DenseNet201-Final Working-V2

February 15, 2020

In [1]: import matplotlib.pyplot as plt
        from keras import applications
        from keras.preprocessing.image import ImageDataGenerator
        from keras import optimizers
        from keras.models import Sequential
        from keras.layers import Dropout, Flatten, Dense
        from keras.applications.inception_v3 import InceptionV3
        from keras.preprocessing import image
        from keras.models import Model
        from keras.layers import Dense, Flatten
        from keras import backend as K
        import numpy as np
        import pandas as pd
        import os
        from sklearn.metrics import classification_report, confusion_matrix
        import sklearn.metrics as metrics
        import sklearn
        from sklearn.metrics import roc_auc_score
        from sklearn.metrics import roc_curve
        import matplotlib.pyplot as plt
        %matplotlib inline

Using TensorFlow backend.

In [2]: # create the base pre-trained model
        # build the VGG16 network
        base_model = applications.densenet.DenseNet201(weights='imagenet', include_top=False,
                                    input_shape=(150,150,3))
        print('Model loaded.')
        base_model.summary()

WARNING: Logging before flag parsing goes to stderr.
W0215 11:14:06.889069 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:06.898453 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:06.901947 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:06.917911 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:06.918711 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:07.033212 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:07.076925 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:07.831431 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

Model loaded.

```
_____
Layer (type)                    Output Shape         Param #     Connected to
==================================================================================================
input_1 (InputLayer)            (None, 150, 150, 3)  0
_____
zero_padding2d_1 (ZeroPadding2D (None, 156, 156, 3)  0           input_1[0][0]
_____
conv1/conv (Conv2D)             (None, 75, 75, 64)   9408        zero_padding2d_1[0][0]
_____
conv1/bn (BatchNormalization)   (None, 75, 75, 64)   256         conv1/conv[0][0]
_____
conv1/relu (Activation)         (None, 75, 75, 64)   0           conv1/bn[0][0]
_____
zero_padding2d_2 (ZeroPadding2D (None, 77, 77, 64)   0           conv1/relu[0][0]
_____
pool1 (MaxPooling2D)            (None, 38, 38, 64)   0           zero_padding2d_2[0][0]
_____
conv2_block1_0_bn (BatchNormali (None, 38, 38, 64)   256         pool1[0][0]
_____
conv2_block1_0_relu (Activation (None, 38, 38, 64)   0           conv2_block1_0_bn[0][0]
_____
conv2_block1_1_conv (Conv2D)    (None, 38, 38, 128)  8192        conv2_block1_0_relu[0][0]
_____
conv2_block1_1_bn (BatchNormali (None, 38, 38, 128)  512         conv2_block1_1_conv[0][0]
_____
conv2_block1_1_relu (Activation (None, 38, 38, 128)  0           conv2_block1_1_bn[0][0]
_____
conv2_block1_2_conv (Conv2D)    (None, 38, 38, 32)   36864       conv2_block1_1_relu[0][0]
_____
conv2_block1_concat (Concatenat (None, 38, 38, 96)   0           pool1[0][0]
                                                                 conv2_block1_2_conv[0][0]
_____
conv2_block2_0_bn (BatchNormali (None, 38, 38, 96)   384         conv2_block1_concat[0][0]
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conv2_block2_0_relu (Activation (None, 38, 38, 96)   0   conv2_block2_0_bn[0][0]

_____

conv2_block2_1_conv (Conv2D)   (None, 38, 38, 128) 12288   conv2_block2_0_relu[0][0]

_____

conv2_block2_1_bn (BatchNormali (None, 38, 38, 128) 512   conv2_block2_1_conv[0][0]

_____

conv2_block2_1_relu (Activation (None, 38, 38, 128) 0   conv2_block2_1_bn[0][0]

_____

conv2_block2_2_conv (Conv2D)   (None, 38, 38, 32) 36864   conv2_block2_1_relu[0][0]

_____

conv2_block2_concat (Concatenat (None, 38, 38, 128) 0   conv2_block1_concat[0][0]
                                                                conv2_block2_2_conv[0][0]

_____

conv2_block3_0_bn (BatchNormali (None, 38, 38, 128) 512   conv2_block2_concat[0][0]

_____

conv2_block3_0_relu (Activation (None, 38, 38, 128) 0   conv2_block3_0_bn[0][0]

_____

conv2_block3_1_conv (Conv2D)   (None, 38, 38, 128) 16384   conv2_block3_0_relu[0][0]

_____

conv2_block3_1_bn (BatchNormali (None, 38, 38, 128) 512   conv2_block3_1_conv[0][0]

_____

conv2_block3_1_relu (Activation (None, 38, 38, 128) 0   conv2_block3_1_bn[0][0]

_____

conv2_block3_2_conv (Conv2D)   (None, 38, 38, 32) 36864   conv2_block3_1_relu[0][0]

_____

conv2_block3_concat (Concatenat (None, 38, 38, 160) 0   conv2_block2_concat[0][0]
                                                                conv2_block3_2_conv[0][0]

_____

conv2_block4_0_bn (BatchNormali (None, 38, 38, 160) 640   conv2_block3_concat[0][0]

_____

conv2_block4_0_relu (Activation (None, 38, 38, 160) 0   conv2_block4_0_bn[0][0]

_____

conv2_block4_1_conv (Conv2D)   (None, 38, 38, 128) 20480   conv2_block4_0_relu[0][0]

_____

conv2_block4_1_bn (BatchNormali (None, 38, 38, 128) 512   conv2_block4_1_conv[0][0]

_____

conv2_block4_1_relu (Activation (None, 38, 38, 128) 0   conv2_block4_1_bn[0][0]

_____

conv2_block4_2_conv (Conv2D)   (None, 38, 38, 32) 36864   conv2_block4_1_relu[0][0]

_____

conv2_block4_concat (Concatenat (None, 38, 38, 192) 0   conv2_block3_concat[0][0]
                                                                conv2_block4_2_conv[0][0]

_____

conv2_block5_0_bn (BatchNormali (None, 38, 38, 192) 768   conv2_block4_concat[0][0]

_____

conv2_block5_0_relu (Activation (None, 38, 38, 192) 0   conv2_block5_0_bn[0][0]

_____

conv2_block5_1_conv (Conv2D)   (None, 38, 38, 128) 24576   conv2_block5_0_relu[0][0]

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conv2_block5_1_bn (BatchNormali (None, 38, 38, 128)  512      conv2_block5_1_conv[0][0]
_____
conv2_block5_1_relu (Activation (None, 38, 38, 128)  0        conv2_block5_1_bn[0][0]
_____
conv2_block5_2_conv (Conv2D)    (None, 38, 38, 32)   36864    conv2_block5_1_relu[0][0]
_____
conv2_block5_concat (Concatenat (None, 38, 38, 224)  0        conv2_block4_concat[0][0]
                                                              conv2_block5_2_conv[0][0]
_____
conv2_block6_0_bn (BatchNormali (None, 38, 38, 224)  896      conv2_block5_concat[0][0]
_____
conv2_block6_0_relu (Activation (None, 38, 38, 224)  0        conv2_block6_0_bn[0][0]
_____
conv2_block6_1_conv (Conv2D)    (None, 38, 38, 128)  28672    conv2_block6_0_relu[0][0]
_____
conv2_block6_1_bn (BatchNormali (None, 38, 38, 128)  512      conv2_block6_1_conv[0][0]
_____
conv2_block6_1_relu (Activation (None, 38, 38, 128)  0        conv2_block6_1_bn[0][0]
_____
conv2_block6_2_conv (Conv2D)    (None, 38, 38, 32)   36864    conv2_block6_1_relu[0][0]
_____
conv2_block6_concat (Concatenat (None, 38, 38, 256)  0        conv2_block5_concat[0][0]
                                                              conv2_block6_2_conv[0][0]
_____
pool2_bn (BatchNormalization)   (None, 38, 38, 256)  1024     conv2_block6_concat[0][0]
_____
pool2_relu (Activation)         (None, 38, 38, 256)  0        pool2_bn[0][0]
_____
pool2_conv (Conv2D)             (None, 38, 38, 128)  32768    pool2_relu[0][0]
_____
pool2_pool (AveragePooling2D)   (None, 19, 19, 128)  0        pool2_conv[0][0]
_____
conv3_block1_0_bn (BatchNormali (None, 19, 19, 128)  512      pool2_pool[0][0]
_____
conv3_block1_0_relu (Activation (None, 19, 19, 128)  0        conv3_block1_0_bn[0][0]
_____
conv3_block1_1_conv (Conv2D)    (None, 19, 19, 128)  16384    conv3_block1_0_relu[0][0]
_____
conv3_block1_1_bn (BatchNormali (None, 19, 19, 128)  512      conv3_block1_1_conv[0][0]
_____
conv3_block1_1_relu (Activation (None, 19, 19, 128)  0        conv3_block1_1_bn[0][0]
_____
conv3_block1_2_conv (Conv2D)    (None, 19, 19, 32)   36864    conv3_block1_1_relu[0][0]
_____
conv3_block1_concat (Concatenat (None, 19, 19, 160)  0        pool2_pool[0][0]
                                                              conv3_block1_2_conv[0][0]
_____
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conv3_block2_0_bn (BatchNormali (None, 19, 19, 160) 640   conv3_block1_concat[0][0]
_____
conv3_block2_0_relu (Activation (None, 19, 19, 160) 0   conv3_block2_0_bn[0][0]
_____
conv3_block2_1_conv (Conv2D)   (None, 19, 19, 128) 20480   conv3_block2_0_relu[0][0]
_____
conv3_block2_1_bn (BatchNormali (None, 19, 19, 128) 512   conv3_block2_1_conv[0][0]
_____
conv3_block2_1_relu (Activation (None, 19, 19, 128) 0   conv3_block2_1_bn[0][0]
_____
conv3_block2_2_conv (Conv2D)   (None, 19, 19, 32)   36864   conv3_block2_1_relu[0][0]
_____
conv3_block2_concat (Concatenat (None, 19, 19, 192) 0   conv3_block1_concat[0][0]
                                                                 conv3_block2_2_conv[0][0]
_____
conv3_block3_0_bn (BatchNormali (None, 19, 19, 192) 768   conv3_block2_concat[0][0]
_____
conv3_block3_0_relu (Activation (None, 19, 19, 192) 0   conv3_block3_0_bn[0][0]
_____
conv3_block3_1_conv (Conv2D)   (None, 19, 19, 128) 24576   conv3_block3_0_relu[0][0]
_____
conv3_block3_1_bn (BatchNormali (None, 19, 19, 128) 512   conv3_block3_1_conv[0][0]
_____
conv3_block3_1_relu (Activation (None, 19, 19, 128) 0   conv3_block3_1_bn[0][0]
_____
conv3_block3_2_conv (Conv2D)   (None, 19, 19, 32)   36864   conv3_block3_1_relu[0][0]
_____
conv3_block3_concat (Concatenat (None, 19, 19, 224) 0   conv3_block2_concat[0][0]
                                                                 conv3_block3_2_conv[0][0]
_____
conv3_block4_0_bn (BatchNormali (None, 19, 19, 224) 896   conv3_block3_concat[0][0]
_____
conv3_block4_0_relu (Activation (None, 19, 19, 224) 0   conv3_block4_0_bn[0][0]
_____
conv3_block4_1_conv (Conv2D)   (None, 19, 19, 128) 28672   conv3_block4_0_relu[0][0]
_____
conv3_block4_1_bn (BatchNormali (None, 19, 19, 128) 512   conv3_block4_1_conv[0][0]
_____
conv3_block4_1_relu (Activation (None, 19, 19, 128) 0   conv3_block4_1_bn[0][0]
_____
conv3_block4_2_conv (Conv2D)   (None, 19, 19, 32)   36864   conv3_block4_1_relu[0][0]
_____
conv3_block4_concat (Concatenat (None, 19, 19, 256) 0   conv3_block3_concat[0][0]
                                                                 conv3_block4_2_conv[0][0]
_____
conv3_block5_0_bn (BatchNormali (None, 19, 19, 256) 1024   conv3_block4_concat[0][0]
_____
conv3_block5_0_relu (Activation (None, 19, 19, 256) 0   conv3_block5_0_bn[0][0]

conv3_block5_1_conv (Conv2D)	(None, 19, 19, 128)	32768	conv3_block5_0_relu[0][0]
conv3_block5_1_bn (BatchNormali	(None, 19, 19, 128)	512	conv3_block5_1_conv[0][0]
conv3_block5_1_relu (Activation	(None, 19, 19, 128)	0	conv3_block5_1_bn[0][0]
conv3_block5_2_conv (Conv2D)	(None, 19, 19, 32)	36864	conv3_block5_1_relu[0][0]
conv3_block5_concat (Concatenat	(None, 19, 19, 288)	0	conv3_block4_concat[0][0] conv3_block5_2_conv[0][0]
conv3_block6_0_bn (BatchNormali	(None, 19, 19, 288)	1152	conv3_block5_concat[0][0]
conv3_block6_0_relu (Activation	(None, 19, 19, 288)	0	conv3_block6_0_bn[0][0]
conv3_block6_1_conv (Conv2D)	(None, 19, 19, 128)	36864	conv3_block6_0_relu[0][0]
conv3_block6_1_bn (BatchNormali	(None, 19, 19, 128)	512	conv3_block6_1_conv[0][0]
conv3_block6_1_relu (Activation	(None, 19, 19, 128)	0	conv3_block6_1_bn[0][0]
conv3_block6_2_conv (Conv2D)	(None, 19, 19, 32)	36864	conv3_block6_1_relu[0][0]
conv3_block6_concat (Concatenat	(None, 19, 19, 320)	0	conv3_block5_concat[0][0] conv3_block6_2_conv[0][0]
conv3_block7_0_bn (BatchNormali	(None, 19, 19, 320)	1280	conv3_block6_concat[0][0]
conv3_block7_0_relu (Activation	(None, 19, 19, 320)	0	conv3_block7_0_bn[0][0]
conv3_block7_1_conv (Conv2D)	(None, 19, 19, 128)	40960	conv3_block7_0_relu[0][0]
conv3_block7_1_bn (BatchNormali	(None, 19, 19, 128)	512	conv3_block7_1_conv[0][0]
conv3_block7_1_relu (Activation	(None, 19, 19, 128)	0	conv3_block7_1_bn[0][0]
conv3_block7_2_conv (Conv2D)	(None, 19, 19, 32)	36864	conv3_block7_1_relu[0][0]
conv3_block7_concat (Concatenat	(None, 19, 19, 352)	0	conv3_block6_concat[0][0] conv3_block7_2_conv[0][0]
conv3_block8_0_bn (BatchNormali	(None, 19, 19, 352)	1408	conv3_block7_concat[0][0]
conv3_block8_0_relu (Activation	(None, 19, 19, 352)	0	conv3_block8_0_bn[0][0]
conv3_block8_1_conv (Conv2D)	(None, 19, 19, 128)	45056	conv3_block8_0_relu[0][0]

conv3_block8_1_bn (BatchNormali (None, 19, 19, 128) 512   conv3_block8_1_conv[0][0]

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conv3_block8_1_relu (Activation (None, 19, 19, 128) 0   conv3_block8_1_bn[0][0]

_____

conv3_block8_2_conv (Conv2D)   (None, 19, 19, 32) 36864   conv3_block8_1_relu[0][0]

_____

conv3_block8_concat (Concatenat (None, 19, 19, 384) 0   conv3_block7_concat[0][0]
                                                               conv3_block8_2_conv[0][0]

_____

conv3_block9_0_bn (BatchNormali (None, 19, 19, 384) 1536   conv3_block8_concat[0][0]

_____

conv3_block9_0_relu (Activation (None, 19, 19, 384) 0   conv3_block9_0_bn[0][0]

_____

conv3_block9_1_conv (Conv2D)   (None, 19, 19, 128) 49152   conv3_block9_0_relu[0][0]

_____

conv3_block9_1_bn (BatchNormali (None, 19, 19, 128) 512   conv3_block9_1_conv[0][0]

_____

conv3_block9_1_relu (Activation (None, 19, 19, 128) 0   conv3_block9_1_bn[0][0]

_____

conv3_block9_2_conv (Conv2D)   (None, 19, 19, 32) 36864   conv3_block9_1_relu[0][0]

_____

conv3_block9_concat (Concatenat (None, 19, 19, 416) 0   conv3_block8_concat[0][0]
                                                               conv3_block9_2_conv[0][0]

_____

conv3_block10_0_bn (BatchNormal (None, 19, 19, 416) 1664   conv3_block9_concat[0][0]

_____

conv3_block10_0_relu (Activatio (None, 19, 19, 416) 0   conv3_block10_0_bn[0][0]

_____

conv3_block10_1_conv (Conv2D)   (None, 19, 19, 128) 53248   conv3_block10_0_relu[0][0]

_____

conv3_block10_1_bn (BatchNormal (None, 19, 19, 128) 512   conv3_block10_1_conv[0][0]

_____

conv3_block10_1_relu (Activatio (None, 19, 19, 128) 0   conv3_block10_1_bn[0][0]

_____

conv3_block10_2_conv (Conv2D)   (None, 19, 19, 32) 36864   conv3_block10_1_relu[0][0]

_____

conv3_block10_concat (Concatena (None, 19, 19, 448) 0   conv3_block9_concat[0][0]
                                                               conv3_block10_2_conv[0][0]

_____

conv3_block11_0_bn (BatchNormal (None, 19, 19, 448) 1792   conv3_block10_concat[0][0]

_____

conv3_block11_0_relu (Activatio (None, 19, 19, 448) 0   conv3_block11_0_bn[0][0]

_____

conv3_block11_1_conv (Conv2D)   (None, 19, 19, 128) 57344   conv3_block11_0_relu[0][0]

_____

conv3_block11_1_bn (BatchNormal (None, 19, 19, 128) 512   conv3_block11_1_conv[0][0]

_____

conv3_block11_1_relu (Activatio (None, 19, 19, 128) 0   conv3_block11_1_bn[0][0]

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_____
conv3_block11_2_conv (Conv2D)    (None, 19, 19, 32)    36864      conv3_block11_1_relu[0][0]
_____
conv3_block11_concat (Concatena  (None, 19, 19, 480)   0          conv3_block10_concat[0][0]
                                                                  conv3_block11_2_conv[0][0]
_____
conv3_block12_0_bn (BatchNormal  (None, 19, 19, 480)   1920       conv3_block11_concat[0][0]
_____
conv3_block12_0_relu (Activatio  (None, 19, 19, 480)   0          conv3_block12_0_bn[0][0]
_____
conv3_block12_1_conv (Conv2D)    (None, 19, 19, 128)   61440      conv3_block12_0_relu[0][0]
_____
conv3_block12_1_bn (BatchNormal  (None, 19, 19, 128)   512        conv3_block12_1_conv[0][0]
_____
conv3_block12_1_relu (Activatio  (None, 19, 19, 128)   0          conv3_block12_1_bn[0][0]
_____
conv3_block12_2_conv (Conv2D)    (None, 19, 19, 32)    36864      conv3_block12_1_relu[0][0]
_____
conv3_block12_concat (Concatena  (None, 19, 19, 512)   0          conv3_block11_concat[0][0]
                                                                  conv3_block12_2_conv[0][0]
_____
pool3_bn (BatchNormalization)    (None, 19, 19, 512)   2048       conv3_block12_concat[0][0]
_____
pool3_relu (Activation)          (None, 19, 19, 512)   0          pool3_bn[0][0]
_____
pool3_conv (Conv2D)              (None, 19, 19, 256)   131072     pool3_relu[0][0]
_____
pool3_pool (AveragePooling2D)    (None, 9, 9, 256)     0          pool3_conv[0][0]
_____
conv4_block1_0_bn (BatchNormali  (None, 9, 9, 256)     1024       pool3_pool[0][0]
_____
conv4_block1_0_relu (Activation  (None, 9, 9, 256)     0          conv4_block1_0_bn[0][0]
_____
conv4_block1_1_conv (Conv2D)     (None, 9, 9, 128)     32768      conv4_block1_0_relu[0][0]
_____
conv4_block1_1_bn (BatchNormali  (None, 9, 9, 128)     512        conv4_block1_1_conv[0][0]
_____
conv4_block1_1_relu (Activation  (None, 9, 9, 128)     0          conv4_block1_1_bn[0][0]
_____
conv4_block1_2_conv (Conv2D)     (None, 9, 9, 32)      36864      conv4_block1_1_relu[0][0]
_____
conv4_block1_concat (Concatenat  (None, 9, 9, 288)     0          pool3_pool[0][0]
                                                                  conv4_block1_2_conv[0][0]
_____
conv4_block2_0_bn (BatchNormali  (None, 9, 9, 288)     1152       conv4_block1_concat[0][0]
_____
conv4_block2_0_relu (Activation  (None, 9, 9, 288)     0          conv4_block2_0_bn[0][0]
_____
```

Layer (type)	Output Shape	Param #	Connected to
conv4_block2_1_conv (Conv2D)	(None, 9, 9, 128)	36864	conv4_block2_0_relu[0][0]
conv4_block2_1_bn (BatchNormali	(None, 9, 9, 128)	512	conv4_block2_1_conv[0][0]
conv4_block2_1_relu (Activation	(None, 9, 9, 128)	0	conv4_block2_1_bn[0][0]
conv4_block2_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block2_1_relu[0][0]
conv4_block2_concat (Concatenat	(None, 9, 9, 320)	0	conv4_block1_concat[0][0] conv4_block2_2_conv[0][0]
conv4_block3_0_bn (BatchNormali	(None, 9, 9, 320)	1280	conv4_block2_concat[0][0]
conv4_block3_0_relu (Activation	(None, 9, 9, 320)	0	conv4_block3_0_bn[0][0]
conv4_block3_1_conv (Conv2D)	(None, 9, 9, 128)	40960	conv4_block3_0_relu[0][0]
conv4_block3_1_bn (BatchNormali	(None, 9, 9, 128)	512	conv4_block3_1_conv[0][0]
conv4_block3_1_relu (Activation	(None, 9, 9, 128)	0	conv4_block3_1_bn[0][0]
conv4_block3_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block3_1_relu[0][0]
conv4_block3_concat (Concatenat	(None, 9, 9, 352)	0	conv4_block2_concat[0][0] conv4_block3_2_conv[0][0]
conv4_block4_0_bn (BatchNormali	(None, 9, 9, 352)	1408	conv4_block3_concat[0][0]
conv4_block4_0_relu (Activation	(None, 9, 9, 352)	0	conv4_block4_0_bn[0][0]
conv4_block4_1_conv (Conv2D)	(None, 9, 9, 128)	45056	conv4_block4_0_relu[0][0]
conv4_block4_1_bn (BatchNormali	(None, 9, 9, 128)	512	conv4_block4_1_conv[0][0]
conv4_block4_1_relu (Activation	(None, 9, 9, 128)	0	conv4_block4_1_bn[0][0]
conv4_block4_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block4_1_relu[0][0]
conv4_block4_concat (Concatenat	(None, 9, 9, 384)	0	conv4_block3_concat[0][0] conv4_block4_2_conv[0][0]
conv4_block5_0_bn (BatchNormali	(None, 9, 9, 384)	1536	conv4_block4_concat[0][0]
conv4_block5_0_relu (Activation	(None, 9, 9, 384)	0	conv4_block5_0_bn[0][0]
conv4_block5_1_conv (Conv2D)	(None, 9, 9, 128)	49152	conv4_block5_0_relu[0][0]
conv4_block5_1_bn (BatchNormali	(None, 9, 9, 128)	512	conv4_block5_1_conv[0][0]

conv4_block5_1_relu (Activation (None, 9, 9, 128)   0   conv4_block5_1_bn[0][0]

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conv4_block5_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block5_1_relu[0][0]

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conv4_block5_concat (Concatenat (None, 9, 9, 416)   0   conv4_block4_concat[0][0]
                                                            conv4_block5_2_conv[0][0]

_____

conv4_block6_0_bn (BatchNormali (None, 9, 9, 416)   1664   conv4_block5_concat[0][0]

_____

conv4_block6_0_relu (Activation (None, 9, 9, 416)   0   conv4_block6_0_bn[0][0]

_____

conv4_block6_1_conv (Conv2D)   (None, 9, 9, 128)   53248   conv4_block6_0_relu[0][0]

_____

conv4_block6_1_bn (BatchNormali (None, 9, 9, 128)   512   conv4_block6_1_conv[0][0]

_____

conv4_block6_1_relu (Activation (None, 9, 9, 128)   0   conv4_block6_1_bn[0][0]

_____

conv4_block6_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block6_1_relu[0][0]

_____

conv4_block6_concat (Concatenat (None, 9, 9, 448)   0   conv4_block5_concat[0][0]
                                                            conv4_block6_2_conv[0][0]

_____

conv4_block7_0_bn (BatchNormali (None, 9, 9, 448)   1792   conv4_block6_concat[0][0]

_____

conv4_block7_0_relu (Activation (None, 9, 9, 448)   0   conv4_block7_0_bn[0][0]

_____

conv4_block7_1_conv (Conv2D)   (None, 9, 9, 128)   57344   conv4_block7_0_relu[0][0]

_____

conv4_block7_1_bn (BatchNormali (None, 9, 9, 128)   512   conv4_block7_1_conv[0][0]

_____

conv4_block7_1_relu (Activation (None, 9, 9, 128)   0   conv4_block7_1_bn[0][0]

_____

conv4_block7_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block7_1_relu[0][0]

_____

conv4_block7_concat (Concatenat (None, 9, 9, 480)   0   conv4_block6_concat[0][0]
                                                            conv4_block7_2_conv[0][0]

_____

conv4_block8_0_bn (BatchNormali (None, 9, 9, 480)   1920   conv4_block7_concat[0][0]

_____

conv4_block8_0_relu (Activation (None, 9, 9, 480)   0   conv4_block8_0_bn[0][0]

_____

conv4_block8_1_conv (Conv2D)   (None, 9, 9, 128)   61440   conv4_block8_0_relu[0][0]

_____

conv4_block8_1_bn (BatchNormali (None, 9, 9, 128)   512   conv4_block8_1_conv[0][0]

_____

conv4_block8_1_relu (Activation (None, 9, 9, 128)   0   conv4_block8_1_bn[0][0]

_____

conv4_block8_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block8_1_relu[0][0]

_____

conv4_block8_concat (Concatenat (None, 9, 9, 512)   0   conv4_block7_concat[0][0]

                                                          conv4_block8_2_conv[0][0]

_____

conv4_block9_0_bn (BatchNormali (None, 9, 9, 512)   2048   conv4_block8_concat[0][0]

_____

conv4_block9_0_relu (Activation (None, 9, 9, 512)   0   conv4_block9_0_bn[0][0]

_____

conv4_block9_1_conv (Conv2D)   (None, 9, 9, 128)   65536   conv4_block9_0_relu[0][0]

_____

conv4_block9_1_bn (BatchNormali (None, 9, 9, 128)   512   conv4_block9_1_conv[0][0]

_____

conv4_block9_1_relu (Activation (None, 9, 9, 128)   0   conv4_block9_1_bn[0][0]

_____

conv4_block9_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block9_1_relu[0][0]

_____

conv4_block9_concat (Concatenat (None, 9, 9, 544)   0   conv4_block8_concat[0][0]

                                                          conv4_block9_2_conv[0][0]

_____

conv4_block10_0_bn (BatchNormal (None, 9, 9, 544)   2176   conv4_block9_concat[0][0]

_____

conv4_block10_0_relu (Activatio (None, 9, 9, 544)   0   conv4_block10_0_bn[0][0]

_____

conv4_block10_1_conv (Conv2D)   (None, 9, 9, 128)   69632   conv4_block10_0_relu[0][0]

_____

conv4_block10_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block10_1_conv[0][0]

_____

conv4_block10_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block10_1_bn[0][0]

_____

conv4_block10_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block10_1_relu[0][0]

_____

conv4_block10_concat (Concatena (None, 9, 9, 576)   0   conv4_block9_concat[0][0]

                                                          conv4_block10_2_conv[0][0]

_____

conv4_block11_0_bn (BatchNormal (None, 9, 9, 576)   2304   conv4_block10_concat[0][0]

_____

conv4_block11_0_relu (Activatio (None, 9, 9, 576)   0   conv4_block11_0_bn[0][0]

_____

conv4_block11_1_conv (Conv2D)   (None, 9, 9, 128)   73728   conv4_block11_0_relu[0][0]

_____

conv4_block11_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block11_1_conv[0][0]

_____

conv4_block11_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block11_1_bn[0][0]

_____

conv4_block11_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block11_1_relu[0][0]

_____

conv4_block11_concat (Concatena (None, 9, 9, 608)   0   conv4_block10_concat[0][0]

conv4_block11_2_conv[0][0]

_____
conv4_block12_0_bn (BatchNormal (None, 9, 9, 608)   2432   conv4_block11_concat[0][0]
_____
conv4_block12_0_relu (Activatio (None, 9, 9, 608)   0   conv4_block12_0_bn[0][0]
_____
conv4_block12_1_conv (Conv2D)   (None, 9, 9, 128)   77824   conv4_block12_0_relu[0][0]
_____
conv4_block12_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block12_1_conv[0][0]
_____
conv4_block12_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block12_1_bn[0][0]
_____
conv4_block12_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block12_1_relu[0][0]
_____
conv4_block12_concat (Concatena (None, 9, 9, 640)   0   conv4_block11_concat[0][0]
                                                               conv4_block12_2_conv[0][0]
_____
conv4_block13_0_bn (BatchNormal (None, 9, 9, 640)   2560   conv4_block12_concat[0][0]
_____
conv4_block13_0_relu (Activatio (None, 9, 9, 640)   0   conv4_block13_0_bn[0][0]
_____
conv4_block13_1_conv (Conv2D)   (None, 9, 9, 128)   81920   conv4_block13_0_relu[0][0]
_____
conv4_block13_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block13_1_conv[0][0]
_____
conv4_block13_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block13_1_bn[0][0]
_____
conv4_block13_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block13_1_relu[0][0]
_____
conv4_block13_concat (Concatena (None, 9, 9, 672)   0   conv4_block12_concat[0][0]
                                                               conv4_block13_2_conv[0][0]
_____
conv4_block14_0_bn (BatchNormal (None, 9, 9, 672)   2688   conv4_block13_concat[0][0]
_____
conv4_block14_0_relu (Activatio (None, 9, 9, 672)   0   conv4_block14_0_bn[0][0]
_____
conv4_block14_1_conv (Conv2D)   (None, 9, 9, 128)   86016   conv4_block14_0_relu[0][0]
_____
conv4_block14_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block14_1_conv[0][0]
_____
conv4_block14_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block14_1_bn[0][0]
_____
conv4_block14_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block14_1_relu[0][0]
_____
conv4_block14_concat (Concatena (None, 9, 9, 704)   0   conv4_block13_concat[0][0]
                                                               conv4_block14_2_conv[0][0]
_____
conv4_block15_0_bn (BatchNormal (None, 9, 9, 704)   2816   conv4_block14_concat[0][0]

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Layer	Output Shape	Param #	Connected to
conv4_block15_0_relu (Activatio	(None, 9, 9, 704)	0	conv4_block15_0_bn[0][0]
conv4_block15_1_conv (Conv2D)	(None, 9, 9, 128)	90112	conv4_block15_0_relu[0][0]
conv4_block15_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block15_1_conv[0][0]
conv4_block15_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block15_1_bn[0][0]
conv4_block15_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block15_1_relu[0][0]
conv4_block15_concat (Concatena	(None, 9, 9, 736)	0	conv4_block14_concat[0][0] conv4_block15_2_conv[0][0]
conv4_block16_0_bn (BatchNormal	(None, 9, 9, 736)	2944	conv4_block15_concat[0][0]
conv4_block16_0_relu (Activatio	(None, 9, 9, 736)	0	conv4_block16_0_bn[0][0]
conv4_block16_1_conv (Conv2D)	(None, 9, 9, 128)	94208	conv4_block16_0_relu[0][0]
conv4_block16_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block16_1_conv[0][0]
conv4_block16_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block16_1_bn[0][0]
conv4_block16_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block16_1_relu[0][0]
conv4_block16_concat (Concatena	(None, 9, 9, 768)	0	conv4_block15_concat[0][0] conv4_block16_2_conv[0][0]
conv4_block17_0_bn (BatchNormal	(None, 9, 9, 768)	3072	conv4_block16_concat[0][0]
conv4_block17_0_relu (Activatio	(None, 9, 9, 768)	0	conv4_block17_0_bn[0][0]
conv4_block17_1_conv (Conv2D)	(None, 9, 9, 128)	98304	conv4_block17_0_relu[0][0]
conv4_block17_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block17_1_conv[0][0]
conv4_block17_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block17_1_bn[0][0]
conv4_block17_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block17_1_relu[0][0]
conv4_block17_concat (Concatena	(None, 9, 9, 800)	0	conv4_block16_concat[0][0] conv4_block17_2_conv[0][0]
conv4_block18_0_bn (BatchNormal	(None, 9, 9, 800)	3200	conv4_block17_concat[0][0]
conv4_block18_0_relu (Activatio	(None, 9, 9, 800)	0	conv4_block18_0_bn[0][0]

Layer (type)	Output Shape	Param #	Connected to
conv4_block18_1_conv (Conv2D)	(None, 9, 9, 128)	102400	conv4_block18_0_relu[0][0]
conv4_block18_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block18_1_conv[0][0]
conv4_block18_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block18_1_bn[0][0]
conv4_block18_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block18_1_relu[0][0]
conv4_block18_concat (Concatena	(None, 9, 9, 832)	0	conv4_block17_concat[0][0] conv4_block18_2_conv[0][0]
conv4_block19_0_bn (BatchNormal	(None, 9, 9, 832)	3328	conv4_block18_concat[0][0]
conv4_block19_0_relu (Activatio	(None, 9, 9, 832)	0	conv4_block19_0_bn[0][0]
conv4_block19_1_conv (Conv2D)	(None, 9, 9, 128)	106496	conv4_block19_0_relu[0][0]
conv4_block19_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block19_1_conv[0][0]
conv4_block19_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block19_1_bn[0][0]
conv4_block19_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block19_1_relu[0][0]
conv4_block19_concat (Concatena	(None, 9, 9, 864)	0	conv4_block18_concat[0][0] conv4_block19_2_conv[0][0]
conv4_block20_0_bn (BatchNormal	(None, 9, 9, 864)	3456	conv4_block19_concat[0][0]
conv4_block20_0_relu (Activatio	(None, 9, 9, 864)	0	conv4_block20_0_bn[0][0]
conv4_block20_1_conv (Conv2D)	(None, 9, 9, 128)	110592	conv4_block20_0_relu[0][0]
conv4_block20_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block20_1_conv[0][0]
conv4_block20_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block20_1_bn[0][0]
conv4_block20_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block20_1_relu[0][0]
conv4_block20_concat (Concatena	(None, 9, 9, 896)	0	conv4_block19_concat[0][0] conv4_block20_2_conv[0][0]
conv4_block21_0_bn (BatchNormal	(None, 9, 9, 896)	3584	conv4_block20_concat[0][0]
conv4_block21_0_relu (Activatio	(None, 9, 9, 896)	0	conv4_block21_0_bn[0][0]
conv4_block21_1_conv (Conv2D)	(None, 9, 9, 128)	114688	conv4_block21_0_relu[0][0]
conv4_block21_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block21_1_conv[0][0]

conv4_block21_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block21_1_bn[0][0]
conv4_block21_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block21_1_relu[0][0]
conv4_block21_concat (Concatena	(None, 9, 9, 928)	0	conv4_block20_concat[0][0]
			conv4_block21_2_conv[0][0]
conv4_block22_0_bn (BatchNormal	(None, 9, 9, 928)	3712	conv4_block21_concat[0][0]
conv4_block22_0_relu (Activatio	(None, 9, 9, 928)	0	conv4_block22_0_bn[0][0]
conv4_block22_1_conv (Conv2D)	(None, 9, 9, 128)	118784	conv4_block22_0_relu[0][0]
conv4_block22_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block22_1_conv[0][0]
conv4_block22_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block22_1_bn[0][0]
conv4_block22_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block22_1_relu[0][0]
conv4_block22_concat (Concatena	(None, 9, 9, 960)	0	conv4_block21_concat[0][0]
			conv4_block22_2_conv[0][0]
conv4_block23_0_bn (BatchNormal	(None, 9, 9, 960)	3840	conv4_block22_concat[0][0]
conv4_block23_0_relu (Activatio	(None, 9, 9, 960)	0	conv4_block23_0_bn[0][0]
conv4_block23_1_conv (Conv2D)	(None, 9, 9, 128)	122880	conv4_block23_0_relu[0][0]
conv4_block23_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block23_1_conv[0][0]
conv4_block23_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block23_1_bn[0][0]
conv4_block23_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block23_1_relu[0][0]
conv4_block23_concat (Concatena	(None, 9, 9, 992)	0	conv4_block22_concat[0][0]
			conv4_block23_2_conv[0][0]
conv4_block24_0_bn (BatchNormal	(None, 9, 9, 992)	3968	conv4_block23_concat[0][0]
conv4_block24_0_relu (Activatio	(None, 9, 9, 992)	0	conv4_block24_0_bn[0][0]
conv4_block24_1_conv (Conv2D)	(None, 9, 9, 128)	126976	conv4_block24_0_relu[0][0]
conv4_block24_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block24_1_conv[0][0]
conv4_block24_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block24_1_bn[0][0]

conv4_block24_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block24_1_relu[0][0]
_____
conv4_block24_concat (Concatena (None, 9, 9, 1024)   0   conv4_block23_concat[0][0]
                                                          conv4_block24_2_conv[0][0]
_____
conv4_block25_0_bn (BatchNormal (None, 9, 9, 1024)   4096   conv4_block24_concat[0][0]
_____
conv4_block25_0_relu (Activatio (None, 9, 9, 1024)   0   conv4_block25_0_bn[0][0]
_____
conv4_block25_1_conv (Conv2D)   (None, 9, 9, 128)   131072   conv4_block25_0_relu[0][0]
_____
conv4_block25_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block25_1_conv[0][0]
_____
conv4_block25_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block25_1_bn[0][0]
_____
conv4_block25_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block25_1_relu[0][0]
_____
conv4_block25_concat (Concatena (None, 9, 9, 1056)   0   conv4_block24_concat[0][0]
                                                          conv4_block25_2_conv[0][0]
_____
conv4_block26_0_bn (BatchNormal (None, 9, 9, 1056)   4224   conv4_block25_concat[0][0]
_____
conv4_block26_0_relu (Activatio (None, 9, 9, 1056)   0   conv4_block26_0_bn[0][0]
_____
conv4_block26_1_conv (Conv2D)   (None, 9, 9, 128)   135168   conv4_block26_0_relu[0][0]
_____
conv4_block26_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block26_1_conv[0][0]
_____
conv4_block26_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block26_1_bn[0][0]
_____
conv4_block26_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block26_1_relu[0][0]
_____
conv4_block26_concat (Concatena (None, 9, 9, 1088)   0   conv4_block25_concat[0][0]
                                                          conv4_block26_2_conv[0][0]
_____
conv4_block27_0_bn (BatchNormal (None, 9, 9, 1088)   4352   conv4_block26_concat[0][0]
_____
conv4_block27_0_relu (Activatio (None, 9, 9, 1088)   0   conv4_block27_0_bn[0][0]
_____
conv4_block27_1_conv (Conv2D)   (None, 9, 9, 128)   139264   conv4_block27_0_relu[0][0]
_____
conv4_block27_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block27_1_conv[0][0]
_____
conv4_block27_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block27_1_bn[0][0]
_____
conv4_block27_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block27_1_relu[0][0]
_____
conv4_block27_concat (Concatena (None, 9, 9, 1120)   0   conv4_block26_concat[0][0]

conv4_block27_2_conv[0][0]
_____
conv4_block28_0_bn (BatchNormal (None, 9, 9, 1120)   4480   conv4_block27_concat[0][0]
_____
conv4_block28_0_relu (Activatio (None, 9, 9, 1120)   0   conv4_block28_0_bn[0][0]
_____
conv4_block28_1_conv (Conv2D)   (None, 9, 9, 128)   143360   conv4_block28_0_relu[0][0]
_____
conv4_block28_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block28_1_conv[0][0]
_____
conv4_block28_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block28_1_bn[0][0]
_____
conv4_block28_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block28_1_relu[0][0]
_____
conv4_block28_concat (Concatena (None, 9, 9, 1152)   0   conv4_block27_concat[0][0]
                                                                 conv4_block28_2_conv[0][0]
_____
conv4_block29_0_bn (BatchNormal (None, 9, 9, 1152)   4608   conv4_block28_concat[0][0]
_____
conv4_block29_0_relu (Activatio (None, 9, 9, 1152)   0   conv4_block29_0_bn[0][0]
_____
conv4_block29_1_conv (Conv2D)   (None, 9, 9, 128)   147456   conv4_block29_0_relu[0][0]
_____
conv4_block29_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block29_1_conv[0][0]
_____
conv4_block29_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block29_1_bn[0][0]
_____
conv4_block29_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block29_1_relu[0][0]
_____
conv4_block29_concat (Concatena (None, 9, 9, 1184)   0   conv4_block28_concat[0][0]
                                                                 conv4_block29_2_conv[0][0]
_____
conv4_block30_0_bn (BatchNormal (None, 9, 9, 1184)   4736   conv4_block29_concat[0][0]
_____
conv4_block30_0_relu (Activatio (None, 9, 9, 1184)   0   conv4_block30_0_bn[0][0]
_____
conv4_block30_1_conv (Conv2D)   (None, 9, 9, 128)   151552   conv4_block30_0_relu[0][0]
_____
conv4_block30_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block30_1_conv[0][0]
_____
conv4_block30_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block30_1_bn[0][0]
_____
conv4_block30_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block30_1_relu[0][0]
_____
conv4_block30_concat (Concatena (None, 9, 9, 1216)   0   conv4_block29_concat[0][0]
                                                                 conv4_block30_2_conv[0][0]
_____
conv4_block31_0_bn (BatchNormal (None, 9, 9, 1216)   4864   conv4_block30_concat[0][0]

conv4_block31_0_relu (Activatio	(None, 9, 9, 1216)	0	conv4_block31_0_bn[0][0]
conv4_block31_1_conv (Conv2D)	(None, 9, 9, 128)	155648	conv4_block31_0_relu[0][0]
conv4_block31_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block31_1_conv[0][0]
conv4_block31_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block31_1_bn[0][0]
conv4_block31_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block31_1_relu[0][0]
conv4_block31_concat (Concatena	(None, 9, 9, 1248)	0	conv4_block30_concat[0][0] conv4_block31_2_conv[0][0]
conv4_block32_0_bn (BatchNormal	(None, 9, 9, 1248)	4992	conv4_block31_concat[0][0]
conv4_block32_0_relu (Activatio	(None, 9, 9, 1248)	0	conv4_block32_0_bn[0][0]
conv4_block32_1_conv (Conv2D)	(None, 9, 9, 128)	159744	conv4_block32_0_relu[0][0]
conv4_block32_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block32_1_conv[0][0]
conv4_block32_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block32_1_bn[0][0]
conv4_block32_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block32_1_relu[0][0]
conv4_block32_concat (Concatena	(None, 9, 9, 1280)	0	conv4_block31_concat[0][0] conv4_block32_2_conv[0][0]
conv4_block33_0_bn (BatchNormal	(None, 9, 9, 1280)	5120	conv4_block32_concat[0][0]
conv4_block33_0_relu (Activatio	(None, 9, 9, 1280)	0	conv4_block33_0_bn[0][0]
conv4_block33_1_conv (Conv2D)	(None, 9, 9, 128)	163840	conv4_block33_0_relu[0][0]
conv4_block33_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block33_1_conv[0][0]
conv4_block33_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block33_1_bn[0][0]
conv4_block33_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block33_1_relu[0][0]
conv4_block33_concat (Concatena	(None, 9, 9, 1312)	0	conv4_block32_concat[0][0] conv4_block33_2_conv[0][0]
conv4_block34_0_bn (BatchNormal	(None, 9, 9, 1312)	5248	conv4_block33_concat[0][0]
conv4_block34_0_relu (Activatio	(None, 9, 9, 1312)	0	conv4_block34_0_bn[0][0]

conv4_block34_1_conv (Conv2D) (None, 9, 9, 128) 167936 conv4_block34_0_relu[0][0]

conv4_block34_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block34_1_conv[0][0]

conv4_block34_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block34_1_bn[0][0]

conv4_block34_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block34_1_relu[0][0]

conv4_block34_concat (Concatena (None, 9, 9, 1344) 0 conv4_block33_concat[0][0]
                                                       conv4_block34_2_conv[0][0]

conv4_block35_0_bn (BatchNormal (None, 9, 9, 1344) 5376 conv4_block34_concat[0][0]

conv4_block35_0_relu (Activatio (None, 9, 9, 1344) 0 conv4_block35_0_bn[0][0]

conv4_block35_1_conv (Conv2D) (None, 9, 9, 128) 172032 conv4_block35_0_relu[0][0]

conv4_block35_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block35_1_conv[0][0]

conv4_block35_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block35_1_bn[0][0]

conv4_block35_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block35_1_relu[0][0]

conv4_block35_concat (Concatena (None, 9, 9, 1376) 0 conv4_block34_concat[0][0]
                                                       conv4_block35_2_conv[0][0]

conv4_block36_0_bn (BatchNormal (None, 9, 9, 1376) 5504 conv4_block35_concat[0][0]

conv4_block36_0_relu (Activatio (None, 9, 9, 1376) 0 conv4_block36_0_bn[0][0]

conv4_block36_1_conv (Conv2D) (None, 9, 9, 128) 176128 conv4_block36_0_relu[0][0]

conv4_block36_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block36_1_conv[0][0]

conv4_block36_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block36_1_bn[0][0]

conv4_block36_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block36_1_relu[0][0]

conv4_block36_concat (Concatena (None, 9, 9, 1408) 0 conv4_block35_concat[0][0]
                                                       conv4_block36_2_conv[0][0]

conv4_block37_0_bn (BatchNormal (None, 9, 9, 1408) 5632 conv4_block36_concat[0][0]

conv4_block37_0_relu (Activatio (None, 9, 9, 1408) 0 conv4_block37_0_bn[0][0]

conv4_block37_1_conv (Conv2D) (None, 9, 9, 128) 180224 conv4_block37_0_relu[0][0]

conv4_block37_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block37_1_conv[0][0]

```
conv4_block37_1_relu (Activatio (None, 9, 9, 128)    0          conv4_block37_1_bn[0][0]
_____
conv4_block37_2_conv (Conv2D)   (None, 9, 9, 32)     36864      conv4_block37_1_relu[0][0]
_____
conv4_block37_concat (Concatena (None, 9, 9, 1440)   0          conv4_block36_concat[0][0]
                                                                conv4_block37_2_conv[0][0]
_____
conv4_block38_0_bn (BatchNormal (None, 9, 9, 1440)   5760       conv4_block37_concat[0][0]
_____
conv4_block38_0_relu (Activatio (None, 9, 9, 1440)   0          conv4_block38_0_bn[0][0]
_____
conv4_block38_1_conv (Conv2D)   (None, 9, 9, 128)    184320     conv4_block38_0_relu[0][0]
_____
conv4_block38_1_bn (BatchNormal (None, 9, 9, 128)    512        conv4_block38_1_conv[0][0]
_____
conv4_block38_1_relu (Activatio (None, 9, 9, 128)    0          conv4_block38_1_bn[0][0]
_____
conv4_block38_2_conv (Conv2D)   (None, 9, 9, 32)     36864      conv4_block38_1_relu[0][0]
_____
conv4_block38_concat (Concatena (None, 9, 9, 1472)   0          conv4_block37_concat[0][0]
                                                                conv4_block38_2_conv[0][0]
_____
conv4_block39_0_bn (BatchNormal (None, 9, 9, 1472)   5888       conv4_block38_concat[0][0]
_____
conv4_block39_0_relu (Activatio (None, 9, 9, 1472)   0          conv4_block39_0_bn[0][0]
_____
conv4_block39_1_conv (Conv2D)   (None, 9, 9, 128)    188416     conv4_block39_0_relu[0][0]
_____
conv4_block39_1_bn (BatchNormal (None, 9, 9, 128)    512        conv4_block39_1_conv[0][0]
_____
conv4_block39_1_relu (Activatio (None, 9, 9, 128)    0          conv4_block39_1_bn[0][0]
_____
conv4_block39_2_conv (Conv2D)   (None, 9, 9, 32)     36864      conv4_block39_1_relu[0][0]
_____
conv4_block39_concat (Concatena (None, 9, 9, 1504)   0          conv4_block38_concat[0][0]
                                                                conv4_block39_2_conv[0][0]
_____
conv4_block40_0_bn (BatchNormal (None, 9, 9, 1504)   6016       conv4_block39_concat[0][0]
_____
conv4_block40_0_relu (Activatio (None, 9, 9, 1504)   0          conv4_block40_0_bn[0][0]
_____
conv4_block40_1_conv (Conv2D)   (None, 9, 9, 128)    192512     conv4_block40_0_relu[0][0]
_____
conv4_block40_1_bn (BatchNormal (None, 9, 9, 128)    512        conv4_block40_1_conv[0][0]
_____
conv4_block40_1_relu (Activatio (None, 9, 9, 128)    0          conv4_block40_1_bn[0][0]
_____
```

conv4_block40_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block40_1_relu[0][0]

_____

conv4_block40_concat (Concatena (None, 9, 9, 1536) 0 conv4_block39_concat[0][0]
                                                          conv4_block40_2_conv[0][0]

_____

conv4_block41_0_bn (BatchNormal (None, 9, 9, 1536) 6144 conv4_block40_concat[0][0]

_____

conv4_block41_0_relu (Activatio (None, 9, 9, 1536) 0 conv4_block41_0_bn[0][0]

_____

conv4_block41_1_conv (Conv2D) (None, 9, 9, 128) 196608 conv4_block41_0_relu[0][0]

_____

conv4_block41_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block41_1_conv[0][0]

_____

conv4_block41_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block41_1_bn[0][0]

_____

conv4_block41_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block41_1_relu[0][0]

_____

conv4_block41_concat (Concatena (None, 9, 9, 1568) 0 conv4_block40_concat[0][0]
                                                          conv4_block41_2_conv[0][0]

_____

conv4_block42_0_bn (BatchNormal (None, 9, 9, 1568) 6272 conv4_block41_concat[0][0]

_____

conv4_block42_0_relu (Activatio (None, 9, 9, 1568) 0 conv4_block42_0_bn[0][0]

_____

conv4_block42_1_conv (Conv2D) (None, 9, 9, 128) 200704 conv4_block42_0_relu[0][0]

_____

conv4_block42_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block42_1_conv[0][0]

_____

conv4_block42_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block42_1_bn[0][0]

_____

conv4_block42_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block42_1_relu[0][0]

_____

conv4_block42_concat (Concatena (None, 9, 9, 1600) 0 conv4_block41_concat[0][0]
                                                          conv4_block42_2_conv[0][0]

_____

conv4_block43_0_bn (BatchNormal (None, 9, 9, 1600) 6400 conv4_block42_concat[0][0]

_____

conv4_block43_0_relu (Activatio (None, 9, 9, 1600) 0 conv4_block43_0_bn[0][0]

_____

conv4_block43_1_conv (Conv2D) (None, 9, 9, 128) 204800 conv4_block43_0_relu[0][0]

_____

conv4_block43_1_bn (BatchNormal (None, 9, 9, 128) 512 conv4_block43_1_conv[0][0]

_____

conv4_block43_1_relu (Activatio (None, 9, 9, 128) 0 conv4_block43_1_bn[0][0]

_____

conv4_block43_2_conv (Conv2D) (None, 9, 9, 32) 36864 conv4_block43_1_relu[0][0]

_____

conv4_block43_concat (Concatena (None, 9, 9, 1632) 0 conv4_block42_concat[0][0]

conv4_block43_2_conv[0][0]

_____

conv4_block44_0_bn (BatchNormal (None, 9, 9, 1632)   6528   conv4_block43_concat[0][0]

_____

conv4_block44_0_relu (Activatio (None, 9, 9, 1632)   0   conv4_block44_0_bn[0][0]

_____

conv4_block44_1_conv (Conv2D)   (None, 9, 9, 128)   208896   conv4_block44_0_relu[0][0]

_____

conv4_block44_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block44_1_conv[0][0]

_____

conv4_block44_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block44_1_bn[0][0]

_____

conv4_block44_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block44_1_relu[0][0]

_____

conv4_block44_concat (Concatena (None, 9, 9, 1664)   0   conv4_block43_concat[0][0]
                                                                 conv4_block44_2_conv[0][0]

_____

conv4_block45_0_bn (BatchNormal (None, 9, 9, 1664)   6656   conv4_block44_concat[0][0]

_____

conv4_block45_0_relu (Activatio (None, 9, 9, 1664)   0   conv4_block45_0_bn[0][0]

_____

conv4_block45_1_conv (Conv2D)   (None, 9, 9, 128)   212992   conv4_block45_0_relu[0][0]

_____

conv4_block45_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block45_1_conv[0][0]

_____

conv4_block45_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block45_1_bn[0][0]

_____

conv4_block45_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block45_1_relu[0][0]

_____

conv4_block45_concat (Concatena (None, 9, 9, 1696)   0   conv4_block44_concat[0][0]
                                                                 conv4_block45_2_conv[0][0]

_____

conv4_block46_0_bn (BatchNormal (None, 9, 9, 1696)   6784   conv4_block45_concat[0][0]

_____

conv4_block46_0_relu (Activatio (None, 9, 9, 1696)   0   conv4_block46_0_bn[0][0]

_____

conv4_block46_1_conv (Conv2D)   (None, 9, 9, 128)   217088   conv4_block46_0_relu[0][0]

_____

conv4_block46_1_bn (BatchNormal (None, 9, 9, 128)   512   conv4_block46_1_conv[0][0]

_____

conv4_block46_1_relu (Activatio (None, 9, 9, 128)   0   conv4_block46_1_bn[0][0]

_____

conv4_block46_2_conv (Conv2D)   (None, 9, 9, 32)   36864   conv4_block46_1_relu[0][0]

_____

conv4_block46_concat (Concatena (None, 9, 9, 1728)   0   conv4_block45_concat[0][0]
                                                                 conv4_block46_2_conv[0][0]

_____

conv4_block47_0_bn (BatchNormal (None, 9, 9, 1728)   6912   conv4_block46_concat[0][0]

conv4_block47_0_relu (Activatio	(None, 9, 9, 1728)	0	conv4_block47_0_bn[0][0]
conv4_block47_1_conv (Conv2D)	(None, 9, 9, 128)	221184	conv4_block47_0_relu[0][0]
conv4_block47_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block47_1_conv[0][0]
conv4_block47_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block47_1_bn[0][0]
conv4_block47_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block47_1_relu[0][0]
conv4_block47_concat (Concatena	(None, 9, 9, 1760)	0	conv4_block46_concat[0][0]
			conv4_block47_2_conv[0][0]
conv4_block48_0_bn (BatchNormal	(None, 9, 9, 1760)	7040	conv4_block47_concat[0][0]
conv4_block48_0_relu (Activatio	(None, 9, 9, 1760)	0	conv4_block48_0_bn[0][0]
conv4_block48_1_conv (Conv2D)	(None, 9, 9, 128)	225280	conv4_block48_0_relu[0][0]
conv4_block48_1_bn (BatchNormal	(None, 9, 9, 128)	512	conv4_block48_1_conv[0][0]
conv4_block48_1_relu (Activatio	(None, 9, 9, 128)	0	conv4_block48_1_bn[0][0]
conv4_block48_2_conv (Conv2D)	(None, 9, 9, 32)	36864	conv4_block48_1_relu[0][0]
conv4_block48_concat (Concatena	(None, 9, 9, 1792)	0	conv4_block47_concat[0][0]
			conv4_block48_2_conv[0][0]
pool4_bn (BatchNormalization)	(None, 9, 9, 1792)	7168	conv4_block48_concat[0][0]
pool4_relu (Activation)	(None, 9, 9, 1792)	0	pool4_bn[0][0]
pool4_conv (Conv2D)	(None, 9, 9, 896)	1605632	pool4_relu[0][0]
pool4_pool (AveragePooling2D)	(None, 4, 4, 896)	0	pool4_conv[0][0]
conv5_block1_0_bn (BatchNormali	(None, 4, 4, 896)	3584	pool4_pool[0][0]
conv5_block1_0_relu (Activation	(None, 4, 4, 896)	0	conv5_block1_0_bn[0][0]
conv5_block1_1_conv (Conv2D)	(None, 4, 4, 128)	114688	conv5_block1_0_relu[0][0]
conv5_block1_1_bn (BatchNormali	(None, 4, 4, 128)	512	conv5_block1_1_conv[0][0]
conv5_block1_1_relu (Activation	(None, 4, 4, 128)	0	conv5_block1_1_bn[0][0]
conv5_block1_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block1_1_relu[0][0]

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_____
conv5_block1_concat (Concatenat (None, 4, 4, 928)    0           pool4_pool[0][0]
                                                                 conv5_block1_2_conv[0][0]
_____
conv5_block2_0_bn (BatchNormali (None, 4, 4, 928)    3712        conv5_block1_concat[0][0]
_____
conv5_block2_0_relu (Activation (None, 4, 4, 928)    0           conv5_block2_0_bn[0][0]
_____
conv5_block2_1_conv (Conv2D)    (None, 4, 4, 128)    118784      conv5_block2_0_relu[0][0]
_____
conv5_block2_1_bn (BatchNormali (None, 4, 4, 128)    512         conv5_block2_1_conv[0][0]
_____
conv5_block2_1_relu (Activation (None, 4, 4, 128)    0           conv5_block2_1_bn[0][0]
_____
conv5_block2_2_conv (Conv2D)    (None, 4, 4, 32)     36864       conv5_block2_1_relu[0][0]
_____
conv5_block2_concat (Concatenat (None, 4, 4, 960)    0           conv5_block1_concat[0][0]
                                                                 conv5_block2_2_conv[0][0]
_____
conv5_block3_0_bn (BatchNormali (None, 4, 4, 960)    3840        conv5_block2_concat[0][0]
_____
conv5_block3_0_relu (Activation (None, 4, 4, 960)    0           conv5_block3_0_bn[0][0]
_____
conv5_block3_1_conv (Conv2D)    (None, 4, 4, 128)    122880      conv5_block3_0_relu[0][0]
_____
conv5_block3_1_bn (BatchNormali (None, 4, 4, 128)    512         conv5_block3_1_conv[0][0]
_____
conv5_block3_1_relu (Activation (None, 4, 4, 128)    0           conv5_block3_1_bn[0][0]
_____
conv5_block3_2_conv (Conv2D)    (None, 4, 4, 32)     36864       conv5_block3_1_relu[0][0]
_____
conv5_block3_concat (Concatenat (None, 4, 4, 992)    0           conv5_block2_concat[0][0]
                                                                 conv5_block3_2_conv[0][0]
_____
conv5_block4_0_bn (BatchNormali (None, 4, 4, 992)    3968        conv5_block3_concat[0][0]
_____
conv5_block4_0_relu (Activation (None, 4, 4, 992)    0           conv5_block4_0_bn[0][0]
_____
conv5_block4_1_conv (Conv2D)    (None, 4, 4, 128)    126976      conv5_block4_0_relu[0][0]
_____
conv5_block4_1_bn (BatchNormali (None, 4, 4, 128)    512         conv5_block4_1_conv[0][0]
_____
conv5_block4_1_relu (Activation (None, 4, 4, 128)    0           conv5_block4_1_bn[0][0]
_____
conv5_block4_2_conv (Conv2D)    (None, 4, 4, 32)     36864       conv5_block4_1_relu[0][0]
_____
conv5_block4_concat (Concatenat (None, 4, 4, 1024)   0           conv5_block3_concat[0][0]
                                                                 conv5_block4_2_conv[0][0]
```

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conv5_block5_0_bn (BatchNormali (None, 4, 4, 1024)   4096       conv5_block4_concat[0][0]
_____
conv5_block5_0_relu (Activation (None, 4, 4, 1024)   0          conv5_block5_0_bn[0][0]
_____
conv5_block5_1_conv (Conv2D)    (None, 4, 4, 128)    131072     conv5_block5_0_relu[0][0]
_____
conv5_block5_1_bn (BatchNormali (None, 4, 4, 128)    512        conv5_block5_1_conv[0][0]
_____
conv5_block5_1_relu (Activation (None, 4, 4, 128)    0          conv5_block5_1_bn[0][0]
_____
conv5_block5_2_conv (Conv2D)    (None, 4, 4, 32)     36864      conv5_block5_1_relu[0][0]
_____
conv5_block5_concat (Concatenat (None, 4, 4, 1056)   0          conv5_block4_concat[0][0]
                                                                conv5_block5_2_conv[0][0]
_____
conv5_block6_0_bn (BatchNormali (None, 4, 4, 1056)   4224       conv5_block5_concat[0][0]
_____
conv5_block6_0_relu (Activation (None, 4, 4, 1056)   0          conv5_block6_0_bn[0][0]
_____
conv5_block6_1_conv (Conv2D)    (None, 4, 4, 128)    135168     conv5_block6_0_relu[0][0]
_____
conv5_block6_1_bn (BatchNormali (None, 4, 4, 128)    512        conv5_block6_1_conv[0][0]
_____
conv5_block6_1_relu (Activation (None, 4, 4, 128)    0          conv5_block6_1_bn[0][0]
_____
conv5_block6_2_conv (Conv2D)    (None, 4, 4, 32)     36864      conv5_block6_1_relu[0][0]
_____
conv5_block6_concat (Concatenat (None, 4, 4, 1088)   0          conv5_block5_concat[0][0]
                                                                conv5_block6_2_conv[0][0]
_____
conv5_block7_0_bn (BatchNormali (None, 4, 4, 1088)   4352       conv5_block6_concat[0][0]
_____
conv5_block7_0_relu (Activation (None, 4, 4, 1088)   0          conv5_block7_0_bn[0][0]
_____
conv5_block7_1_conv (Conv2D)    (None, 4, 4, 128)    139264     conv5_block7_0_relu[0][0]
_____
conv5_block7_1_bn (BatchNormali (None, 4, 4, 128)    512        conv5_block7_1_conv[0][0]
_____
conv5_block7_1_relu (Activation (None, 4, 4, 128)    0          conv5_block7_1_bn[0][0]
_____
conv5_block7_2_conv (Conv2D)    (None, 4, 4, 32)     36864      conv5_block7_1_relu[0][0]
_____
conv5_block7_concat (Concatenat (None, 4, 4, 1120)   0          conv5_block6_concat[0][0]
                                                                conv5_block7_2_conv[0][0]
_____
conv5_block8_0_bn (BatchNormali (None, 4, 4, 1120)   4480       conv5_block7_concat[0][0]
_____
```

Layer (type)	Output Shape	Param #	Connected to
conv5_block8_0_relu (Activation	(None, 4, 4, 1120)	0	conv5_block8_0_bn[0][0]
conv5_block8_1_conv (Conv2D)	(None, 4, 4, 128)	143360	conv5_block8_0_relu[0][0]
conv5_block8_1_bn (BatchNormali	(None, 4, 4, 128)	512	conv5_block8_1_conv[0][0]
conv5_block8_1_relu (Activation	(None, 4, 4, 128)	0	conv5_block8_1_bn[0][0]
conv5_block8_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block8_1_relu[0][0]
conv5_block8_concat (Concatenat	(None, 4, 4, 1152)	0	conv5_block7_concat[0][0]
			conv5_block8_2_conv[0][0]
conv5_block9_0_bn (BatchNormali	(None, 4, 4, 1152)	4608	conv5_block8_concat[0][0]
conv5_block9_0_relu (Activation	(None, 4, 4, 1152)	0	conv5_block9_0_bn[0][0]
conv5_block9_1_conv (Conv2D)	(None, 4, 4, 128)	147456	conv5_block9_0_relu[0][0]
conv5_block9_1_bn (BatchNormali	(None, 4, 4, 128)	512	conv5_block9_1_conv[0][0]
conv5_block9_1_relu (Activation	(None, 4, 4, 128)	0	conv5_block9_1_bn[0][0]
conv5_block9_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block9_1_relu[0][0]
conv5_block9_concat (Concatenat	(None, 4, 4, 1184)	0	conv5_block8_concat[0][0]
			conv5_block9_2_conv[0][0]
conv5_block10_0_bn (BatchNormal	(None, 4, 4, 1184)	4736	conv5_block9_concat[0][0]
conv5_block10_0_relu (Activatio	(None, 4, 4, 1184)	0	conv5_block10_0_bn[0][0]
conv5_block10_1_conv (Conv2D)	(None, 4, 4, 128)	151552	conv5_block10_0_relu[0][0]
conv5_block10_1_bn (BatchNormal	(None, 4, 4, 128)	512	conv5_block10_1_conv[0][0]
conv5_block10_1_relu (Activatio	(None, 4, 4, 128)	0	conv5_block10_1_bn[0][0]
conv5_block10_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block10_1_relu[0][0]
conv5_block10_concat (Concatena	(None, 4, 4, 1216)	0	conv5_block9_concat[0][0]
			conv5_block10_2_conv[0][0]
conv5_block11_0_bn (BatchNormal	(None, 4, 4, 1216)	4864	conv5_block10_concat[0][0]
conv5_block11_0_relu (Activatio	(None, 4, 4, 1216)	0	conv5_block11_0_bn[0][0]
conv5_block11_1_conv (Conv2D)	(None, 4, 4, 128)	155648	conv5_block11_0_relu[0][0]

conv5_block11_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block11_1_conv[0][0]
_____
conv5_block11_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block11_1_bn[0][0]
_____
conv5_block11_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block11_1_relu[0][0]
_____
conv5_block11_concat (Concatena (None, 4, 4, 1248)   0   conv5_block10_concat[0][0]
                                                                conv5_block11_2_conv[0][0]
_____
conv5_block12_0_bn (BatchNormal (None, 4, 4, 1248)   4992   conv5_block11_concat[0][0]
_____
conv5_block12_0_relu (Activatio (None, 4, 4, 1248)   0   conv5_block12_0_bn[0][0]
_____
conv5_block12_1_conv (Conv2D)   (None, 4, 4, 128)   159744   conv5_block12_0_relu[0][0]
_____
conv5_block12_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block12_1_conv[0][0]
_____
conv5_block12_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block12_1_bn[0][0]
_____
conv5_block12_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block12_1_relu[0][0]
_____
conv5_block12_concat (Concatena (None, 4, 4, 1280)   0   conv5_block11_concat[0][0]
                                                                conv5_block12_2_conv[0][0]
_____
conv5_block13_0_bn (BatchNormal (None, 4, 4, 1280)   5120   conv5_block12_concat[0][0]
_____
conv5_block13_0_relu (Activatio (None, 4, 4, 1280)   0   conv5_block13_0_bn[0][0]
_____
conv5_block13_1_conv (Conv2D)   (None, 4, 4, 128)   163840   conv5_block13_0_relu[0][0]
_____
conv5_block13_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block13_1_conv[0][0]
_____
conv5_block13_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block13_1_bn[0][0]
_____
conv5_block13_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block13_1_relu[0][0]
_____
conv5_block13_concat (Concatena (None, 4, 4, 1312)   0   conv5_block12_concat[0][0]
                                                                conv5_block13_2_conv[0][0]
_____
conv5_block14_0_bn (BatchNormal (None, 4, 4, 1312)   5248   conv5_block13_concat[0][0]
_____
conv5_block14_0_relu (Activatio (None, 4, 4, 1312)   0   conv5_block14_0_bn[0][0]
_____
conv5_block14_1_conv (Conv2D)   (None, 4, 4, 128)   167936   conv5_block14_0_relu[0][0]
_____
conv5_block14_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block14_1_conv[0][0]
_____

conv5_block14_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block14_1_bn[0][0]
_____
conv5_block14_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block14_1_relu[0][0]
_____
conv5_block14_concat (Concatena (None, 4, 4, 1344) 0   conv5_block13_concat[0][0]
                                                                conv5_block14_2_conv[0][0]
_____
conv5_block15_0_bn (BatchNormal (None, 4, 4, 1344) 5376   conv5_block14_concat[0][0]
_____
conv5_block15_0_relu (Activatio (None, 4, 4, 1344) 0   conv5_block15_0_bn[0][0]
_____
conv5_block15_1_conv (Conv2D)   (None, 4, 4, 128)   172032   conv5_block15_0_relu[0][0]
_____
conv5_block15_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block15_1_conv[0][0]
_____
conv5_block15_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block15_1_bn[0][0]
_____
conv5_block15_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block15_1_relu[0][0]
_____
conv5_block15_concat (Concatena (None, 4, 4, 1376) 0   conv5_block14_concat[0][0]
                                                                conv5_block15_2_conv[0][0]
_____
conv5_block16_0_bn (BatchNormal (None, 4, 4, 1376) 5504   conv5_block15_concat[0][0]
_____
conv5_block16_0_relu (Activatio (None, 4, 4, 1376) 0   conv5_block16_0_bn[0][0]
_____
conv5_block16_1_conv (Conv2D)   (None, 4, 4, 128)   176128   conv5_block16_0_relu[0][0]
_____
conv5_block16_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block16_1_conv[0][0]
_____
conv5_block16_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block16_1_bn[0][0]
_____
conv5_block16_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block16_1_relu[0][0]
_____
conv5_block16_concat (Concatena (None, 4, 4, 1408) 0   conv5_block15_concat[0][0]
                                                                conv5_block16_2_conv[0][0]
_____
conv5_block17_0_bn (BatchNormal (None, 4, 4, 1408) 5632   conv5_block16_concat[0][0]
_____
conv5_block17_0_relu (Activatio (None, 4, 4, 1408) 0   conv5_block17_0_bn[0][0]
_____
conv5_block17_1_conv (Conv2D)   (None, 4, 4, 128)   180224   conv5_block17_0_relu[0][0]
_____
conv5_block17_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block17_1_conv[0][0]
_____
conv5_block17_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block17_1_bn[0][0]
_____
conv5_block17_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block17_1_relu[0][0]

```
_____
conv5_block17_concat (Concatena (None, 4, 4, 1440)   0         conv5_block16_concat[0][0]
                                                               conv5_block17_2_conv[0][0]
_____
conv5_block18_0_bn (BatchNormal (None, 4, 4, 1440)   5760      conv5_block17_concat[0][0]
_____
conv5_block18_0_relu (Activatio (None, 4, 4, 1440)   0         conv5_block18_0_bn[0][0]
_____
conv5_block18_1_conv (Conv2D)   (None, 4, 4, 128)    184320    conv5_block18_0_relu[0][0]
_____
conv5_block18_1_bn (BatchNormal (None, 4, 4, 128)    512       conv5_block18_1_conv[0][0]
_____
conv5_block18_1_relu (Activatio (None, 4, 4, 128)    0         conv5_block18_1_bn[0][0]
_____
conv5_block18_2_conv (Conv2D)   (None, 4, 4, 32)     36864     conv5_block18_1_relu[0][0]
_____
conv5_block18_concat (Concatena (None, 4, 4, 1472)   0         conv5_block17_concat[0][0]
                                                               conv5_block18_2_conv[0][0]
_____
conv5_block19_0_bn (BatchNormal (None, 4, 4, 1472)   5888      conv5_block18_concat[0][0]
_____
conv5_block19_0_relu (Activatio (None, 4, 4, 1472)   0         conv5_block19_0_bn[0][0]
_____
conv5_block19_1_conv (Conv2D)   (None, 4, 4, 128)    188416    conv5_block19_0_relu[0][0]
_____
conv5_block19_1_bn (BatchNormal (None, 4, 4, 128)    512       conv5_block19_1_conv[0][0]
_____
conv5_block19_1_relu (Activatio (None, 4, 4, 128)    0         conv5_block19_1_bn[0][0]
_____
conv5_block19_2_conv (Conv2D)   (None, 4, 4, 32)     36864     conv5_block19_1_relu[0][0]
_____
conv5_block19_concat (Concatena (None, 4, 4, 1504)   0         conv5_block18_concat[0][0]
                                                               conv5_block19_2_conv[0][0]
_____
conv5_block20_0_bn (BatchNormal (None, 4, 4, 1504)   6016      conv5_block19_concat[0][0]
_____
conv5_block20_0_relu (Activatio (None, 4, 4, 1504)   0         conv5_block20_0_bn[0][0]
_____
conv5_block20_1_conv (Conv2D)   (None, 4, 4, 128)    192512    conv5_block20_0_relu[0][0]
_____
conv5_block20_1_bn (BatchNormal (None, 4, 4, 128)    512       conv5_block20_1_conv[0][0]
_____
conv5_block20_1_relu (Activatio (None, 4, 4, 128)    0         conv5_block20_1_bn[0][0]
_____
conv5_block20_2_conv (Conv2D)   (None, 4, 4, 32)     36864     conv5_block20_1_relu[0][0]
_____
conv5_block20_concat (Concatena (None, 4, 4, 1536)   0         conv5_block19_concat[0][0]
                                                               conv5_block20_2_conv[0][0]
```

conv5_block21_0_bn (BatchNormal (None, 4, 4, 1536) 6144   conv5_block20_concat[0][0]
_____
conv5_block21_0_relu (Activatio (None, 4, 4, 1536) 0   conv5_block21_0_bn[0][0]
_____
conv5_block21_1_conv (Conv2D)   (None, 4, 4, 128)   196608   conv5_block21_0_relu[0][0]
_____
conv5_block21_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block21_1_conv[0][0]
_____
conv5_block21_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block21_1_bn[0][0]
_____
conv5_block21_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block21_1_relu[0][0]
_____
conv5_block21_concat (Concatena (None, 4, 4, 1568) 0   conv5_block20_concat[0][0]
                                                               conv5_block21_2_conv[0][0]
_____
conv5_block22_0_bn (BatchNormal (None, 4, 4, 1568) 6272   conv5_block21_concat[0][0]
_____
conv5_block22_0_relu (Activatio (None, 4, 4, 1568) 0   conv5_block22_0_bn[0][0]
_____
conv5_block22_1_conv (Conv2D)   (None, 4, 4, 128)   200704   conv5_block22_0_relu[0][0]
_____
conv5_block22_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block22_1_conv[0][0]
_____
conv5_block22_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block22_1_bn[0][0]
_____
conv5_block22_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block22_1_relu[0][0]
_____
conv5_block22_concat (Concatena (None, 4, 4, 1600) 0   conv5_block21_concat[0][0]
                                                               conv5_block22_2_conv[0][0]
_____
conv5_block23_0_bn (BatchNormal (None, 4, 4, 1600) 6400   conv5_block22_concat[0][0]
_____
conv5_block23_0_relu (Activatio (None, 4, 4, 1600) 0   conv5_block23_0_bn[0][0]
_____
conv5_block23_1_conv (Conv2D)   (None, 4, 4, 128)   204800   conv5_block23_0_relu[0][0]
_____
conv5_block23_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block23_1_conv[0][0]
_____
conv5_block23_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block23_1_bn[0][0]
_____
conv5_block23_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block23_1_relu[0][0]
_____
conv5_block23_concat (Concatena (None, 4, 4, 1632) 0   conv5_block22_concat[0][0]
                                                               conv5_block23_2_conv[0][0]
_____
conv5_block24_0_bn (BatchNormal (None, 4, 4, 1632) 6528   conv5_block23_concat[0][0]
_____

conv5_block24_0_relu (Activatio (None, 4, 4, 1632)   0   conv5_block24_0_bn[0][0]

_____
conv5_block24_1_conv (Conv2D)   (None, 4, 4, 128)   208896   conv5_block24_0_relu[0][0]

_____
conv5_block24_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block24_1_conv[0][0]

_____
conv5_block24_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block24_1_bn[0][0]

_____
conv5_block24_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block24_1_relu[0][0]

_____
conv5_block24_concat (Concatena (None, 4, 4, 1664)   0   conv5_block23_concat[0][0]
                                                               conv5_block24_2_conv[0][0]

_____
conv5_block25_0_bn (BatchNormal (None, 4, 4, 1664)   6656   conv5_block24_concat[0][0]

_____
conv5_block25_0_relu (Activatio (None, 4, 4, 1664)   0   conv5_block25_0_bn[0][0]

_____
conv5_block25_1_conv (Conv2D)   (None, 4, 4, 128)   212992   conv5_block25_0_relu[0][0]

_____
conv5_block25_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block25_1_conv[0][0]

_____
conv5_block25_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block25_1_bn[0][0]

_____
conv5_block25_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block25_1_relu[0][0]

_____
conv5_block25_concat (Concatena (None, 4, 4, 1696)   0   conv5_block24_concat[0][0]
                                                               conv5_block25_2_conv[0][0]

_____
conv5_block26_0_bn (BatchNormal (None, 4, 4, 1696)   6784   conv5_block25_concat[0][0]

_____
conv5_block26_0_relu (Activatio (None, 4, 4, 1696)   0   conv5_block26_0_bn[0][0]

_____
conv5_block26_1_conv (Conv2D)   (None, 4, 4, 128)   217088   conv5_block26_0_relu[0][0]

_____
conv5_block26_1_bn (BatchNormal (None, 4, 4, 128)   512   conv5_block26_1_conv[0][0]

_____
conv5_block26_1_relu (Activatio (None, 4, 4, 128)   0   conv5_block26_1_bn[0][0]

_____
conv5_block26_2_conv (Conv2D)   (None, 4, 4, 32)   36864   conv5_block26_1_relu[0][0]

_____
conv5_block26_concat (Concatena (None, 4, 4, 1728)   0   conv5_block25_concat[0][0]
                                                               conv5_block26_2_conv[0][0]

_____
conv5_block27_0_bn (BatchNormal (None, 4, 4, 1728)   6912   conv5_block26_concat[0][0]

_____
conv5_block27_0_relu (Activatio (None, 4, 4, 1728)   0   conv5_block27_0_bn[0][0]

_____
conv5_block27_1_conv (Conv2D)   (None, 4, 4, 128)   221184   conv5_block27_0_relu[0][0]

```
conv5_block27_1_bn (BatchNormal (None, 4, 4, 128)    512        conv5_block27_1_conv[0][0]
_____
conv5_block27_1_relu (Activatio (None, 4, 4, 128)     0          conv5_block27_1_bn[0][0]
_____
conv5_block27_2_conv (Conv2D)   (None, 4, 4, 32)     36864      conv5_block27_1_relu[0][0]
_____
conv5_block27_concat (Concatena (None, 4, 4, 1760)   0          conv5_block26_concat[0][0]
                                                                conv5_block27_2_conv[0][0]
_____
conv5_block28_0_bn (BatchNormal (None, 4, 4, 1760)   7040       conv5_block27_concat[0][0]
_____
conv5_block28_0_relu (Activatio (None, 4, 4, 1760)   0          conv5_block28_0_bn[0][0]
_____
conv5_block28_1_conv (Conv2D)   (None, 4, 4, 128)    225280     conv5_block28_0_relu[0][0]
_____
conv5_block28_1_bn (BatchNormal (None, 4, 4, 128)    512        conv5_block28_1_conv[0][0]
_____
conv5_block28_1_relu (Activatio (None, 4, 4, 128)     0          conv5_block28_1_bn[0][0]
_____
conv5_block28_2_conv (Conv2D)   (None, 4, 4, 32)     36864      conv5_block28_1_relu[0][0]
_____
conv5_block28_concat (Concatena (None, 4, 4, 1792)   0          conv5_block27_concat[0][0]
                                                                conv5_block28_2_conv[0][0]
_____
conv5_block29_0_bn (BatchNormal (None, 4, 4, 1792)   7168       conv5_block28_concat[0][0]
_____
conv5_block29_0_relu (Activatio (None, 4, 4, 1792)   0          conv5_block29_0_bn[0][0]
_____
conv5_block29_1_conv (Conv2D)   (None, 4, 4, 128)    229376     conv5_block29_0_relu[0][0]
_____
conv5_block29_1_bn (BatchNormal (None, 4, 4, 128)    512        conv5_block29_1_conv[0][0]
_____
conv5_block29_1_relu (Activatio (None, 4, 4, 128)     0          conv5_block29_1_bn[0][0]
_____
conv5_block29_2_conv (Conv2D)   (None, 4, 4, 32)     36864      conv5_block29_1_relu[0][0]
_____
conv5_block29_concat (Concatena (None, 4, 4, 1824)   0          conv5_block28_concat[0][0]
                                                                conv5_block29_2_conv[0][0]
_____
conv5_block30_0_bn (BatchNormal (None, 4, 4, 1824)   7296       conv5_block29_concat[0][0]
_____
conv5_block30_0_relu (Activatio (None, 4, 4, 1824)   0          conv5_block30_0_bn[0][0]
_____
conv5_block30_1_conv (Conv2D)   (None, 4, 4, 128)    233472     conv5_block30_0_relu[0][0]
_____
conv5_block30_1_bn (BatchNormal (None, 4, 4, 128)    512        conv5_block30_1_conv[0][0]
_____
```

conv5_block30_1_relu (Activatio	(None, 4, 4, 128)	0	conv5_block30_1_bn[0][0]
conv5_block30_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block30_1_relu[0][0]
conv5_block30_concat (Concatena	(None, 4, 4, 1856)	0	conv5_block29_concat[0][0] conv5_block30_2_conv[0][0]
conv5_block31_0_bn (BatchNormal	(None, 4, 4, 1856)	7424	conv5_block30_concat[0][0]
conv5_block31_0_relu (Activatio	(None, 4, 4, 1856)	0	conv5_block31_0_bn[0][0]
conv5_block31_1_conv (Conv2D)	(None, 4, 4, 128)	237568	conv5_block31_0_relu[0][0]
conv5_block31_1_bn (BatchNormal	(None, 4, 4, 128)	512	conv5_block31_1_conv[0][0]
conv5_block31_1_relu (Activatio	(None, 4, 4, 128)	0	conv5_block31_1_bn[0][0]
conv5_block31_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block31_1_relu[0][0]
conv5_block31_concat (Concatena	(None, 4, 4, 1888)	0	conv5_block30_concat[0][0] conv5_block31_2_conv[0][0]
conv5_block32_0_bn (BatchNormal	(None, 4, 4, 1888)	7552	conv5_block31_concat[0][0]
conv5_block32_0_relu (Activatio	(None, 4, 4, 1888)	0	conv5_block32_0_bn[0][0]
conv5_block32_1_conv (Conv2D)	(None, 4, 4, 128)	241664	conv5_block32_0_relu[0][0]
conv5_block32_1_bn (BatchNormal	(None, 4, 4, 128)	512	conv5_block32_1_conv[0][0]
conv5_block32_1_relu (Activatio	(None, 4, 4, 128)	0	conv5_block32_1_bn[0][0]
conv5_block32_2_conv (Conv2D)	(None, 4, 4, 32)	36864	conv5_block32_1_relu[0][0]
conv5_block32_concat (Concatena	(None, 4, 4, 1920)	0	conv5_block31_concat[0][0] conv5_block32_2_conv[0][0]
bn (BatchNormalization)	(None, 4, 4, 1920)	7680	conv5_block32_concat[0][0]
relu (Activation)	(None, 4, 4, 1920)	0	bn[0][0]

Total params: 18,321,984
Trainable params: 18,092,928
Non-trainable params: 229,056

_____

In [3]: # this is the model we will train

```
model =Sequential()
model.add(base_model)
model.add(Flatten())
model.add(Dense(256,activation='relu'))
model.add(Dense(1, activation='sigmoid'))

model.summary()
```

Layer (type)	Output Shape	Param #
densenet201 (Model)	(None, 4, 4, 1920)	18321984
flatten_1 (Flatten)	(None, 30720)	0
dense_1 (Dense)	(None, 256)	7864576
dense_2 (Dense)	(None, 1)	257

Total params: 26,186,817
Trainable params: 25,957,761
Non-trainable params: 229,056

_____

In [4]: print('Number of trainable weights before freezing: ', len(model.trainable_weights))
        ## to freesze all convolutional layers in pretrained network method 1
        # base_model.trainable=False

Number of trainable weights before freezing: 606

In [5]: # def recall_m(y_true, y_pred):
        #   true_positives = K.sum(K.round(K.clip(y_true * y_pred,0,1)))
        #   possible_positives = K.sum(K.round(K.clip(y_true,0,1)))
        #   recall = true_positives / (possible_positives + K.epsilon())
        #   return recall
        # def precision_m(y_true, ypred):
        #   true_positives = K.sum(K.round(K.clip(y_true * y_pred,0,1)))
        #   predicted_positives = K.sum(K.round(K.clip(y_pred,0,1)))
        #   precision = true_positives/(predicted_positives+K.epsilon())
        #   return precision

        # first: train only the top layers (which were randomly initialized)
        # i.e. freeze all convolutional pretrained layers method 2
        for layer in base_model.layers:
            layer.trainable = False
        print('After freezing: ', len(model.trainable_weights))
```

```python
        # compile the model (should be done *after* setting layers to non-trainable)
        model.compile(optimizer=optimizers.Adam(lr=1e-4),metrics=['acc'], loss='binary_crossentropy')
```

W0215 11:14:38.732696 140199875950400 deprecation_wrapper.py:119] From /home/mlab/anaconda3/lib/python

W0215 11:14:38.738514 140199875950400 deprecation.py:323] From /home/mlab/anaconda3/lib/python3.7/site-p
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where

After freezing: 4

```python
In [6]: train_data_dir = '/home/mlab/Documents/brats_hl_data/train'
        validation_data_dir = '/home/mlab/Documents/brats_hl_data/val'
        # 44938
        # 5616
        nb_train_samples = 44938
        nb_validation_samples = 5616
        epochs = 8
        batch_size = 128
        # prepare data augmentation configuration
        train_datagen = ImageDataGenerator(
            rescale=1. / 255,
            shear_range=0.2,
            zoom_range=0.2,
            horizontal_flip=True)

        test_datagen = ImageDataGenerator(rescale=1. / 255)

        train_generator = train_datagen.flow_from_directory(
            train_data_dir,
            target_size=(150, 150),
            batch_size=batch_size,
            class_mode='binary')

        validation_generator = test_datagen.flow_from_directory(
            validation_data_dir,
            target_size=(150, 150),
            batch_size=batch_size,
            class_mode='binary')
```

Found 44938 images belonging to 2 classes.
Found 5616 images belonging to 2 classes.

```python
In [7]: true_classes = train_generator.classes
        print(true_classes)
        class_labels = list(train_generator.class_indices.keys())
        print(class_labels)
```

[0 0 0 ... 1 1 1]
['high', 'low']

In [8]: # train the model on the new data for a few epochs
        history =model.fit_generator(train_generator,
                                steps_per_epoch=nb_train_samples//batch_size,
                                epochs=epochs,
                                validation_data=validation_generator,
                                validation_steps=nb_validation_samples//batch_size)

Epoch 1/8
351/351 [==============================] - 1841s 5s/step - loss: 0.5165 - acc: 0.7288 - val_l
Epoch 2/8
351/351 [==============================] - 1837s 5s/step - loss: 0.4079 - acc: 0.8022 - val_l
Epoch 3/8
351/351 [==============================] - 1829s 5s/step - loss: 0.3568 - acc: 0.8302 - val_l
Epoch 4/8
351/351 [==============================] - 1808s 5s/step - loss: 0.3214 - acc: 0.8532 - val_l
Epoch 5/8
351/351 [==============================] - 1854s 5s/step - loss: 0.2911 - acc: 0.8715 - val_l
Epoch 6/8
351/351 [==============================] - 1834s 5s/step - loss: 0.2728 - acc: 0.8781 - val_l
Epoch 7/8
351/351 [==============================] - 1816s 5s/step - loss: 0.2526 - acc: 0.8893 - val_l
Epoch 8/8
351/351 [==============================] - 1814s 5s/step - loss: 0.2368 - acc: 0.8981 - val_l

In [9]: true_classes_1 = validation_generator.classes
        print(true_classes)
        class_labels_1 = list(validation_generator.class_indices.keys())
        print(class_labels_1)

[0 0 0 ... 1 1 1]
['high', 'low']

In [10]: #Confution Matrix and Classification Report
        Y_pred = model.predict_generator(validation_generator, nb_validation_samples // batch_size+1)

In [11]: # y_pred = np.argmax(Y_pred, axis=1)
        y_pred = (Y_pred<0.475).astype(np.int)

        # print('Confusion Matrix')
        # print(confusion_matrix(true_classes_1, y_pred))
        # print('Classification Report')
        # print(classification_report(validation_generator.classes, y_pred,
        #   target_names=class_labels_1))

36

In [12]: # print(validation_generator.classes)

In [13]: confusion_matrix = metrics.confusion_matrix(true_classes_1,y_pred)
         print(confusion_matrix)

[[1584 1191]
 [1580 1261]]

In [14]: report= sklearn.metrics.classification_report(true_classes_1, y_pred,
                                         target_names = class_labels_1)
         print(report)

	precision	recall	f1-score	support
high	0.50	0.57	0.53	2775
low	0.51	0.44	0.48	2841
micro avg	0.51	0.51	0.51	5616
macro avg	0.51	0.51	0.50	5616
weighted avg	0.51	0.51	0.50	5616

In [15]: fpr, tpr, thresholds = roc_curve(validation_generator.classes, y_pred)

         # create plot
         plt.plot(fpr, tpr, label='ROC curve')
         plt.plot([0, 1], [0, 1], 'k--', label='Random guess')
         _ = plt.xlabel('False Positive Rate')
         _ = plt.ylabel('True Positive Rate')
         _ = plt.title('ROC Curve')
         _ = plt.xlim([-0.02, 1])
         _ = plt.ylim([0, 1.02])
         _ = plt.legend(loc="lower right")

ROC Curve

In [16]: roc_auc_score(validation_generator.classes, y_pred)

Out[16]: 0.5073343036806606

In [17]: batchX, batchy = train_generator.next()
         _, accuracy = model.evaluate(batchX, batchy)
         print('Accuracy training: %.2f' % (accuracy*100))
         batchXv, batchyv = validation_generator.next()
         _, accuracy = model.evaluate(batchXv, batchyv)
         print('Accuracy val: %.2f' % (accuracy*100))

128/128 [==============================] - 5s 35ms/step
Accuracy training: 92.19
128/128 [==============================] - 5s 36ms/step
Accuracy val: 84.38

In [18]: #plot the train and val curve
         #get the details from the history object
         acc = history.history['acc']
         val_acc=history.history['val_acc']
         loss = history.history['loss']
         val_loss = history.history['val_loss']

```
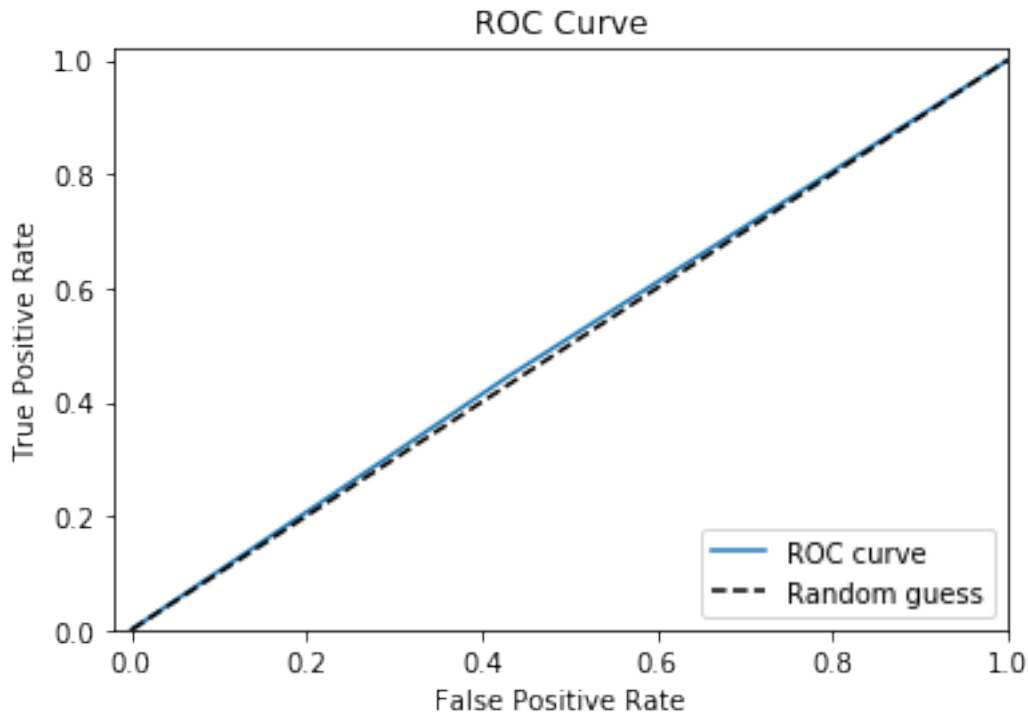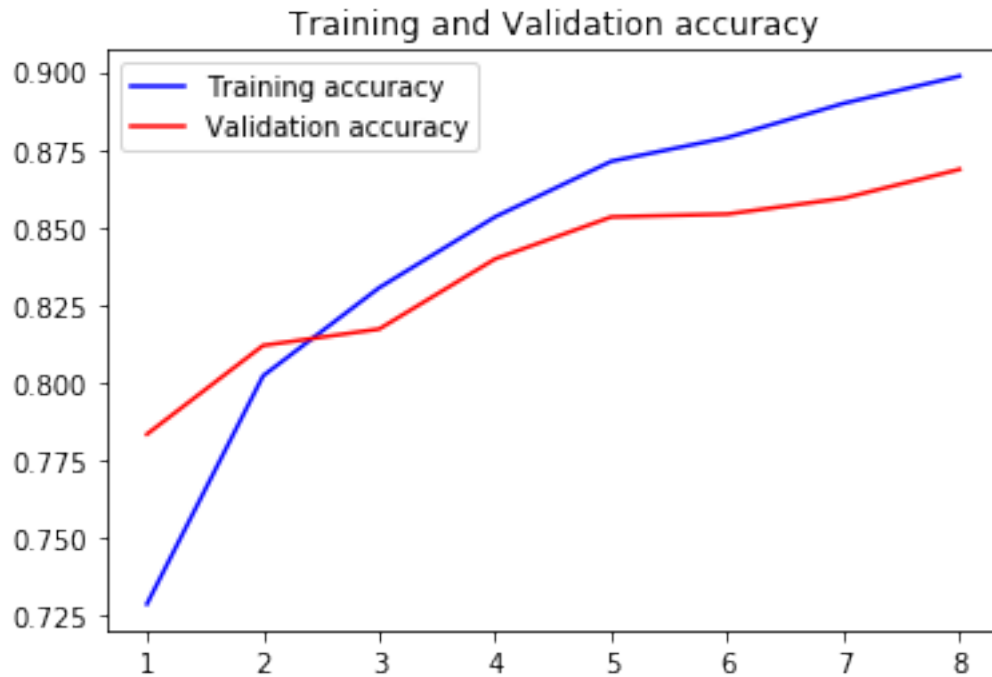epochs = range(1,len(acc)+1)

#train and validation accuracy
plt.plot(epochs,acc,'b',label='Training accuracy')
plt.plot(epochs,val_acc,'r',label='Validation accuracy')
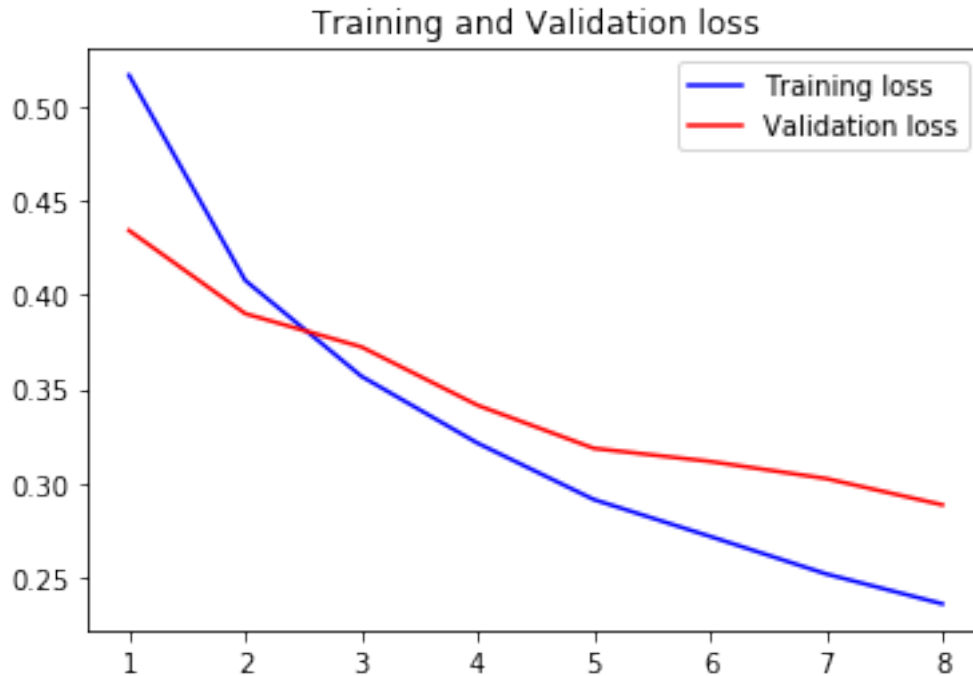plt.title('Training and Validation accuracy')
plt.legend()
```

Out[18]: <matplotlib.legend.Legend at 0x7f817c5af518>

Training and Validation accuracy

In [19]: #train and validation loss
```
plt.plot(epochs, loss, 'b',label='Training loss')
plt.plot(epochs, val_loss, 'r',label='Validation loss')
plt.title('Training and Validation loss')
plt.legend()
plt.show()
```

Training and Validation loss

In [20]: test_generator = test_datagen.flow_from_directory('/home/mlab/Documents/brats_hl_data/test',
                                class_mode='binary',
                                batch_size=batch_size,
                                target_size=(150,150))
         scores = model.evaluate_generator(test_generator, steps=nb_validation_samples//batch_size)

Found 5619 images belonging to 2 classes.

In [21]: print("%s: %.2f%%" % (model.metrics_names[1], scores[1]*100))

acc: 86.17%

In [22]: #Confution Matrix and Classification Report
         # Y_pred = model.predict_generator(val_generator, 5616 // batch_size)
         nb_test_samples=5619
         Y_pred1 = model.predict_generator(test_generator,nb_test_samples//batch_size+1)
         # y_pred = np.argmax(Y_pred,axis=1)

In [23]: true_classes_2 = test_generator.classes
         print(true_classes_2)
         class_labels_2 = list(test_generator.class_indices.keys())
         print(class_labels_2)

```
[0 0 0 ... 1 1 1]
['high', 'low']
```

In [24]: # y_pred1 = (Y_pred1<0.5).astype(np.int)
y_pred1 = (Y_pred1 < 0.475).astype(np.int)
# print(y_pred)
# print('Confusion Matrix')
# print(confusion_matrix(true_classes_2, y_pred1))
# print('Classification Report')
# print(classification_report(true_classes_2, y_pred1, target_names=class_labels_2))

In [25]: confusion_matrix1 = metrics.confusion_matrix(true_classes_2,y_pred1)
print(confusion_matrix1)

```
[[1546 1230]
 [1604 1239]]
```

In [26]: report1= sklearn.metrics.classification_report(true_classes_2, y_pred1,
                                          target_names = class_labels_2)
print(report1)

```
              precision    recall  f1-score   support

       high       0.49       0.56      0.52      2776
        low       0.50       0.44      0.47      2843

  micro avg       0.50       0.50      0.50      5619
  macro avg       0.50       0.50      0.49      5619
weighted avg      0.50       0.50      0.49      5619
```

In [27]: print(" Loss: ", scores[0],"\n","Accuracy: ", scores[1])

```
 Loss:  0.31125389455362806
 Accuracy:  0.8617369186046512
```