Transfer Learning Inception V3 using Keras

Please download the dataset from the below url

In [ ]:

In [1]:

```python
from tensorflow.compat.v1 import ConfigProto
from tensorflow.compat.v1 import InteractiveSession

config = ConfigProto()
config.gpu_options.per_process_gpu_memory_fraction = 0.2
config.gpu_options.allow_growth = True
session = InteractiveSession(config=config)
```

In [2]:

```python
# import the libraries as shown below

from tensorflow.keras.layers import Input, Lambda, Dense, Flatten
from tensorflow.keras.models import Model
#from tensorflow.keras.applications.resnet152V2 import ResNet152V2
#from keras.applications.vgg16 import VGG16
from tensorflow.keras.applications.inception_v3 import preprocess_input
from tensorflow.keras.preprocessing import image
from tensorflow.keras.preprocessing.image import ImageDataGenerator,load_img
from tensorflow.keras.models import Sequential
import numpy as np
from glob import glob
#import matplotlib.pyplot as plt
```

In [3]:

```python
# re-size all the images to this
IMAGE_SIZE = [224, 224]

train_path = 'Datasets/train'
valid_path = 'Datasets/test'
```

In [4]:

```python
# Import the Vgg 16 library as shown below and add preprocessing layer to the front of VGG
# Here we will be using imagenet weights
import tensorflow
resnet152V2 =tensorflow.keras.applications.ResNet152V2(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)
```

In [5]:

```python
# don't train existing weights
for layer in resnet152V2.layers:
    layer.trainable = False
```

In [6]:

```python
# useful for getting number of output classes
folders = glob('Datasets/train/*')
```

In [7]:

```python
# our layers - you can add more if you want
```

```
x = Flatten()(resnet152V2.output)
```

In [8]:

```
prediction = Dense(len(folders), activation='softmax')(x)

# create a model object
model = Model(inputs=resnet152V2.input, outputs=prediction)
```

In [9]:

```
# view the structure of the model
model.summary()
```

Model: "model"

_____

Layer (type)   Output Shape   Param #   Connected to

==
=========
input_1 (InputLayer)   [(None, 224, 224, 3) 0

_____

conv1_pad (ZeroPadding2D)   (None, 230, 230, 3)   0   input_1[0][0]

_____

conv1_conv (Conv2D)   (None, 112, 112, 64) 9472   conv1_pad[0][0]

_____

pool1_pad (ZeroPadding2D)   (None, 114, 114, 64) 0   conv1_conv[0][0]

_____

pool1_pool (MaxPooling2D)   (None, 56, 56, 64)   0   pool1_pad[0][0]

_____

conv2_block1_preact_bn (BatchNo (None, 56, 56, 64) 256   pool1_pool[0][0]

_____

conv2_block1_preact_relu (Activ (None, 56, 56, 64) 0   conv2_block1_preact_bn[0
][0]
_____

conv2_block1_1_conv (Conv2D)   (None, 56, 56, 64) 4096   conv2_block1_preact_relu
[0][0]
_____

conv2_block1_1_bn (BatchNormali (None, 56, 56, 64) 256   conv2_block1_1_conv[0][0
]
_____

conv2_block1_1_relu (Activation (None, 56, 56, 64) 0   conv2_block1_1_bn[0][0]

_____

conv2_block1_2_pad (ZeroPadding (None, 58, 58, 64) 0   conv2_block1_1_relu[0][0
]
_____

conv2_block1_2_conv (Conv2D)   (None, 56, 56, 64) 36864   conv2_block1_2_pad[0][0]

_____

conv2_block1_2_bn (BatchNormali (None, 56, 56, 64) 256   conv2_block1_2_conv[0][0
]
```

| Layer (type) | Output Shape | Param # | Connected to |
|---|---|---|---|
| conv2_block1_2_relu (Activation | (None, 56, 56, 64) | 0 | conv2_block1_2_bn[0][0] |
| conv2_block1_0_conv (Conv2D) | (None, 56, 56, 256) | 16640 | conv2_block1_preact_relu[0][0] |
| conv2_block1_3_conv (Conv2D) | (None, 56, 56, 256) | 16640 | conv2_block1_2_relu[0][0] |
| conv2_block1_out (Add) | (None, 56, 56, 256) | 0 | conv2_block1_0_conv[0][0]<br>conv2_block1_3_conv[0][0] |
| conv2_block2_preact_bn (BatchNo | (None, 56, 56, 256) | 1024 | conv2_block1_out[0][0] |
| conv2_block2_preact_relu (Activ | (None, 56, 56, 256) | 0 | conv2_block2_preact_bn[0][0] |
| conv2_block2_1_conv (Conv2D) | (None, 56, 56, 64) | 16384 | conv2_block2_preact_relu[0][0] |
| conv2_block2_1_bn (BatchNormali | (None, 56, 56, 64) | 256 | conv2_block2_1_conv[0][0] |
| conv2_block2_1_relu (Activation | (None, 56, 56, 64) | 0 | conv2_block2_1_bn[0][0] |
| conv2_block2_2_pad (ZeroPadding | (None, 58, 58, 64) | 0 | conv2_block2_1_relu[0][0] |
| conv2_block2_2_conv (Conv2D) | (None, 56, 56, 64) | 36864 | conv2_block2_2_pad[0][0] |
| conv2_block2_2_bn (BatchNormali | (None, 56, 56, 64) | 256 | conv2_block2_2_conv[0][0] |
| conv2_block2_2_relu (Activation | (None, 56, 56, 64) | 0 | conv2_block2_2_bn[0][0] |
| conv2_block2_3_conv (Conv2D) | (None, 56, 56, 256) | 16640 | conv2_block2_2_relu[0][0] |
| conv2_block2_out (Add) | (None, 56, 56, 256) | 0 | conv2_block1_out[0][0]<br>conv2_block2_3_conv[0][0] |
| conv2_block3_preact_bn (BatchNo | (None, 56, 56, 256) | 1024 | conv2_block2_out[0][0] |
| conv2_block3_preact_relu (Activ | (None, 56, 56, 256) | 0 | conv2_block3_preact_bn[0][0] |

```
_____
conv2_block3_1_conv (Conv2D)      (None, 56, 56, 64)    16384      conv2_block3_preact_relu
[0][0]
_____
conv2_block3_1_bn (BatchNormali   (None, 56, 56, 64)    256        conv2_block3_1_conv[0][0
]
_____
conv2_block3_1_relu (Activation   (None, 56, 56, 64)    0          conv2_block3_1_bn[0][0]
_____
conv2_block3_2_pad (ZeroPadding   (None, 58, 58, 64)    0          conv2_block3_1_relu[0][0
]
_____
conv2_block3_2_conv (Conv2D)      (None, 28, 28, 64)    36864      conv2_block3_2_pad[0][0]
_____
conv2_block3_2_bn (BatchNormali   (None, 28, 28, 64)    256        conv2_block3_2_conv[0][0
]
_____
conv2_block3_2_relu (Activation   (None, 28, 28, 64)    0          conv2_block3_2_bn[0][0]
_____
max_pooling2d (MaxPooling2D)      (None, 28, 28, 256)   0          conv2_block2_out[0][0]
_____
conv2_block3_3_conv (Conv2D)      (None, 28, 28, 256)   16640      conv2_block3_2_relu[0][0
]
_____
conv2_block3_out (Add)            (None, 28, 28, 256)   0          max_pooling2d[0][0]

                                                                   conv2_block3_3_conv[0]
[0]
_____
conv3_block1_preact_bn (BatchNo   (None, 28, 28, 256)   1024       conv2_block3_out[0][0]
_____
conv3_block1_preact_relu (Activ   (None, 28, 28, 256)   0          conv3_block1_preact_bn[0
][0]
_____
conv3_block1_1_conv (Conv2D)      (None, 28, 28, 128)   32768      conv3_block1_preact_relu
[0][0]
_____
conv3_block1_1_bn (BatchNormali   (None, 28, 28, 128)   512        conv3_block1_1_conv[0][0
]
_____
conv3_block1_1_relu (Activation   (None, 28, 28, 128)   0          conv3_block1_1_bn[0][0]
_____
conv3_block1_2_pad (ZeroPadding   (None, 30, 30, 128)   0          conv3_block1_1_relu[0][0
]
_____
conv3_block1_2_conv (Conv2D)      (None, 28, 28, 128)   147456     conv3_block1_2_pad[0][0]
_____
conv3_block1_2_bn (BatchNormali   (None, 28, 28, 128)   512        conv3_block1_2_conv[0][0
```

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]
_____
_____
conv3_block1_2_relu (Activation  (None, 28, 28, 128)  0          conv3_block1_2_bn[0][0]
_____
_____
conv3_block1_0_conv (Conv2D)     (None, 28, 28, 512)  131584     conv3_block1_preact_relu
[0][0]
_____
_____
conv3_block1_3_conv (Conv2D)     (None, 28, 28, 512)  66048      conv3_block1_2_relu[0][0
]
_____
_____
conv3_block1_out (Add)           (None, 28, 28, 512)  0          conv3_block1_0_conv[0][
0]

                                                                 conv3_block1_3_conv[0]
[0]
_____
_____
conv3_block2_preact_bn (BatchNo  (None, 28, 28, 512)  2048       conv3_block1_out[0][0]
_____
_____
conv3_block2_preact_relu (Activ  (None, 28, 28, 512)  0          conv3_block2_preact_bn[0
][0]
_____
_____
conv3_block2_1_conv (Conv2D)     (None, 28, 28, 128)  65536      conv3_block2_preact_relu
[0][0]
_____
_____
conv3_block2_1_bn (BatchNormali  (None, 28, 28, 128)  512        conv3_block2_1_conv[0][0
]
_____
_____
conv3_block2_1_relu (Activation  (None, 28, 28, 128)  0          conv3_block2_1_bn[0][0]
_____
_____
conv3_block2_2_pad (ZeroPadding  (None, 30, 30, 128)  0          conv3_block2_1_relu[0][0
]
_____
_____
conv3_block2_2_conv (Conv2D)     (None, 28, 28, 128)  147456     conv3_block2_2_pad[0][0]
_____
_____
conv3_block2_2_bn (BatchNormali  (None, 28, 28, 128)  512        conv3_block2_2_conv[0][0
]
_____
_____
conv3_block2_2_relu (Activation  (None, 28, 28, 128)  0          conv3_block2_2_bn[0][0]
_____
_____
conv3_block2_3_conv (Conv2D)     (None, 28, 28, 512)  66048      conv3_block2_2_relu[0][0
]
_____
_____
conv3_block2_out (Add)           (None, 28, 28, 512)  0          conv3_block1_out[0][0]

                                                                 conv3_block2_3_conv[0]
[0]
_____
_____
conv3_block3_preact_bn (BatchNo  (None, 28, 28, 512)  2048       conv3_block2_out[0][0]
_____
_____
conv3_block3_preact_relu (Activ  (None, 28, 28, 512)  0          conv3_block3_preact_bn[0
```

Layer (type)	Output Shape	Param #	Connected to
conv3_block3_1_conv (Conv2D)	(None, 28, 28, 128)	65536	conv3_block3_preact_relu[0][0]
conv3_block3_1_bn (BatchNormali	(None, 28, 28, 128)	512	conv3_block3_1_conv[0][0]
conv3_block3_1_relu (Activation	(None, 28, 28, 128)	0	conv3_block3_1_bn[0][0]
conv3_block3_2_pad (ZeroPadding	(None, 30, 30, 128)	0	conv3_block3_1_relu[0][0]
conv3_block3_2_conv (Conv2D)	(None, 28, 28, 128)	147456	conv3_block3_2_pad[0][0]
conv3_block3_2_bn (BatchNormali	(None, 28, 28, 128)	512	conv3_block3_2_conv[0][0]
conv3_block3_2_relu (Activation	(None, 28, 28, 128)	0	conv3_block3_2_bn[0][0]
conv3_block3_3_conv (Conv2D)	(None, 28, 28, 512)	66048	conv3_block3_2_relu[0][0]
conv3_block3_out (Add)	(None, 28, 28, 512)	0	conv3_block2_out[0][0] conv3_block3_3_conv[0][0]
conv3_block4_preact_bn (BatchNo	(None, 28, 28, 512)	2048	conv3_block3_out[0][0]
conv3_block4_preact_relu (Activ	(None, 28, 28, 512)	0	conv3_block4_preact_bn[0][0]
conv3_block4_1_conv (Conv2D)	(None, 28, 28, 128)	65536	conv3_block4_preact_relu[0][0]
conv3_block4_1_bn (BatchNormali	(None, 28, 28, 128)	512	conv3_block4_1_conv[0][0]
conv3_block4_1_relu (Activation	(None, 28, 28, 128)	0	conv3_block4_1_bn[0][0]
conv3_block4_2_pad (ZeroPadding	(None, 30, 30, 128)	0	conv3_block4_1_relu[0][0]
conv3_block4_2_conv (Conv2D)	(None, 28, 28, 128)	147456	conv3_block4_2_pad[0][0]
conv3_block4_2_bn (BatchNormali	(None, 28, 28, 128)	512	conv3_block4_2_conv[0][0]

```
_____
conv3_block4_2_relu (Activation (None, 28, 28, 128)  0           conv3_block4_2_bn[0][0]
_____
_____
conv3_block4_3_conv (Conv2D)    (None, 28, 28, 512)  66048       conv3_block4_2_relu[0][0
]
_____
conv3_block4_out (Add)          (None, 28, 28, 512)  0           conv3_block3_out[0][0]
                                                                 conv3_block4_3_conv[0]
[0]
_____
conv3_block5_preact_bn (BatchNo (None, 28, 28, 512)  2048        conv3_block4_out[0][0]
_____
conv3_block5_preact_relu (Activ (None, 28, 28, 512)  0           conv3_block5_preact_bn[0
][0]
_____
conv3_block5_1_conv (Conv2D)    (None, 28, 28, 128)  65536       conv3_block5_preact_relu
[0][0]
_____
conv3_block5_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block5_1_conv[0][0
]
_____
conv3_block5_1_relu (Activation (None, 28, 28, 128)  0           conv3_block5_1_bn[0][0]
_____
conv3_block5_2_pad (ZeroPadding (None, 30, 30, 128)  0           conv3_block5_1_relu[0][0
]
_____
conv3_block5_2_conv (Conv2D)    (None, 28, 28, 128)  147456      conv3_block5_2_pad[0][0]
_____
conv3_block5_2_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block5_2_conv[0][0
]
_____
conv3_block5_2_relu (Activation (None, 28, 28, 128)  0           conv3_block5_2_bn[0][0]
_____
conv3_block5_3_conv (Conv2D)    (None, 28, 28, 512)  66048       conv3_block5_2_relu[0][0
]
_____
conv3_block5_out (Add)          (None, 28, 28, 512)  0           conv3_block4_out[0][0]
                                                                 conv3_block5_3_conv[0]
[0]
_____
conv3_block6_preact_bn (BatchNo (None, 28, 28, 512)  2048        conv3_block5_out[0][0]
_____
conv3_block6_preact_relu (Activ (None, 28, 28, 512)  0           conv3_block6_preact_bn[0
][0]
_____
conv3_block6_1_conv (Conv2D)    (None, 28, 28, 128)  65536       conv3_block6_preact_relu
[0][0]
```

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_____
conv3_block6_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block6_1_conv[0][0
]
_____
conv3_block6_1_relu (Activation (None, 28, 28, 128)  0           conv3_block6_1_bn[0][0]
_____
conv3_block6_2_pad (ZeroPadding (None, 30, 30, 128)  0           conv3_block6_1_relu[0][0
]
_____
conv3_block6_2_conv (Conv2D)    (None, 28, 28, 128)  147456      conv3_block6_2_pad[0][0]
_____
conv3_block6_2_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block6_2_conv[0][0
]
_____
conv3_block6_2_relu (Activation (None, 28, 28, 128)  0           conv3_block6_2_bn[0][0]
_____
conv3_block6_3_conv (Conv2D)    (None, 28, 28, 512)  66048       conv3_block6_2_relu[0][0
]
_____
conv3_block6_out (Add)          (None, 28, 28, 512)  0           conv3_block5_out[0][0]

                                                                 conv3_block6_3_conv[0]
[0]
_____
conv3_block7_preact_bn (BatchNo (None, 28, 28, 512)  2048        conv3_block6_out[0][0]
_____
conv3_block7_preact_relu (Activ (None, 28, 28, 512)  0           conv3_block7_preact_bn[0
][0]
_____
conv3_block7_1_conv (Conv2D)    (None, 28, 28, 128)  65536       conv3_block7_preact_relu
[0][0]
_____
conv3_block7_1_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block7_1_conv[0][0
]
_____
conv3_block7_1_relu (Activation (None, 28, 28, 128)  0           conv3_block7_1_bn[0][0]
_____
conv3_block7_2_pad (ZeroPadding (None, 30, 30, 128)  0           conv3_block7_1_relu[0][0
]
_____
conv3_block7_2_conv (Conv2D)    (None, 28, 28, 128)  147456      conv3_block7_2_pad[0][0]
_____
conv3_block7_2_bn (BatchNormali (None, 28, 28, 128)  512         conv3_block7_2_conv[0][0
]
_____
conv3_block7_2_relu (Activation (None, 28, 28, 128)  0           conv3_block7_2_bn[0][0]
_____
conv3_block7_3_conv (Conv2D)    (None, 28, 28, 512)  66048       conv3_block7_2_relu[0][0
```

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]                                                                  _       _  _   _  _ _

_____

conv3_block7_out (Add)          (None, 28, 28, 512)   0          conv3_block6_out[0][0]

                                                                 conv3_block7_3_conv[0]
[0]
_____

conv3_block8_preact_bn (BatchNo (None, 28, 28, 512)   2048       conv3_block7_out[0][0]
_____

conv3_block8_preact_relu (Activ (None, 28, 28, 512)   0          conv3_block8_preact_bn[0
][0]
_____

conv3_block8_1_conv (Conv2D)    (None, 28, 28, 128)   65536      conv3_block8_preact_relu
[0][0]
_____

conv3_block8_1_bn (BatchNormali (None, 28, 28, 128)   512        conv3_block8_1_conv[0][0
]
_____

conv3_block8_1_relu (Activation (None, 28, 28, 128)   0          conv3_block8_1_bn[0][0]
_____

conv3_block8_2_pad (ZeroPadding (None, 30, 30, 128)   0          conv3_block8_1_relu[0][0
]
_____

conv3_block8_2_conv (Conv2D)    (None, 14, 14, 128)   147456     conv3_block8_2_pad[0][0]
_____

conv3_block8_2_bn (BatchNormali (None, 14, 14, 128)   512        conv3_block8_2_conv[0][0
]
_____

conv3_block8_2_relu (Activation (None, 14, 14, 128)   0          conv3_block8_2_bn[0][0]
_____

max_pooling2d_1 (MaxPooling2D)  (None, 14, 14, 512)   0          conv3_block7_out[0][0]
_____

conv3_block8_3_conv (Conv2D)    (None, 14, 14, 512)   66048      conv3_block8_2_relu[0][0
]
_____

conv3_block8_out (Add)          (None, 14, 14, 512)   0          max_pooling2d_1[0][0]

                                                                 conv3_block8_3_conv[0]
[0]
_____

conv4_block1_preact_bn (BatchNo (None, 14, 14, 512)   2048       conv3_block8_out[0][0]
_____

conv4_block1_preact_relu (Activ (None, 14, 14, 512)   0          conv4_block1_preact_bn[0
][0]
_____

conv4_block1_1_conv (Conv2D)    (None, 14, 14, 256)   131072     conv4_block1_preact_relu
[0][0]
_____

conv4_block1_1_bn (BatchNormali (None, 14, 14, 256)   1024       conv4_block1_1_conv[0][0
```

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]
_____
conv4_block1_1_relu (Activation (None, 14, 14, 256)  0           conv4_block1_1_bn[0][0]
_____
conv4_block1_2_pad (ZeroPadding (None, 16, 16, 256)  0           conv4_block1_1_relu[0][0
]
_____
conv4_block1_2_conv (Conv2D)    (None, 14, 14, 256)  589824      conv4_block1_2_pad[0][0]
_____
conv4_block1_2_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block1_2_conv[0][0
]
_____
conv4_block1_2_relu (Activation (None, 14, 14, 256)  0           conv4_block1_2_bn[0][0]
_____
conv4_block1_0_conv (Conv2D)    (None, 14, 14, 1024) 525312      conv4_block1_preact_relu
[0][0]
_____
conv4_block1_3_conv (Conv2D)    (None, 14, 14, 1024) 263168      conv4_block1_2_relu[0][0
]
_____
conv4_block1_out (Add)          (None, 14, 14, 1024) 0           conv4_block1_0_conv[0][
0]
                                                                 conv4_block1_3_conv[0]
[0]
_____
conv4_block2_preact_bn (BatchNo (None, 14, 14, 1024) 4096        conv4_block1_out[0][0]
_____
conv4_block2_preact_relu (Activ (None, 14, 14, 1024) 0           conv4_block2_preact_bn[0
][0]
_____
conv4_block2_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block2_preact_relu
[0][0]
_____
conv4_block2_1_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block2_1_conv[0][0
]
_____
conv4_block2_1_relu (Activation (None, 14, 14, 256)  0           conv4_block2_1_bn[0][0]
_____
conv4_block2_2_pad (ZeroPadding (None, 16, 16, 256)  0           conv4_block2_1_relu[0][0
]
_____
conv4_block2_2_conv (Conv2D)    (None, 14, 14, 256)  589824      conv4_block2_2_pad[0][0]
_____
conv4_block2_2_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block2_2_conv[0][0
]
_____
conv4_block2_2_relu (Activation (None, 14, 14, 256)  0           conv4_block2_2_bn[0][0]
```

```
_____
conv4_block2_3_conv (Conv2D)      (None, 14, 14, 1024) 263168    conv4_block2_2_relu[0][0
]
_____
conv4_block2_out (Add)            (None, 14, 14, 1024) 0         conv4_block1_out[0][0]

                                                                conv4_block2_3_conv[0]
[0]
_____
conv4_block3_preact_bn (BatchNo   (None, 14, 14, 1024) 4096      conv4_block2_out[0][0]

_____
conv4_block3_preact_relu (Activ   (None, 14, 14, 1024) 0         conv4_block3_preact_bn[0
][0]
_____
conv4_block3_1_conv (Conv2D)      (None, 14, 14, 256)  262144    conv4_block3_preact_relu
[0][0]
_____
conv4_block3_1_bn (BatchNormali   (None, 14, 14, 256)  1024      conv4_block3_1_conv[0][0
]
_____
conv4_block3_1_relu (Activation   (None, 14, 14, 256)  0         conv4_block3_1_bn[0][0]

_____
conv4_block3_2_pad (ZeroPadding   (None, 16, 16, 256)  0         conv4_block3_1_relu[0][0
]
_____
conv4_block3_2_conv (Conv2D)      (None, 14, 14, 256)  589824    conv4_block3_2_pad[0][0]

_____
conv4_block3_2_bn (BatchNormali   (None, 14, 14, 256)  1024      conv4_block3_2_conv[0][0
]
_____
conv4_block3_2_relu (Activation   (None, 14, 14, 256)  0         conv4_block3_2_bn[0][0]

_____
conv4_block3_3_conv (Conv2D)      (None, 14, 14, 1024) 263168    conv4_block3_2_relu[0][0
]
_____
conv4_block3_out (Add)            (None, 14, 14, 1024) 0         conv4_block2_out[0][0]

                                                                conv4_block3_3_conv[0]
[0]
_____
conv4_block4_preact_bn (BatchNo   (None, 14, 14, 1024) 4096      conv4_block3_out[0][0]

_____
conv4_block4_preact_relu (Activ   (None, 14, 14, 1024) 0         conv4_block4_preact_bn[0
][0]
_____
conv4_block4_1_conv (Conv2D)      (None, 14, 14, 256)  262144    conv4_block4_preact_relu
[0][0]
_____
conv4_block4_1_bn (BatchNormali   (None, 14, 14, 256)  1024      conv4_block4_1_conv[0][0
]
```

```
_____
conv4_block4_1_relu (Activation  (None, 14, 14, 256)   0           conv4_block4_1_bn[0][0]

_____
_____
conv4_block4_2_pad (ZeroPadding  (None, 16, 16, 256)   0           conv4_block4_1_relu[0][0
]
_____
_____
conv4_block4_2_conv (Conv2D)     (None, 14, 14, 256)   589824      conv4_block4_2_pad[0][0]

_____
_____
conv4_block4_2_bn (BatchNormali  (None, 14, 14, 256)   1024        conv4_block4_2_conv[0][0
]
_____
_____
conv4_block4_2_relu (Activation  (None, 14, 14, 256)   0           conv4_block4_2_bn[0][0]

_____
_____
conv4_block4_3_conv (Conv2D)     (None, 14, 14, 1024)  263168      conv4_block4_2_relu[0][0
]
_____
_____
conv4_block4_out (Add)           (None, 14, 14, 1024)  0           conv4_block3_out[0][0]

                                                                   conv4_block4_3_conv[0]
[0]
_____
_____
conv4_block5_preact_bn (BatchNo  (None, 14, 14, 1024)  4096        conv4_block4_out[0][0]

_____
_____
conv4_block5_preact_relu (Activ  (None, 14, 14, 1024)  0           conv4_block5_preact_bn[0
][0]
_____
_____
conv4_block5_1_conv (Conv2D)     (None, 14, 14, 256)   262144      conv4_block5_preact_relu
[0][0]
_____
_____
conv4_block5_1_bn (BatchNormali  (None, 14, 14, 256)   1024        conv4_block5_1_conv[0][0
]
_____
_____
conv4_block5_1_relu (Activation  (None, 14, 14, 256)   0           conv4_block5_1_bn[0][0]

_____
_____
conv4_block5_2_pad (ZeroPadding  (None, 16, 16, 256)   0           conv4_block5_1_relu[0][0
]
_____
_____
conv4_block5_2_conv (Conv2D)     (None, 14, 14, 256)   589824      conv4_block5_2_pad[0][0]

_____
_____
conv4_block5_2_bn (BatchNormali  (None, 14, 14, 256)   1024        conv4_block5_2_conv[0][0
]
_____
_____
conv4_block5_2_relu (Activation  (None, 14, 14, 256)   0           conv4_block5_2_bn[0][0]

_____
_____
conv4_block5_3_conv (Conv2D)     (None, 14, 14, 1024)  263168      conv4_block5_2_relu[0][0
]
_____
_____
conv4_block5_out (Add)           (None, 14, 14, 1024)  0           conv4_block4_out[0][0]
```

```
                                                    conv4_block5_3_conv[0]
[0]
_____
conv4_block6_preact_bn (BatchNo (None, 14, 14, 1024) 4096        conv4_block5_out[0][0]

_____
conv4_block6_preact_relu (Activ (None, 14, 14, 1024) 0           conv4_block6_preact_bn[0
][0]
_____
conv4_block6_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block6_preact_relu
[0][0]
_____
conv4_block6_1_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block6_1_conv[0][0
]
_____
conv4_block6_1_relu (Activation (None, 14, 14, 256)  0           conv4_block6_1_bn[0][0]

_____
conv4_block6_2_pad (ZeroPadding (None, 16, 16, 256)  0           conv4_block6_1_relu[0][0
]
_____
conv4_block6_2_conv (Conv2D)    (None, 14, 14, 256)  589824      conv4_block6_2_pad[0][0]

_____
conv4_block6_2_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block6_2_conv[0][0
]
_____
conv4_block6_2_relu (Activation (None, 14, 14, 256)  0           conv4_block6_2_bn[0][0]

_____
conv4_block6_3_conv (Conv2D)    (None, 14, 14, 1024) 263168      conv4_block6_2_relu[0][0
]
_____
conv4_block6_out (Add)          (None, 14, 14, 1024) 0           conv4_block5_out[0][0]

                                                                 conv4_block6_3_conv[0]
[0]
_____
conv4_block7_preact_bn (BatchNo (None, 14, 14, 1024) 4096        conv4_block6_out[0][0]

_____
conv4_block7_preact_relu (Activ (None, 14, 14, 1024) 0           conv4_block7_preact_bn[0
][0]
_____
conv4_block7_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block7_preact_relu
[0][0]
_____
conv4_block7_1_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block7_1_conv[0][0
]
_____
conv4_block7_1_relu (Activation (None, 14, 14, 256)  0           conv4_block7_1_bn[0][0]

_____
conv4_block7_2_pad (ZeroPadding (None, 16, 16, 256)  0           conv4_block7_1_relu[0][0
```

```
_____
]
_____
_____
conv4_block7_2_conv (Conv2D)     (None, 14, 14, 256)  589824    conv4_block7_2_pad[0][0]
_____
_____
conv4_block7_2_bn (BatchNormali  (None, 14, 14, 256)  1024      conv4_block7_2_conv[0][0
]
_____
_____
conv4_block7_2_relu (Activation  (None, 14, 14, 256)  0         conv4_block7_2_bn[0][0]
_____
_____
conv4_block7_3_conv (Conv2D)     (None, 14, 14, 1024) 263168    conv4_block7_2_relu[0][0
]
_____
_____
conv4_block7_out (Add)           (None, 14, 14, 1024) 0         conv4_block6_out[0][0]

                                                                conv4_block7_3_conv[0]
[0]
_____
_____
conv4_block8_preact_bn (BatchNo  (None, 14, 14, 1024) 4096      conv4_block7_out[0][0]
_____
_____
conv4_block8_preact_relu (Activ  (None, 14, 14, 1024) 0         conv4_block8_preact_bn[0
][0]
_____
_____
conv4_block8_1_conv (Conv2D)     (None, 14, 14, 256)  262144    conv4_block8_preact_relu
[0][0]
_____
_____
conv4_block8_1_bn (BatchNormali  (None, 14, 14, 256)  1024      conv4_block8_1_conv[0][0
]
_____
_____
conv4_block8_1_relu (Activation  (None, 14, 14, 256)  0         conv4_block8_1_bn[0][0]
_____
_____
conv4_block8_2_pad (ZeroPadding  (None, 16, 16, 256)  0         conv4_block8_1_relu[0][0
]
_____
_____
conv4_block8_2_conv (Conv2D)     (None, 14, 14, 256)  589824    conv4_block8_2_pad[0][0]
_____
_____
conv4_block8_2_bn (BatchNormali  (None, 14, 14, 256)  1024      conv4_block8_2_conv[0][0
]
_____
_____
conv4_block8_2_relu (Activation  (None, 14, 14, 256)  0         conv4_block8_2_bn[0][0]
_____
_____
conv4_block8_3_conv (Conv2D)     (None, 14, 14, 1024) 263168    conv4_block8_2_relu[0][0
]
_____
_____
conv4_block8_out (Add)           (None, 14, 14, 1024) 0         conv4_block7_out[0][0]

                                                                conv4_block8_3_conv[0]
[0]
_____
_____
conv4_block9_preact_bn (BatchNo  (None, 14, 14, 1024) 4096      conv4_block8_out[0][0]
```

```
_____
conv4_block9_preact_relu (Activ (None, 14, 14, 1024) 0           conv4_block9_preact_bn[0
][0]
_____
conv4_block9_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block9_preact_relu
[0][0]
_____
conv4_block9_1_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block9_1_conv[0][0
]
_____
conv4_block9_1_relu (Activation (None, 14, 14, 256)  0           conv4_block9_1_bn[0][0]
_____
conv4_block9_2_pad (ZeroPadding (None, 16, 16, 256)  0           conv4_block9_1_relu[0][0
]
_____
conv4_block9_2_conv (Conv2D)    (None, 14, 14, 256)  589824      conv4_block9_2_pad[0][0]
_____
conv4_block9_2_bn (BatchNormali (None, 14, 14, 256)  1024        conv4_block9_2_conv[0][0
]
_____
conv4_block9_2_relu (Activation (None, 14, 14, 256)  0           conv4_block9_2_bn[0][0]
_____
conv4_block9_3_conv (Conv2D)    (None, 14, 14, 1024) 263168      conv4_block9_2_relu[0][0
]
_____
conv4_block9_out (Add)          (None, 14, 14, 1024) 0           conv4_block8_out[0][0]

                                                                 conv4_block9_3_conv[0]
[0]
_____
conv4_block10_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block9_out[0][0]
_____
conv4_block10_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block10_preact_bn[
0][0]
_____
conv4_block10_1_conv (Conv2D)   (None, 14, 14, 256)  262144      conv4_block10_preact_rel
u[0][0]
_____
conv4_block10_1_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block10_1_conv[0][
0]
_____
conv4_block10_1_relu (Activatio (None, 14, 14, 256)  0           conv4_block10_1_bn[0][0]
_____
conv4_block10_2_pad (ZeroPaddin (None, 16, 16, 256)  0           conv4_block10_1_relu[0][
0]
_____
conv4_block10_2_conv (Conv2D)   (None, 14, 14, 256)  589824      conv4_block10_2_pad[0][0
]
```

```
_____
conv4_block10_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block10_2_conv[0][
0]
_____
conv4_block10_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block10_2_bn[0][0]
_____
conv4_block10_3_conv (Conv2D)   (None, 14, 14, 1024) 263168       conv4_block10_2_relu[0][
0]
_____
conv4_block10_out (Add)         (None, 14, 14, 1024) 0            conv4_block9_out[0][0]

                                                                  conv4_block10_3_conv[0
][0]
_____
conv4_block11_preact_bn (BatchN (None, 14, 14, 1024) 4096         conv4_block10_out[0][0]
_____
conv4_block11_preact_relu (Acti (None, 14, 14, 1024) 0            conv4_block11_preact_bn[
0][0]
_____
conv4_block11_1_conv (Conv2D)   (None, 14, 14, 256)   262144      conv4_block11_preact_rel
u[0][0]
_____
conv4_block11_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block11_1_conv[0][
0]
_____
conv4_block11_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block11_1_bn[0][0]
_____
conv4_block11_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block11_1_relu[0][
0]
_____
conv4_block11_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block11_2_pad[0][0
]
_____
conv4_block11_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block11_2_conv[0][
0]
_____
conv4_block11_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block11_2_bn[0][0]
_____
conv4_block11_3_conv (Conv2D)   (None, 14, 14, 1024) 263168       conv4_block11_2_relu[0][
0]
_____
conv4_block11_out (Add)         (None, 14, 14, 1024) 0            conv4_block10_out[0][0]

                                                                  conv4_block11_3_conv[0
][0]
_____
conv4_block12_preact_bn (BatchN (None, 14, 14, 1024) 4096         conv4_block11_out[0][0]
_____
conv4_block12_preact_relu (Acti (None, 14, 14, 1024) 0            conv4_block12_preact_bn[
0][0]
```

```
_____
conv4_block12_1_conv (Conv2D)    (None, 14, 14, 256) 262144    conv4_block12_preact_rel
u[0][0]
_____
conv4_block12_1_bn (BatchNormal (None, 14, 14, 256) 1024      conv4_block12_1_conv[0][
0]
_____
conv4_block12_1_relu (Activatio (None, 14, 14, 256) 0        conv4_block12_1_bn[0][0]

_____
conv4_block12_2_pad (ZeroPaddin (None, 16, 16, 256) 0        conv4_block12_1_relu[0][
0]
_____
conv4_block12_2_conv (Conv2D)    (None, 14, 14, 256) 589824    conv4_block12_2_pad[0][0
]
_____
conv4_block12_2_bn (BatchNormal (None, 14, 14, 256) 1024      conv4_block12_2_conv[0][
0]
_____
conv4_block12_2_relu (Activatio (None, 14, 14, 256) 0        conv4_block12_2_bn[0][0]

_____
conv4_block12_3_conv (Conv2D)    (None, 14, 14, 1024) 263168    conv4_block12_2_relu[0][
0]
_____
conv4_block12_out (Add)          (None, 14, 14, 1024) 0        conv4_block11_out[0][0]

                                                              conv4_block12_3_conv[0
][0]
_____
conv4_block13_preact_bn (BatchN (None, 14, 14, 1024) 4096      conv4_block12_out[0][0]

_____
conv4_block13_preact_relu (Acti (None, 14, 14, 1024) 0        conv4_block13_preact_bn[
0][0]
_____
conv4_block13_1_conv (Conv2D)    (None, 14, 14, 256) 262144    conv4_block13_preact_rel
u[0][0]
_____
conv4_block13_1_bn (BatchNormal (None, 14, 14, 256) 1024      conv4_block13_1_conv[0][
0]
_____
conv4_block13_1_relu (Activatio (None, 14, 14, 256) 0        conv4_block13_1_bn[0][0]

_____
conv4_block13_2_pad (ZeroPaddin (None, 16, 16, 256) 0        conv4_block13_1_relu[0][
0]
_____
conv4_block13_2_conv (Conv2D)    (None, 14, 14, 256) 589824    conv4_block13_2_pad[0][0
]
_____
conv4_block13_2_bn (BatchNormal (None, 14, 14, 256) 1024      conv4_block13_2_conv[0][
0]
_____
conv4_block13_2_relu (Activatio (None, 14, 14, 256) 0        conv4_block13_2_bn[0][0]
```

```
_____
conv4_block13_3_conv (Conv2D)    (None, 14, 14, 1024) 263168      conv4_block13_2_relu[0][
0]
_____
conv4_block13_out (Add)          (None, 14, 14, 1024) 0           conv4_block12_out[0][0]

                                                                 conv4_block13_3_conv[0
][0]
_____
conv4_block14_preact_bn (BatchN  (None, 14, 14, 1024) 4096        conv4_block13_out[0][0]

_____
conv4_block14_preact_relu (Acti  (None, 14, 14, 1024) 0           conv4_block14_preact_bn[
0][0]
_____
conv4_block14_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block14_preact_rel
u[0][0]
_____
conv4_block14_1_bn (BatchNormal  (None, 14, 14, 256)  1024        conv4_block14_1_conv[0][
0]
_____
conv4_block14_1_relu (Activatio  (None, 14, 14, 256)  0           conv4_block14_1_bn[0][0]

_____
conv4_block14_2_pad (ZeroPaddin  (None, 16, 16, 256)  0           conv4_block14_1_relu[0][
0]
_____
conv4_block14_2_conv (Conv2D)    (None, 14, 14, 256)  589824      conv4_block14_2_pad[0][0
]
_____
conv4_block14_2_bn (BatchNormal  (None, 14, 14, 256)  1024        conv4_block14_2_conv[0][
0]
_____
conv4_block14_2_relu (Activatio  (None, 14, 14, 256)  0           conv4_block14_2_bn[0][0]

_____
conv4_block14_3_conv (Conv2D)    (None, 14, 14, 1024) 263168      conv4_block14_2_relu[0][
0]
_____
conv4_block14_out (Add)          (None, 14, 14, 1024) 0           conv4_block13_out[0][0]

                                                                 conv4_block14_3_conv[0
][0]
_____
conv4_block15_preact_bn (BatchN  (None, 14, 14, 1024) 4096        conv4_block14_out[0][0]

_____
conv4_block15_preact_relu (Acti  (None, 14, 14, 1024) 0           conv4_block15_preact_bn[
0][0]
_____
conv4_block15_1_conv (Conv2D)    (None, 14, 14, 256)  262144      conv4_block15_preact_rel
u[0][0]
_____
conv4_block15_1_bn (BatchNormal  (None, 14, 14, 256)  1024        conv4_block15_1_conv[0][
```

```
0]
_____
conv4_block15_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block15_1_bn[0][0]
_____
conv4_block15_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block15_1_relu[0][
0]
_____
conv4_block15_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block15_2_pad[0][0
]
_____
conv4_block15_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block15_2_conv[0][
0]
_____
conv4_block15_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block15_2_bn[0][0]
_____
conv4_block15_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block15_2_relu[0][
0]
_____
conv4_block15_out (Add)         (None, 14, 14, 1024)  0           conv4_block14_out[0][0]

                                                                  conv4_block15_3_conv[0
][0]
_____
conv4_block16_preact_bn (BatchN (None, 14, 14, 1024)  4096        conv4_block15_out[0][0]
_____
conv4_block16_preact_relu (Acti (None, 14, 14, 1024)  0           conv4_block16_preact_bn[
0][0]
_____
conv4_block16_1_conv (Conv2D)   (None, 14, 14, 256)   262144      conv4_block16_preact_rel
u[0][0]
_____
conv4_block16_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block16_1_conv[0][
0]
_____
conv4_block16_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block16_1_bn[0][0]
_____
conv4_block16_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block16_1_relu[0][
0]
_____
conv4_block16_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block16_2_pad[0][0
]
_____
conv4_block16_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block16_2_conv[0][
0]
_____
conv4_block16_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block16_2_bn[0][0]
_____
conv4_block16_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block16_2_relu[0][
0]
```

```
_____
conv4_block16_out (Add)         (None, 14, 14, 1024) 0          conv4_block15_out[0][0]

                                                                conv4_block16_3_conv[0
][0]
_____
conv4_block17_preact_bn (BatchN (None, 14, 14, 1024) 4096       conv4_block16_out[0][0]

_____
conv4_block17_preact_relu (Acti (None, 14, 14, 1024) 0          conv4_block17_preact_bn[
0][0]
_____
conv4_block17_1_conv (Conv2D)   (None, 14, 14, 256)  262144     conv4_block17_preact_rel
u[0][0]
_____
conv4_block17_1_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block17_1_conv[0][
0]
_____
conv4_block17_1_relu (Activatio (None, 14, 14, 256)  0          conv4_block17_1_bn[0][0]

_____
conv4_block17_2_pad (ZeroPaddin (None, 16, 16, 256)  0          conv4_block17_1_relu[0][
0]
_____
conv4_block17_2_conv (Conv2D)   (None, 14, 14, 256)  589824     conv4_block17_2_pad[0][0
]
_____
conv4_block17_2_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block17_2_conv[0][
0]
_____
conv4_block17_2_relu (Activatio (None, 14, 14, 256)  0          conv4_block17_2_bn[0][0]

_____
conv4_block17_3_conv (Conv2D)   (None, 14, 14, 1024) 263168     conv4_block17_2_relu[0][
0]
_____
conv4_block17_out (Add)         (None, 14, 14, 1024) 0          conv4_block16_out[0][0]

                                                                conv4_block17_3_conv[0
][0]
_____
conv4_block18_preact_bn (BatchN (None, 14, 14, 1024) 4096       conv4_block17_out[0][0]

_____
conv4_block18_preact_relu (Acti (None, 14, 14, 1024) 0          conv4_block18_preact_bn[
0][0]
_____
conv4_block18_1_conv (Conv2D)   (None, 14, 14, 256)  262144     conv4_block18_preact_rel
u[0][0]
_____
conv4_block18_1_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block18_1_conv[0][
0]
_____
conv4_block18_1_relu (Activatio (None, 14, 14, 256)  0          conv4_block18_1_bn[0][0]
```

```
_____
conv4_block18_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block18_1_relu[0][
0]
_____
conv4_block18_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block18_2_pad[0][0
]
_____
conv4_block18_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block18_2_conv[0][
0]
_____
conv4_block18_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block18_2_bn[0][0]
_____
conv4_block18_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block18_2_relu[0][
0]
_____
conv4_block18_out (Add)         (None, 14, 14, 1024)  0           conv4_block17_out[0][0]

                                                                  conv4_block18_3_conv[0
][0]
_____
conv4_block19_preact_bn (BatchN (None, 14, 14, 1024)  4096        conv4_block18_out[0][0]
_____
conv4_block19_preact_relu (Acti (None, 14, 14, 1024)  0           conv4_block19_preact_bn[
0][0]
_____
conv4_block19_1_conv (Conv2D)   (None, 14, 14, 256)   262144      conv4_block19_preact_rel
u[0][0]
_____
conv4_block19_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block19_1_conv[0][
0]
_____
conv4_block19_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block19_1_bn[0][0]
_____
conv4_block19_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block19_1_relu[0][
0]
_____
conv4_block19_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block19_2_pad[0][0
]
_____
conv4_block19_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block19_2_conv[0][
0]
_____
conv4_block19_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block19_2_bn[0][0]
_____
conv4_block19_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block19_2_relu[0][
0]
_____
conv4_block19_out (Add)         (None, 14, 14, 1024)  0           conv4_block18_out[0][0]

                                                                  conv4_block19_3_conv[0
][0]
```

```
_____
conv4_block20_preact_bn (BatchN  (None, 14, 14, 1024)  4096      conv4_block19_out[0][0]
_____
conv4_block20_preact_relu (Acti  (None, 14, 14, 1024)  0         conv4_block20_preact_bn[
0][0]
_____
conv4_block20_1_conv (Conv2D)    (None, 14, 14, 256)   262144    conv4_block20_preact_rel
u[0][0]
_____
conv4_block20_1_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block20_1_conv[0][
0]
_____
conv4_block20_1_relu (Activatio  (None, 14, 14, 256)   0         conv4_block20_1_bn[0][0]
_____
conv4_block20_2_pad (ZeroPaddin  (None, 16, 16, 256)   0         conv4_block20_1_relu[0][
0]
_____
conv4_block20_2_conv (Conv2D)    (None, 14, 14, 256)   589824    conv4_block20_2_pad[0][0
]
_____
conv4_block20_2_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block20_2_conv[0][
0]
_____
conv4_block20_2_relu (Activatio  (None, 14, 14, 256)   0         conv4_block20_2_bn[0][0]
_____
conv4_block20_3_conv (Conv2D)    (None, 14, 14, 1024)  263168    conv4_block20_2_relu[0][
0]
_____
conv4_block20_out (Add)          (None, 14, 14, 1024)  0         conv4_block19_out[0][0]

                                                                 conv4_block20_3_conv[0
][0]
_____
conv4_block21_preact_bn (BatchN  (None, 14, 14, 1024)  4096      conv4_block20_out[0][0]
_____
conv4_block21_preact_relu (Acti  (None, 14, 14, 1024)  0         conv4_block21_preact_bn[
0][0]
_____
conv4_block21_1_conv (Conv2D)    (None, 14, 14, 256)   262144    conv4_block21_preact_rel
u[0][0]
_____
conv4_block21_1_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block21_1_conv[0][
0]
_____
conv4_block21_1_relu (Activatio  (None, 14, 14, 256)   0         conv4_block21_1_bn[0][0]
_____
conv4_block21_2_pad (ZeroPaddin  (None, 16, 16, 256)   0         conv4_block21_1_relu[0][
0]
_____
conv4_block21_2_conv (Conv2D)    (None, 14, 14, 256)   589824    conv4_block21_2_pad[0][0
```

```
]
_____
conv4_block21_2_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block21_2_conv[0][
0]
_____
conv4_block21_2_relu (Activatio (None, 14, 14, 256)  0           conv4_block21_2_bn[0][0]
_____
conv4_block21_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block21_2_relu[0][
0]
_____
conv4_block21_out (Add)         (None, 14, 14, 1024) 0           conv4_block20_out[0][0]

                                                                 conv4_block21_3_conv[0
][0]
_____
conv4_block22_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block21_out[0][0]

_____
conv4_block22_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block22_preact_bn[
0][0]
_____
conv4_block22_1_conv (Conv2D)   (None, 14, 14, 256)  262144      conv4_block22_preact_rel
u[0][0]
_____
conv4_block22_1_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block22_1_conv[0][
0]
_____
conv4_block22_1_relu (Activatio (None, 14, 14, 256)  0           conv4_block22_1_bn[0][0]
_____
conv4_block22_2_pad (ZeroPaddin (None, 16, 16, 256)  0           conv4_block22_1_relu[0][
0]
_____
conv4_block22_2_conv (Conv2D)   (None, 14, 14, 256)  589824      conv4_block22_2_pad[0][0
]
_____
conv4_block22_2_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block22_2_conv[0][
0]
_____
conv4_block22_2_relu (Activatio (None, 14, 14, 256)  0           conv4_block22_2_bn[0][0]

_____
conv4_block22_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block22_2_relu[0][
0]
_____
conv4_block22_out (Add)         (None, 14, 14, 1024) 0           conv4_block21_out[0][0]

                                                                 conv4_block22_3_conv[0
][0]
_____
conv4_block23_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block22_out[0][0]

_____
conv4_block23_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block23_preact_bn[
```

```
                                                                            ___  __  __  _
0][0]
_____
_____
conv4_block23_1_conv (Conv2D)    (None, 14, 14, 256)   262144    conv4_block23_preact_rel
u[0][0]
_____
_____
conv4_block23_1_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block23_1_conv[0][
0]
_____
_____
conv4_block23_1_relu (Activatio  (None, 14, 14, 256)   0         conv4_block23_1_bn[0][0]

_____
_____
conv4_block23_2_pad (ZeroPaddin  (None, 16, 16, 256)   0         conv4_block23_1_relu[0][
0]
_____
_____
conv4_block23_2_conv (Conv2D)    (None, 14, 14, 256)   589824    conv4_block23_2_pad[0][0
]
_____
_____
conv4_block23_2_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block23_2_conv[0][
0]
_____
_____
conv4_block23_2_relu (Activatio  (None, 14, 14, 256)   0         conv4_block23_2_bn[0][0]

_____
_____
conv4_block23_3_conv (Conv2D)    (None, 14, 14, 1024)  263168    conv4_block23_2_relu[0][
0]
_____
_____
conv4_block23_out (Add)          (None, 14, 14, 1024)  0         conv4_block22_out[0][0]

                                                                 conv4_block23_3_conv[0
][0]
_____
_____
conv4_block24_preact_bn (BatchN  (None, 14, 14, 1024)  4096      conv4_block23_out[0][0]

_____
_____
conv4_block24_preact_relu (Acti  (None, 14, 14, 1024)  0         conv4_block24_preact_bn[
0][0]
_____
_____
conv4_block24_1_conv (Conv2D)    (None, 14, 14, 256)   262144    conv4_block24_preact_rel
u[0][0]
_____
_____
conv4_block24_1_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block24_1_conv[0][
0]
_____
_____
conv4_block24_1_relu (Activatio  (None, 14, 14, 256)   0         conv4_block24_1_bn[0][0]

_____
_____
conv4_block24_2_pad (ZeroPaddin  (None, 16, 16, 256)   0         conv4_block24_1_relu[0][
0]
_____
_____
conv4_block24_2_conv (Conv2D)    (None, 14, 14, 256)   589824    conv4_block24_2_pad[0][0
]
_____
_____
conv4_block24_2_bn (BatchNormal  (None, 14, 14, 256)   1024      conv4_block24_2_conv[0][
0]
```

```
conv4_block24_2_relu (Activatio (None, 14, 14, 256)   0          conv4_block24_2_bn[0][0]
_____
conv4_block24_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block24_2_relu[0][
0]
_____
conv4_block24_out (Add)         (None, 14, 14, 1024) 0           conv4_block23_out[0][0]

                                                                 conv4_block24_3_conv[0
][0]
_____
conv4_block25_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block24_out[0][0]

_____
conv4_block25_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block25_preact_bn[
0][0]
_____
conv4_block25_1_conv (Conv2D)   (None, 14, 14, 256)   262144     conv4_block25_preact_rel
u[0][0]
_____
conv4_block25_1_bn (BatchNormal (None, 14, 14, 256)   1024       conv4_block25_1_conv[0][
0]
_____
conv4_block25_1_relu (Activatio (None, 14, 14, 256)   0          conv4_block25_1_bn[0][0]

_____
conv4_block25_2_pad (ZeroPaddin (None, 16, 16, 256)   0          conv4_block25_1_relu[0][
0]
_____
conv4_block25_2_conv (Conv2D)   (None, 14, 14, 256)   589824     conv4_block25_2_pad[0][0
]
_____
conv4_block25_2_bn (BatchNormal (None, 14, 14, 256)   1024       conv4_block25_2_conv[0][
0]
_____
conv4_block25_2_relu (Activatio (None, 14, 14, 256)   0          conv4_block25_2_bn[0][0]

_____
conv4_block25_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block25_2_relu[0][
0]
_____
conv4_block25_out (Add)         (None, 14, 14, 1024) 0           conv4_block24_out[0][0]

                                                                 conv4_block25_3_conv[0
][0]
_____
conv4_block26_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block25_out[0][0]

_____
conv4_block26_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block26_preact_bn[
0][0]
_____
conv4_block26_1_conv (Conv2D)   (None, 14, 14, 256)   262144     conv4_block26_preact_rel
u[0][0]
```

```
_____
conv4_block26_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block26_1_conv[0][
0]
_____
conv4_block26_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block26_1_bn[0][0]
_____
conv4_block26_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block26_1_relu[0][
0]
_____
conv4_block26_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block26_2_pad[0][0
]
_____
conv4_block26_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block26_2_conv[0][
0]
_____
conv4_block26_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block26_2_bn[0][0]
_____
conv4_block26_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block26_2_relu[0][
0]
_____
conv4_block26_out (Add)         (None, 14, 14, 1024)  0           conv4_block25_out[0][0]

                                                                  conv4_block26_3_conv[0
][0]
_____
conv4_block27_preact_bn (BatchN (None, 14, 14, 1024)  4096        conv4_block26_out[0][0]
_____
conv4_block27_preact_relu (Acti (None, 14, 14, 1024)  0           conv4_block27_preact_bn[
0][0]
_____
conv4_block27_1_conv (Conv2D)   (None, 14, 14, 256)   262144      conv4_block27_preact_rel
u[0][0]
_____
conv4_block27_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block27_1_conv[0][
0]
_____
conv4_block27_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block27_1_bn[0][0]
_____
conv4_block27_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block27_1_relu[0][
0]
_____
conv4_block27_2_conv (Conv2D)   (None, 14, 14, 256)   589824      conv4_block27_2_pad[0][0
]
_____
conv4_block27_2_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block27_2_conv[0][
0]
_____
conv4_block27_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block27_2_bn[0][0]
_____
conv4_block27_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block27_2_relu[0][
```

```
_          _  _                                          _       _ _     ___
0]
_____
_____
conv4_block27_out (Add)          (None, 14, 14, 1024) 0          conv4_block26_out[0][0]

                                                                 conv4_block27_3_conv[0
][0]
_____
_____
conv4_block28_preact_bn (BatchN  (None, 14, 14, 1024) 4096       conv4_block27_out[0][0]

_____
_____
conv4_block28_preact_relu (Acti  (None, 14, 14, 1024) 0          conv4_block28_preact_bn[
0][0]
_____
_____
conv4_block28_1_conv (Conv2D)    (None, 14, 14, 256)  262144     conv4_block28_preact_rel
u[0][0]
_____
_____
conv4_block28_1_bn (BatchNormal  (None, 14, 14, 256)  1024       conv4_block28_1_conv[0][
0]
_____
_____
conv4_block28_1_relu (Activatio  (None, 14, 14, 256)  0          conv4_block28_1_bn[0][0]

_____
_____
conv4_block28_2_pad (ZeroPaddin  (None, 16, 16, 256)  0          conv4_block28_1_relu[0][
0]
_____
_____
conv4_block28_2_conv (Conv2D)    (None, 14, 14, 256)  589824     conv4_block28_2_pad[0][0
]
_____
_____
conv4_block28_2_bn (BatchNormal  (None, 14, 14, 256)  1024       conv4_block28_2_conv[0][
0]
_____
_____
conv4_block28_2_relu (Activatio  (None, 14, 14, 256)  0          conv4_block28_2_bn[0][0]

_____
_____
conv4_block28_3_conv (Conv2D)    (None, 14, 14, 1024) 263168     conv4_block28_2_relu[0][
0]
_____
_____
conv4_block28_out (Add)          (None, 14, 14, 1024) 0          conv4_block27_out[0][0]

                                                                 conv4_block28_3_conv[0
][0]
_____
_____
conv4_block29_preact_bn (BatchN  (None, 14, 14, 1024) 4096       conv4_block28_out[0][0]

_____
_____
conv4_block29_preact_relu (Acti  (None, 14, 14, 1024) 0          conv4_block29_preact_bn[
0][0]
_____
_____
conv4_block29_1_conv (Conv2D)    (None, 14, 14, 256)  262144     conv4_block29_preact_rel
u[0][0]
_____
_____
conv4_block29_1_bn (BatchNormal  (None, 14, 14, 256)  1024       conv4_block29_1_conv[0][
0]
_____
_____
conv4_block29_1_relu (Activatio  (None, 14, 14, 256)  0          conv4_block29_1_bn[0][0]
```

```
_____
conv4_block29_2_pad (ZeroPaddin (None, 16, 16, 256)  0           conv4_block29_1_relu[0][
0]
_____
conv4_block29_2_conv (Conv2D)   (None, 14, 14, 256)  589824      conv4_block29_2_pad[0][0
]
_____
conv4_block29_2_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block29_2_conv[0][
0]
_____
conv4_block29_2_relu (Activatio (None, 14, 14, 256)  0           conv4_block29_2_bn[0][0]
_____
conv4_block29_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block29_2_relu[0][
0]
_____
conv4_block29_out (Add)         (None, 14, 14, 1024) 0           conv4_block28_out[0][0]

                                                                 conv4_block29_3_conv[0
][0]
_____
conv4_block30_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block29_out[0][0]
_____
conv4_block30_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block30_preact_bn[
0][0]
_____
conv4_block30_1_conv (Conv2D)   (None, 14, 14, 256)  262144      conv4_block30_preact_rel
u[0][0]
_____
conv4_block30_1_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block30_1_conv[0][
0]
_____
conv4_block30_1_relu (Activatio (None, 14, 14, 256)  0           conv4_block30_1_bn[0][0]
_____
conv4_block30_2_pad (ZeroPaddin (None, 16, 16, 256)  0           conv4_block30_1_relu[0][
0]
_____
conv4_block30_2_conv (Conv2D)   (None, 14, 14, 256)  589824      conv4_block30_2_pad[0][0
]
_____
conv4_block30_2_bn (BatchNormal (None, 14, 14, 256)  1024        conv4_block30_2_conv[0][
0]
_____
conv4_block30_2_relu (Activatio (None, 14, 14, 256)  0           conv4_block30_2_bn[0][0]
_____
conv4_block30_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block30_2_relu[0][
0]
_____
conv4_block30_out (Add)         (None, 14, 14, 1024) 0           conv4_block29_out[0][0]

                                                                 conv4_block30_3_conv[0
```

```
                                                                      ][0]
_____
conv4_block31_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block30_out[0][0]

_____
conv4_block31_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block31_preact_bn[
0][0]
_____
conv4_block31_1_conv (Conv2D)   (None, 14, 14, 256) 262144       conv4_block31_preact_rel
u[0][0]
_____
conv4_block31_1_bn (BatchNormal (None, 14, 14, 256) 1024         conv4_block31_1_conv[0][
0]
_____
conv4_block31_1_relu (Activatio (None, 14, 14, 256) 0           conv4_block31_1_bn[0][0]

_____
conv4_block31_2_pad (ZeroPaddin (None, 16, 16, 256) 0           conv4_block31_1_relu[0][
0]
_____
conv4_block31_2_conv (Conv2D)   (None, 14, 14, 256) 589824       conv4_block31_2_pad[0][0
]
_____
conv4_block31_2_bn (BatchNormal (None, 14, 14, 256) 1024         conv4_block31_2_conv[0][
0]
_____
conv4_block31_2_relu (Activatio (None, 14, 14, 256) 0           conv4_block31_2_bn[0][0]

_____
conv4_block31_3_conv (Conv2D)   (None, 14, 14, 1024) 263168      conv4_block31_2_relu[0][
0]
_____
conv4_block31_out (Add)         (None, 14, 14, 1024) 0           conv4_block30_out[0][0]

                                                                 conv4_block31_3_conv[0
][0]
_____
conv4_block32_preact_bn (BatchN (None, 14, 14, 1024) 4096        conv4_block31_out[0][0]

_____
conv4_block32_preact_relu (Acti (None, 14, 14, 1024) 0           conv4_block32_preact_bn[
0][0]
_____
conv4_block32_1_conv (Conv2D)   (None, 14, 14, 256) 262144       conv4_block32_preact_rel
u[0][0]
_____
conv4_block32_1_bn (BatchNormal (None, 14, 14, 256) 1024         conv4_block32_1_conv[0][
0]
_____
conv4_block32_1_relu (Activatio (None, 14, 14, 256) 0           conv4_block32_1_bn[0][0]

_____
conv4_block32_2_pad (ZeroPaddin (None, 16, 16, 256) 0           conv4_block32_1_relu[0][
0]
```

Layer (type)	Output Shape	Param #	Connected to
conv4_block32_2_conv (Conv2D)	(None, 14, 14, 256)	589824	conv4_block32_2_pad[0][0]
conv4_block32_2_bn (BatchNormal	(None, 14, 14, 256)	1024	conv4_block32_2_conv[0][0]
conv4_block32_2_relu (Activatio	(None, 14, 14, 256)	0	conv4_block32_2_bn[0][0]
conv4_block32_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block32_2_relu[0][0]
conv4_block32_out (Add)	(None, 14, 14, 1024)	0	conv4_block31_out[0][0]
			conv4_block32_3_conv[0][0]
conv4_block33_preact_bn (BatchN	(None, 14, 14, 1024)	4096	conv4_block32_out[0][0]
conv4_block33_preact_relu (Acti	(None, 14, 14, 1024)	0	conv4_block33_preact_bn[0][0]
conv4_block33_1_conv (Conv2D)	(None, 14, 14, 256)	262144	conv4_block33_preact_relu[0][0]
conv4_block33_1_bn (BatchNormal	(None, 14, 14, 256)	1024	conv4_block33_1_conv[0][0]
conv4_block33_1_relu (Activatio	(None, 14, 14, 256)	0	conv4_block33_1_bn[0][0]
conv4_block33_2_pad (ZeroPaddin	(None, 16, 16, 256)	0	conv4_block33_1_relu[0][0]
conv4_block33_2_conv (Conv2D)	(None, 14, 14, 256)	589824	conv4_block33_2_pad[0][0]
conv4_block33_2_bn (BatchNormal	(None, 14, 14, 256)	1024	conv4_block33_2_conv[0][0]
conv4_block33_2_relu (Activatio	(None, 14, 14, 256)	0	conv4_block33_2_bn[0][0]
conv4_block33_3_conv (Conv2D)	(None, 14, 14, 1024)	263168	conv4_block33_2_relu[0][0]
conv4_block33_out (Add)	(None, 14, 14, 1024)	0	conv4_block32_out[0][0]
			conv4_block33_3_conv[0][0]
conv4_block34_preact_bn (BatchN	(None, 14, 14, 1024)	4096	conv4_block33_out[0][0]

```
_____
conv4_block34_preact_relu (Acti (None, 14, 14, 1024) 0          conv4_block34_preact_bn[
0][0]
_____
conv4_block34_1_conv (Conv2D)   (None, 14, 14, 256)  262144     conv4_block34_preact_rel
u[0][0]
_____
conv4_block34_1_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block34_1_conv[0][
0]
_____
conv4_block34_1_relu (Activatio (None, 14, 14, 256)  0          conv4_block34_1_bn[0][0]
_____
conv4_block34_2_pad (ZeroPaddin (None, 16, 16, 256)  0          conv4_block34_1_relu[0][
0]
_____
conv4_block34_2_conv (Conv2D)   (None, 14, 14, 256)  589824     conv4_block34_2_pad[0][0
]
_____
conv4_block34_2_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block34_2_conv[0][
0]
_____
conv4_block34_2_relu (Activatio (None, 14, 14, 256)  0          conv4_block34_2_bn[0][0]
_____
conv4_block34_3_conv (Conv2D)   (None, 14, 14, 1024) 263168     conv4_block34_2_relu[0][
0]
_____
conv4_block34_out (Add)         (None, 14, 14, 1024) 0          conv4_block33_out[0][0]

                                                                conv4_block34_3_conv[0
][0]
_____
conv4_block35_preact_bn (BatchN (None, 14, 14, 1024) 4096       conv4_block34_out[0][0]

_____
conv4_block35_preact_relu (Acti (None, 14, 14, 1024) 0          conv4_block35_preact_bn[
0][0]
_____
conv4_block35_1_conv (Conv2D)   (None, 14, 14, 256)  262144     conv4_block35_preact_rel
u[0][0]
_____
conv4_block35_1_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block35_1_conv[0][
0]
_____
conv4_block35_1_relu (Activatio (None, 14, 14, 256)  0          conv4_block35_1_bn[0][0]
_____
conv4_block35_2_pad (ZeroPaddin (None, 16, 16, 256)  0          conv4_block35_1_relu[0][
0]
_____
conv4_block35_2_conv (Conv2D)   (None, 14, 14, 256)  589824     conv4_block35_2_pad[0][0
]
_____
conv4_block35_2_bn (BatchNormal (None, 14, 14, 256)  1024       conv4_block35_2_conv[0][
```

```
                                                                                            _        _   _    ...
0]
_____
_____
conv4_block35_2_relu (Activatio (None, 14, 14, 256)   0           conv4_block35_2_bn[0][0]
_____
_____
conv4_block35_3_conv (Conv2D)   (None, 14, 14, 1024)  263168      conv4_block35_2_relu[0][
0]
_____
_____
conv4_block35_out (Add)         (None, 14, 14, 1024)  0           conv4_block34_out[0][0]

                                                                  conv4_block35_3_conv[0
][0]
_____
_____
conv4_block36_preact_bn (BatchN (None, 14, 14, 1024)  4096        conv4_block35_out[0][0]
_____
_____
conv4_block36_preact_relu (Acti (None, 14, 14, 1024)  0           conv4_block36_preact_bn[
0][0]
_____
_____
conv4_block36_1_conv (Conv2D)   (None, 14, 14, 256)   262144      conv4_block36_preact_rel
u[0][0]
_____
_____
conv4_block36_1_bn (BatchNormal (None, 14, 14, 256)   1024        conv4_block36_1_conv[0][
0]
_____
_____
conv4_block36_1_relu (Activatio (None, 14, 14, 256)   0           conv4_block36_1_bn[0][0]
_____
_____
conv4_block36_2_pad (ZeroPaddin (None, 16, 16, 256)   0           conv4_block36_1_relu[0][
0]
_____
_____
conv4_block36_2_conv (Conv2D)   (None, 7, 7, 256)     589824      conv4_block36_2_pad[0][0
]
_____
_____
conv4_block36_2_bn (BatchNormal (None, 7, 7, 256)     1024        conv4_block36_2_conv[0][
0]
_____
_____
conv4_block36_2_relu (Activatio (None, 7, 7, 256)     0           conv4_block36_2_bn[0][0]
_____
_____
max_pooling2d_2 (MaxPooling2D)  (None, 7, 7, 1024)    0           conv4_block35_out[0][0]
_____
_____
conv4_block36_3_conv (Conv2D)   (None, 7, 7, 1024)    263168      conv4_block36_2_relu[0][
0]
_____
_____
conv4_block36_out (Add)         (None, 7, 7, 1024)    0           max_pooling2d_2[0][0]

                                                                  conv4_block36_3_conv[0
][0]
_____
_____
conv5_block1_preact_bn (BatchNo (None, 7, 7, 1024)    4096        conv4_block36_out[0][0]
_____
_____
conv5_block1_preact_relu (Activ (None, 7, 7, 1024)    0           conv5_block1_preact_bn[0
```

```
                                                                                   ][0]
_____
conv5_block1_1_conv (Conv2D)    (None, 7, 7, 512)    524288      conv5_block1_preact_relu
                                                                 [0][0]
_____
conv5_block1_1_bn (BatchNormali (None, 7, 7, 512)    2048        conv5_block1_1_conv[0][0
                                                                 ]
_____
conv5_block1_1_relu (Activation (None, 7, 7, 512)    0           conv5_block1_1_bn[0][0]

_____
conv5_block1_2_pad (ZeroPadding (None, 9, 9, 512)    0           conv5_block1_1_relu[0][0
                                                                 ]
_____
conv5_block1_2_conv (Conv2D)    (None, 7, 7, 512)    2359296     conv5_block1_2_pad[0][0]

_____
conv5_block1_2_bn (BatchNormali (None, 7, 7, 512)    2048        conv5_block1_2_conv[0][0
                                                                 ]
_____
conv5_block1_2_relu (Activation (None, 7, 7, 512)    0           conv5_block1_2_bn[0][0]

_____
conv5_block1_0_conv (Conv2D)    (None, 7, 7, 2048)   2099200     conv5_block1_preact_relu
                                                                 [0][0]
_____
conv5_block1_3_conv (Conv2D)    (None, 7, 7, 2048)   1050624     conv5_block1_2_relu[0][0
                                                                 ]
_____
conv5_block1_out (Add)          (None, 7, 7, 2048)   0           conv5_block1_0_conv[0][
                                                                 0]

                                                                 conv5_block1_3_conv[0]
                                                                 [0]
_____
conv5_block2_preact_bn (BatchNo (None, 7, 7, 2048)   8192        conv5_block1_out[0][0]

_____
conv5_block2_preact_relu (Activ (None, 7, 7, 2048)   0           conv5_block2_preact_bn[0
                                                                 ][0]
_____
conv5_block2_1_conv (Conv2D)    (None, 7, 7, 512)    1048576     conv5_block2_preact_relu
                                                                 [0][0]
_____
conv5_block2_1_bn (BatchNormali (None, 7, 7, 512)    2048        conv5_block2_1_conv[0][0
                                                                 ]
_____
conv5_block2_1_relu (Activation (None, 7, 7, 512)    0           conv5_block2_1_bn[0][0]

_____
conv5_block2_2_pad (ZeroPadding (None, 9, 9, 512)    0           conv5_block2_1_relu[0][0
                                                                 ]
_____
conv5_block2_2_conv (Conv2D)    (None, 7, 7, 512)    2359296     conv5_block2_2_pad[0][0]
```

```
conv5_block2_2_bn (BatchNormali  (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_out (Add)           (None, 7, 7, 2048)    0           conv5_block1_out[0][0]

                                                                   conv5_block2_3_conv[0]
[0]
_____
conv5_block3_preact_bn (BatchNo  (None, 7, 7, 2048)    8192        conv5_block2_out[0][0]
_____
conv5_block3_preact_relu (Activ  (None, 7, 7, 2048)    0           conv5_block3_preact_bn[0
][0]
_____
conv5_block3_1_conv (Conv2D)     (None, 7, 7, 512)     1048576     conv5_block3_preact_relu
[0][0]
_____
conv5_block3_1_bn (BatchNormali  (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_pad (ZeroPadding  (None, 9, 9, 512)     0           conv5_block3_1_relu[0][0
]
_____
conv5_block3_2_conv (Conv2D)     (None, 7, 7, 512)     2359296     conv5_block3_2_pad[0][0]
_____
conv5_block3_2_bn (BatchNormali  (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_out (Add)           (None, 7, 7, 2048)    0           conv5_block2_out[0][0]

                                                                   conv5_block3_3_conv[0]
[0]
_____
post_bn (BatchNormalization)     (None, 7, 7, 2048)    8192        conv5_block3_out[0][0]
_____
post_relu (Activation)           (None, 7, 7, 2048)    0           post_bn[0][0]
```

```
_____
flatten (Flatten)              (None, 100352)         0           post_relu[0][0]


_____
dense (Dense)                  (None, 4)              401412      flatten[0][0]

==================================================================================
=========
Total params: 58,733,060
Trainable params: 401,412
Non-trainable params: 58,331,648
_____
_____
```

In [10]:

```python
# tell the model what cost and optimization method to use
model.compile(
    loss='categorical_crossentropy',
    optimizer='adam',
    metrics=['accuracy']
)
```

In [11]:

```python
# Use the Image Data Generator to import the images from the dataset
from tensorflow.keras.preprocessing.image import ImageDataGenerator

train_datagen = ImageDataGenerator(rescale = 1./255,
                                   shear_range = 0.2,
                                   zoom_range = 0.2,
                                   horizontal_flip = True)

test_datagen = ImageDataGenerator(rescale = 1./255)
```

In [12]:

```python
# Make sure you provide the same target size as initialied for the image size
training_set = train_datagen.flow_from_directory('Datasets/train',
                                                 target_size = (224, 224),
                                                 batch_size = 32,
                                                 class_mode = 'categorical')
```

Found 1951 images belonging to 4 classes.

In [13]:

```python
test_set = test_datagen.flow_from_directory('Datasets/test',
                                            target_size = (224, 224),
                                            batch_size = 32,
                                            class_mode = 'categorical')
```

Found 18 images belonging to 4 classes.

In [14]:

```python
# fit the model
# Run the cell. It will take some time to execute
r = model.fit_generator(
    training_set,
    validation_data=test_set,
    epochs=20,
    steps_per_epoch=len(training_set),
    validation_steps=len(test_set)
)
```

WARNING:tensorflow:From <ipython-input-14-2d02736eff38>:8: Model.fit_generator (from tens
orflow.python.keras.engine.training) is deprecated and will be removed in a future versio
n.
Instructions for updating:

Please use Model.fit, which supports generators.
Epoch 1/20
61/61 [==============================] - 28s 466ms/step - loss: 1.4618 - accuracy: 0.8093 - val_loss: 0.0069 - val_accuracy: 1.0000
Epoch 2/20
61/61 [==============================] - 20s 324ms/step - loss: 0.4206 - accuracy: 0.9288 - val_loss: 0.0103 - val_accuracy: 1.0000
Epoch 3/20
61/61 [==============================] - 20s 327ms/step - loss: 0.3835 - accuracy: 0.9416 - val_loss: 0.3192 - val_accuracy: 0.8889
Epoch 4/20
61/61 [==============================] - 20s 327ms/step - loss: 0.3231 - accuracy: 0.9498 - val_loss: 0.9201 - val_accuracy: 0.8889
Epoch 5/20
61/61 [==============================] - 20s 327ms/step - loss: 0.1914 - accuracy: 0.9662 - val_loss: 0.3125 - val_accuracy: 0.9444
Epoch 6/20
61/61 [==============================] - 20s 330ms/step - loss: 0.2973 - accuracy: 0.9616 - val_loss: 0.7044 - val_accuracy: 0.9444
Epoch 7/20
61/61 [==============================] - 20s 328ms/step - loss: 0.2958 - accuracy: 0.9657 - val_loss: 0.0167 - val_accuracy: 1.0000
Epoch 8/20
61/61 [==============================] - 20s 328ms/step - loss: 0.3025 - accuracy: 0.9692 - val_loss: 1.0431 - val_accuracy: 0.9444
Epoch 9/20
61/61 [==============================] - 20s 327ms/step - loss: 0.3309 - accuracy: 0.9682 - val_loss: 0.5506 - val_accuracy: 0.9444
Epoch 10/20
61/61 [==============================] - 20s 321ms/step - loss: 0.2806 - accuracy: 0.9733 - val_loss: 0.4829 - val_accuracy: 0.8889
Epoch 11/20
61/61 [==============================] - 19s 320ms/step - loss: 0.2029 - accuracy: 0.9769 - val_loss: 0.2896 - val_accuracy: 0.9444
Epoch 12/20
61/61 [==============================] - 19s 319ms/step - loss: 0.2322 - accuracy: 0.9698 - val_loss: 0.1019 - val_accuracy: 0.9444
Epoch 13/20
61/61 [==============================] - 20s 321ms/step - loss: 0.2119 - accuracy: 0.9728 - val_loss: 1.4550e-04 - val_accuracy: 1.0000
Epoch 14/20
61/61 [==============================] - 20s 322ms/step - loss: 0.2009 - accuracy: 0.9769 - val_loss: 0.4633 - val_accuracy: 0.9444
Epoch 15/20
61/61 [==============================] - 20s 320ms/step - loss: 0.1325 - accuracy: 0.9836 - val_loss: 1.0994e-06 - val_accuracy: 1.0000
Epoch 16/20
61/61 [==============================] - 19s 318ms/step - loss: 0.2099 - accuracy: 0.9795 - val_loss: 0.0091 - val_accuracy: 1.0000
Epoch 17/20
61/61 [==============================] - 19s 318ms/step - loss: 0.1249 - accuracy: 0.9810 - val_loss: 0.0000e+00 - val_accuracy: 1.0000
Epoch 18/20
61/61 [==============================] - 19s 319ms/step - loss: 0.1294 - accuracy: 0.9826 - val_loss: 1.3245e-08 - val_accuracy: 1.0000
Epoch 19/20
61/61 [==============================] - 19s 318ms/step - loss: 0.2218 - accuracy: 0.9795 - val_loss: 1.1013e-05 - val_accuracy: 1.0000
Epoch 20/20
61/61 [==============================] - 19s 319ms/step - loss: 0.2298 - accuracy: 0.9800 - val_loss: 1.8554e-05 - val_accuracy: 1.0000

In [15]:

```python
import matplotlib.pyplot as plt
```

In [16]:

```python
# plot the loss
plt.plot(r.history['loss'], label='train loss')
plt.plot(r.history['val_loss'], label='val loss')
plt.legend()
```

```
plt.show()
plt.savefig('LossVal_loss')

# plot the accuracy
plt.plot(r.history['accuracy'], label='train acc')
plt.plot(r.history['val_accuracy'], label='val acc')
plt.legend()
plt.show()
plt.savefig('AccVal_acc')
```



```
<Figure size 432x288 with 0 Axes>
```
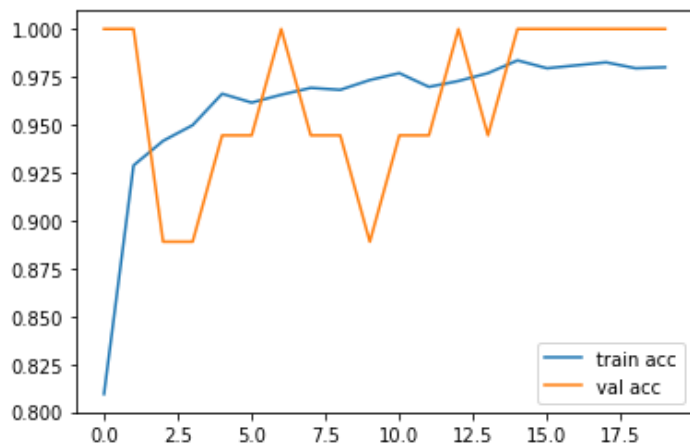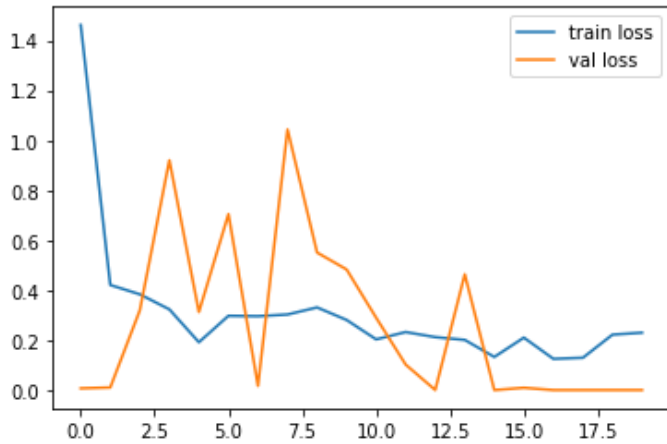
In [17]:

```
# save it as a h5 file

from tensorflow.keras.models import load_model

model.save('model_resnet152V2.h5')
```

In [ ]:

In [18]:

```
y_pred = model.predict(test_set)
```

In [19]:

```
y_pred
```

Out[19]:

```
array([[5.3846088e-29, 2.2531559e-23, 1.0000000e+00, 0.0000000e+00],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 0.0000000e+00],
       [2.1657728e-08, 1.2172376e-20, 1.0000000e+00, 1.5230057e-28],
       [4.8872598e-30, 0.0000000e+00, 1.0000000e+00, 0.0000000e+00],
       [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 0.0000000e+00],
       [1.0000000e+00, 0.0000000e+00, 1.3303991e-33, 0.0000000e+00],
```

```
        [4.5714924e-16, 8.6781859e-11, 1.3235285e-09, 1.0000000e+00],
        [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 0.0000000e+00],
        [5.4839473e-28, 1.0000000e+00, 3.3122518e-22, 6.6293510e-21],
        [1.0000000e+00, 5.0101860e-30, 0.0000000e+00, 0.0000000e+00],
        [7.8975147e-36, 2.7945514e-23, 1.0478895e-18, 1.0000000e+00],
        [0.0000000e+00, 1.0000000e+00, 0.0000000e+00, 1.2099686e-36],
        [0.0000000e+00, 0.0000000e+00, 1.0000000e+00, 0.0000000e+00],
        [5.2780553e-25, 1.6846226e-15, 1.0000000e+00, 1.5684442e-16],
        [0.0000000e+00, 3.1915728e-17, 0.0000000e+00, 1.0000000e+00],
        [3.0335591e-24, 0.0000000e+00, 1.0000000e+00, 9.1854229e-36],
        [4.6160116e-12, 5.1804220e-14, 1.4135714e-14, 1.0000000e+00],
        [1.1229754e-26, 1.5938108e-01, 2.6465597e-11, 8.4061897e-01]],
      dtype=float32)
```

In [20]:

```python
import numpy as np
y_pred = np.argmax(y_pred, axis=1)
```

In [21]:

```python
y_pred
```

Out[21]:

```
array([2, 1, 2, 2, 1, 0, 3, 1, 1, 0, 3, 1, 2, 2, 3, 2, 3, 3], dtype=int64)
```

In [ ]:

In [1]:

```python
from tensorflow.keras.models import load_model
from tensorflow.keras.preprocessing import image
```

In [2]:

```python
model=load_model('model_resnet50.h5')
```

In [39]:

```python
img_data
```

Out[39]:

```
array([[[[ 6.7060997e+01,  5.4221001e+01,  4.7320000e+01],
         [ 6.9060997e+01,  5.6221001e+01,  4.9320000e+01],
         [ 7.3060997e+01,  6.0221001e+01,  5.3320000e+01],
         ...,
         [ 7.4060997e+01,  5.6221001e+01,  4.6320000e+01],
         [ 5.5060997e+01,  3.7221001e+01,  2.7320000e+01],
         [ 4.1060997e+01,  2.3221001e+01,  1.3320000e+01]],

        [[ 7.5060997e+01,  6.2221001e+01,  5.5320000e+01],
         [ 7.8060997e+01,  6.5221001e+01,  5.8320000e+01],
         [ 8.1060997e+01,  6.8221001e+01,  6.1320000e+01],
         ...,
         [ 9.7060997e+01,  7.9221001e+01,  6.9320000e+01],
         [ 7.3060997e+01,  5.5221001e+01,  4.5320000e+01],
         [ 4.9060997e+01,  3.1221001e+01,  2.1320000e+01]],

        [[ 8.7060997e+01,  7.4221001e+01,  6.7320000e+01],
         [ 9.0060997e+01,  7.7221001e+01,  7.0320000e+01],
         [ 9.3060997e+01,  8.0221001e+01,  7.3320000e+01],
         ...,
         [ 1.0106100e+02,  8.3221001e+01,  7.3320000e+01],
         [ 7.5060997e+01,  5.7221001e+01,  4.7320000e+01],
         [ 5.0060997e+01,  3.2221001e+01,  2.2320000e+01]],

        ...,
```

```
       [[ 1.0406100e+02,  8.9221001e+01,  9.4320000e+01],
        [ 1.0206100e+02,  8.7221001e+01,  9.2320000e+01],
        [ 9.9060997e+01,  8.4221001e+01,  8.9320000e+01],
        ...,
        [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01],
        [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01],
        [-1.0939003e+01, -1.6778999e+01, -1.4680000e+01]],

       [[ 1.0606100e+02,  9.1221001e+01,  9.6320000e+01],
        [ 1.0406100e+02,  8.9221001e+01,  9.4320000e+01],
        [ 1.0006100e+02,  8.5221001e+01,  9.0320000e+01],
        ...,
        [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00],
        [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00],
        [-5.9390030e+00, -1.1778999e+01, -9.6800003e+00]],

       [[ 1.0806100e+02,  9.4221001e+01,  9.6320000e+01],
        [ 1.0606100e+02,  9.2221001e+01,  9.4320000e+01],
        [ 1.0206100e+02,  8.8221001e+01,  9.0320000e+01],
        ...,
        [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00],
        [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00],
        [ 6.0997009e-02, -5.7789993e+00, -3.6800003e+00]]]],
      dtype=float32)
```

In [11]:

```
img=image.load_img('Datasets/Test/Coffee/download (2).jpg',target_size=(224,224))
```

In [12]:

```
x=image.img_to_array(img)
x
```

Out[12]:

```
array([[[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[254., 254., 254.],
        [254., 254., 254.],
        [254., 254., 254.],
        ...,
        [254., 254., 254.],
        [255., 255., 255.],
        [255., 255., 255.]],

       ...,

       [[255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.],
        ...,
        [255., 255., 255.],
        [255., 255., 255.],
        [255., 255., 255.]],

       [[255., 255., 255.],
        [255., 255., 255.],
```

```
          [255., 255., 255.],
          ...,
          [255., 255., 255.],
          [255., 255., 255.],
          [255., 255., 255.]],

         [[255., 255., 255.],
          [255., 255., 255.],
          [255., 255., 255.],
          ...,
          [255., 255., 255.],
          [255., 255., 255.],
          [255., 255., 255.]]], dtype=float32)
```

In [13]:

```
x.shape
```

Out[13]:

```
(224, 224, 3)
```

In [14]:

```
x=x/255
```

In [15]:

```
import numpy as np
x=np.expand_dims(x,axis=0)
img_data=preprocess_input(x)
img_data.shape
```

Out[15]:

```
(1, 224, 224, 3)
```

In [16]:

```
model.predict(img_data)
```

Out[16]:

```
array([[0.9745471, 0.0254529]], dtype=float32)
```

In [17]:

```
a=np.argmax(model.predict(img_data), axis=1)
```

In [102]:

```
a==1
```

Out[102]:

```
array([ True])
```

In [18]:

```
import tensorflow as tf
```

In [19]:

```
tf.__version__
```

Out[19]:

```
'2.2.0'
```

In [ ]: