Transfer Learning

In this lab, you will see how you can use a pre-trained model to achieve good results even with a small training dataset. This is called *transfer learning* and you do this by leveraging the trained layers of an existing model and adding your own layers to fit your application. For example, you can:

1. just get the convolution layers of one model
2. attach some dense layers onto it
3. train just the dense network
4. evaluate the results

Doing this will allow you to save time building your application because you will essentially skip weeks of training time of very deep networks. You will just use the features it has learned and tweak it for your dataset. Let's see how these are done in the next sections.

IMPORTANT NOTE: This notebook is designed to run as a Colab. Running the notebook on your local machine might result in some of the code blocks throwing errors.

Setup the pretrained model

You will need to prepare pretrained model and configure the layers that you need. For this exercise, you will use the convolution layers of the InceptionV3 architecture as your base model. To do that, you need to:

1. Set the input shape to fit your application. In this case. set it to `150x150x3`.
2. Pick and freeze the convolution layers to take advantage of the features it has learned already.
3. Add dense layers which you will train.

Let's see how to do these in the next cells.

First, in preparing the input to the model, you want to fetch the pretrained weights of the `InceptionV3` model and remove the fully connected layer at the end because you will be replacing it later. You will also specify the input shape that your model will accept. Lastly, you want to freeze the weights of these layers because they have been trained already.

```
# Download the pre-trained weights. No top means it excludes the fully connected layer it uses for classification.
!wget --no-check-certificate \
    https://storage.googleapis.com/mledu-datasets/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5 \
    -O /tmp/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5
```

```
--2025-08-13 17:12:28--  https://storage.googleapis.com/mledu-datasets/inception_v3_weights_tf_dim_ordering_tf_kerı
Resolving storage.googleapis.com (storage.googleapis.com)... 173.194.69.207, 173.194.79.207, 108.177.96.207, ...
Connecting to storage.googleapis.com (storage.googleapis.com)|173.194.69.207|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 87910968 (84M) [application/x-hdf]
Saving to: '/tmp/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5'

/tmp/inception_v3_w 100%[===================>]  83.84M  25.3MB/s    in 3.3s

2025-08-13 17:12:31 (25.3 MB/s) - '/tmp/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5' saved [87910968/8
```

```
from tensorflow.keras.applications.inception_v3 import InceptionV3
from tensorflow.keras import layers

# Set the weights file you downloaded into a variable
local_weights_file = '/tmp/inception_v3_weights_tf_dim_ordering_tf_kernels_notop.h5'

# Initialize the base model.
# Set the input shape and remove the dense layers.
pre_trained_model = InceptionV3(include_top=False,#weights='imagenet',
                                input_shape=(150, 150, 3))

# Load the pre-trained weights you downloaded.
pre_trained_model.load_weights(local_weights_file)

# Freeze the weights of the layers.
for layer in pre_trained_model.layers:
  layer.trainable = False
```

You can see the summary of the model below. You can see that it is a very deep network. You can then select up to which point of the network you want to use. As Laurence showed in the exercise, you will use up to `mixed7` as your base model and add to that. This is because the original last layer might be too specialized in what it has learned so it might not translate well into your application. `mixed7` on the other hand will be more generalized and you can start with that for your application. After the exercise, feel free to modify and use other layers to see what the results you get.

```
pre_trained_model.summary()
```

Model: "inception_v3"

Layer (type)	Output Shape	Param #	Connected to
input_layer_7 (InputLayer)	(None, 150, 150, 3)	0	–
conv2d_658 (Conv2D)	(None, 74, 74, 32)	864	input_layer_7[0]…
batch_normalizatio… (BatchNormalizatio…	(None, 74, 74, 32)	96	conv2d_658[0][0]
activation_658 (Activation)	(None, 74, 74, 32)	0	batch_normalizat…
conv2d_659 (Conv2D)	(None, 72, 72, 32)	9,216	activation_658[0…
batch_normalizatio… (BatchNormalizatio…	(None, 72, 72, 32)	96	conv2d_659[0][0]
activation_659 (Activation)	(None, 72, 72, 32)	0	batch_normalizat…
conv2d_660 (Conv2D)	(None, 72, 72, 64)	18,432	activation_659[0…
batch_normalizatio… (BatchNormalizatio…	(None, 72, 72, 64)	192	conv2d_660[0][0]
activation_660 (Activation)	(None, 72, 72, 64)	0	batch_normalizat…
max_pooling2d_28 (MaxPooling2D)	(None, 35, 35, 64)	0	activation_660[0…
conv2d_661 (Conv2D)	(None, 35, 35, 80)	5,120	max_pooling2d_28…
batch_normalizatio… (BatchNormalizatio…	(None, 35, 35, 80)	240	conv2d_661[0][0]
activation_661 (Activation)	(None, 35, 35, 80)	0	batch_normalizat…
conv2d_662 (Conv2D)	(None, 33, 33, 192)	138,240	activation_661[0…
batch_normalizatio… (BatchNormalizatio…	(None, 33, 33, 192)	576	conv2d_662[0][0]
activation_662 (Activation)	(None, 33, 33, 192)	0	batch_normalizat…
max_pooling2d_29 (MaxPooling2D)	(None, 16, 16, 192)	0	activation_662[0…
conv2d_666 (Conv2D)	(None, 16, 16, 64)	12,288	max_pooling2d_29…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_666[0][0]
activation_666 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
conv2d_664 (Conv2D)	(None, 16, 16, 48)	9,216	max_pooling2d_29…
conv2d_667 (Conv2D)	(None, 16, 16, 96)	55,296	activation_666[0…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 48)	144	conv2d_664[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_667[0][0]
activation_664 (Activation)	(None, 16, 16, 48)	0	batch_normalizat…
activation_667 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 16, 16, 192)	0	max_pooling2d_29…
conv2d_663 (Conv2D)	(None, 16, 16, 64)	12,288	max_pooling2d_29…
conv2d_665 (Conv2D)	(None, 16, 16, 64)	76,800	activation_664[0…

conv2d_668 (Conv2D)	(None, 16, 16, 96)	82,944	activation_667[0…
conv2d_669 (Conv2D)	(None, 16, 16, 32)	6,144	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_663[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_665[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_668[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 32)	96	conv2d_669[0][0]
activation_663 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
activation_665 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
activation_668 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
activation_669 (Activation)	(None, 16, 16, 32)	0	batch_normalizat…
mixed0 (Concatenate)	(None, 16, 16, 256)	0	activation_663[0… activation_665[0… activation_668[0… activation_669[0…
conv2d_673 (Conv2D)	(None, 16, 16, 64)	16,384	mixed0[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_673[0][0]
activation_673 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
conv2d_671 (Conv2D)	(None, 16, 16, 48)	12,288	mixed0[0][0]
conv2d_674 (Conv2D)	(None, 16, 16, 96)	55,296	activation_673[0…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 48)	144	conv2d_671[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_674[0][0]
activation_671 (Activation)	(None, 16, 16, 48)	0	batch_normalizat…
activation_674 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 16, 16, 256)	0	mixed0[0][0]
conv2d_670 (Conv2D)	(None, 16, 16, 64)	16,384	mixed0[0][0]
conv2d_672 (Conv2D)	(None, 16, 16, 64)	76,800	activation_671[0…
conv2d_675 (Conv2D)	(None, 16, 16, 96)	82,944	activation_674[0…
conv2d_676 (Conv2D)	(None, 16, 16, 64)	16,384	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_670[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_672[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_675[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_676[0][0]
activation_670 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
activation_672 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…

(Activation)	64)		
activation_675 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
activation_676 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
mixed1 (Concatenate)	(None, 16, 16, 288)	0	activation_670[0… activation_672[0… activation_675[0… activation_676[0…
conv2d_680 (Conv2D)	(None, 16, 16, 64)	18,432	mixed1[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_680[0][0]
activation_680 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
conv2d_678 (Conv2D)	(None, 16, 16, 48)	13,824	mixed1[0][0]
conv2d_681 (Conv2D)	(None, 16, 16, 96)	55,296	activation_680[0…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 48)	144	conv2d_678[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_681[0][0]
activation_678 (Activation)	(None, 16, 16, 48)	0	batch_normalizat…
activation_681 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 16, 16, 288)	0	mixed1[0][0]
conv2d_677 (Conv2D)	(None, 16, 16, 64)	18,432	mixed1[0][0]
conv2d_679 (Conv2D)	(None, 16, 16, 64)	76,800	activation_678[0…
conv2d_682 (Conv2D)	(None, 16, 16, 96)	82,944	activation_681[0…
conv2d_683 (Conv2D)	(None, 16, 16, 64)	18,432	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_677[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_679[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_682[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_683[0][0]
activation_677 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
activation_679 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
activation_682 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
activation_683 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
mixed2 (Concatenate)	(None, 16, 16, 288)	0	activation_677[0… activation_679[0… activation_682[0… activation_683[0…
conv2d_685 (Conv2D)	(None, 16, 16, 64)	18,432	mixed2[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 64)	192	conv2d_685[0][0]
activation_685 (Activation)	(None, 16, 16, 64)	0	batch_normalizat…
conv2d_686 (Conv2D)	(None, 16, 16, 96)	55,296	activation_685[0…

	96)		
batch_normalizatio… (BatchNormalizatio…	(None, 16, 16, 96)	288	conv2d_686[0][0]
activation_686 (Activation)	(None, 16, 16, 96)	0	batch_normalizat…
conv2d_684 (Conv2D)	(None, 7, 7, 384)	995,328	mixed2[0][0]
conv2d_687 (Conv2D)	(None, 7, 7, 96)	82,944	activation_686[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 384)	1,152	conv2d_684[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 96)	288	conv2d_687[0][0]
activation_684 (Activation)	(None, 7, 7, 384)	0	batch_normalizat…
activation_687 (Activation)	(None, 7, 7, 96)	0	batch_normalizat…
max_pooling2d_30 (MaxPooling2D)	(None, 7, 7, 288)	0	mixed2[0][0]
mixed3 (Concatenate)	(None, 7, 7, 768)	0	activation_684[0… activation_687[0… max_pooling2d_30…
conv2d_692 (Conv2D)	(None, 7, 7, 128)	98,304	mixed3[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_692[0][0]
activation_692 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
conv2d_693 (Conv2D)	(None, 7, 7, 128)	114,688	activation_692[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_693[0][0]
activation_693 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
conv2d_689 (Conv2D)	(None, 7, 7, 128)	98,304	mixed3[0][0]
conv2d_694 (Conv2D)	(None, 7, 7, 128)	114,688	activation_693[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_689[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_694[0][0]
activation_689 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
activation_694 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
conv2d_690 (Conv2D)	(None, 7, 7, 128)	114,688	activation_689[0…
conv2d_695 (Conv2D)	(None, 7, 7, 128)	114,688	activation_694[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_690[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 128)	384	conv2d_695[0][0]
activation_690 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
activation_695 (Activation)	(None, 7, 7, 128)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 7, 7, 768)	0	mixed3[0][0]
conv2d_688 (Conv2D)	(None, 7, 7, 192)	147,456	mixed3[0][0]
conv2d_691 (Conv2D)	(None, 7, 7, 192)	172,032	activation_690[0…
conv2d_696 (Conv2D)	(None, 7, 7, 192)	172,032	activation_695[0…
conv2d_697 (Conv2D)	(None, 7, 7, 192)	147,456	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_688[0][0]
batch_normalizatio…	(None, 7, 7, 192)	576	conv2d_691[0][0]

(BatchNormalizatio…			
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_696[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_697[0][0]
activation_688 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_691 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_696 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_697 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
mixed4 (Concatenate)	(None, 7, 7, 768)	0	activation_688[0… activation_691[0… activation_696[0… activation_697[0…
conv2d_702 (Conv2D)	(None, 7, 7, 160)	122,880	mixed4[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_702[0][0]
activation_702 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_703 (Conv2D)	(None, 7, 7, 160)	179,200	activation_702[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_703[0][0]
activation_703 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_699 (Conv2D)	(None, 7, 7, 160)	122,880	mixed4[0][0]
conv2d_704 (Conv2D)	(None, 7, 7, 160)	179,200	activation_703[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_699[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_704[0][0]
activation_699 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
activation_704 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_700 (Conv2D)	(None, 7, 7, 160)	179,200	activation_699[0…
conv2d_705 (Conv2D)	(None, 7, 7, 160)	179,200	activation_704[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_700[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_705[0][0]
activation_700 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
activation_705 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 7, 7, 768)	0	mixed4[0][0]
conv2d_698 (Conv2D)	(None, 7, 7, 192)	147,456	mixed4[0][0]
conv2d_701 (Conv2D)	(None, 7, 7, 192)	215,040	activation_700[0…
conv2d_706 (Conv2D)	(None, 7, 7, 192)	215,040	activation_705[0…
conv2d_707 (Conv2D)	(None, 7, 7, 192)	147,456	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_698[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_701[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_706[0][0]
batch_normalizatio…	(None, 7, 7, 192)	576	conv2d_707[0][0]

(BatchNormalizatio…			
activation_698 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_701 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_706 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_707 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
mixed5 (Concatenate)	(None, 7, 7, 768)	0	activation_698[0… activation_701[0… activation_706[0… activation_707[0…
conv2d_712 (Conv2D)	(None, 7, 7, 160)	122,880	mixed5[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_712[0][0]
activation_712 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_713 (Conv2D)	(None, 7, 7, 160)	179,200	activation_712[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_713[0][0]
activation_713 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_709 (Conv2D)	(None, 7, 7, 160)	122,880	mixed5[0][0]
conv2d_714 (Conv2D)	(None, 7, 7, 160)	179,200	activation_713[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_709[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_714[0][0]
activation_709 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
activation_714 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
conv2d_710 (Conv2D)	(None, 7, 7, 160)	179,200	activation_709[0…
conv2d_715 (Conv2D)	(None, 7, 7, 160)	179,200	activation_714[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_710[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 160)	480	conv2d_715[0][0]
activation_710 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
activation_715 (Activation)	(None, 7, 7, 160)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 7, 7, 768)	0	mixed5[0][0]
conv2d_708 (Conv2D)	(None, 7, 7, 192)	147,456	mixed5[0][0]
conv2d_711 (Conv2D)	(None, 7, 7, 192)	215,040	activation_710[0…
conv2d_716 (Conv2D)	(None, 7, 7, 192)	215,040	activation_715[0…
conv2d_717 (Conv2D)	(None, 7, 7, 192)	147,456	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_708[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_711[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_716[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_717[0][0]
activation_708 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_711	(None, 7, 7, 192)	0	batch_normalizat…

(Activation)			
activation_716 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_717 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
mixed6 (Concatenate)	(None, 7, 7, 768)	0	activation_708[0… activation_711[0… activation_716[0… activation_717[0…
conv2d_722 (Conv2D)	(None, 7, 7, 192)	147,456	mixed6[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_722[0][0]
activation_722 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
conv2d_723 (Conv2D)	(None, 7, 7, 192)	258,048	activation_722[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_723[0][0]
activation_723 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
conv2d_719 (Conv2D)	(None, 7, 7, 192)	147,456	mixed6[0][0]
conv2d_724 (Conv2D)	(None, 7, 7, 192)	258,048	activation_723[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_719[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_724[0][0]
activation_719 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_724 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
conv2d_720 (Conv2D)	(None, 7, 7, 192)	258,048	activation_719[0…
conv2d_725 (Conv2D)	(None, 7, 7, 192)	258,048	activation_724[0…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_720[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_725[0][0]
activation_720 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_725 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
average_pooling2d_… (AveragePooling2D)	(None, 7, 7, 768)	0	mixed6[0][0]
conv2d_718 (Conv2D)	(None, 7, 7, 192)	147,456	mixed6[0][0]
conv2d_721 (Conv2D)	(None, 7, 7, 192)	258,048	activation_720[0…
conv2d_726 (Conv2D)	(None, 7, 7, 192)	258,048	activation_725[0…
conv2d_727 (Conv2D)	(None, 7, 7, 192)	147,456	average_pooling2…
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_718[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_721[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_726[0][0]
batch_normalizatio… (BatchNormalizatio…	(None, 7, 7, 192)	576	conv2d_727[0][0]
activation_718 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_721 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_726 (Activation)	(None, 7, 7, 192)	0	batch_normalizat…
activation_727	(None, 7, 7, 192)	0	batch_normalizat…