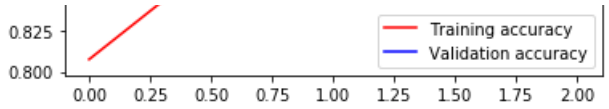
In [10]:

```
%matplotlib inline
import matplotlib.pyplot as plt
acc = history.history['acc']
val_acc = history.history['val_acc']
loss = history.history['loss']
val_loss = history.history['val_loss']

epochs = range(len(acc))

plt.plot(epochs, acc, 'r', label='Training accuracy')
plt.plot(epochs, val_acc, 'b', label='Validation accuracy')
plt.title('Training and validation accuracy')
plt.legend(loc=0)
plt.figure()


plt.show()
```




```
<Figure size 432x288 with 0 Axes>
```

Submission Instructions

In [ ]:

```
# Now click the 'Submit Assignment' button above.
```

When you're done or would like to take a break, please run the two cells below to save your work and close the Notebook. This will free up resources for your fellow learners.

In [ ]:

```
%%javascript
<!-- Save the notebook -->
IPython.notebook.save_checkpoint();
```

In [ ]:

```
%%javascript
IPython.notebook.session.delete();
window.onbeforeunload = null
setTimeout(function() { window.close(); }, 1000);
```