In [1]:
```python
from keras.layers import Input, Lambda, Dense, Flatten
from keras.models import Model
#from keras.applications.resnet50 import ResNet50
from keras.applications.densenet import DenseNet121
from keras.layers import Dense, GlobalAveragePooling2D
from keras.applications.vgg16 import preprocess_input
from keras.preprocessing import image
from keras.preprocessing.image import ImageDataGenerator
from keras.models import Sequential
import numpy as np
from glob import glob
import matplotlib.pyplot as plt
```

In [2]:
```python
IMAGE_SIZE = [224, 224]

train_path = 'E:\\chest_xray\\train\\'
valid_path = 'E:\\chest_xray\\test\\'
```

In [3]:
```python
densenet = DenseNet121(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top
```

In [4]:
```python
for layer in densenet.layers:
    layer.trainable = False
```

In [5]:
```python
folders = glob('E:\\chest_xray\\train\\*')
```

In [6]:
```python
x = Flatten()(densenet.output)
```

In [7]:
```python
prediction = Dense(len(folders), activation='softmax')(x)
model = Model(inputs=densenet.input, outputs=prediction)
```

In [8]:
```python
model.summary()
```

```
Model: "functional_1"
_____
_____
Layer (type)                 Output Shape         Param #     Connected to
=================================================================
==============
input_1 (InputLayer)         [(None, 224, 224, 3) 0
_____
_____
zero_padding2d (ZeroPadding2D) (None, 230, 230, 3)  0           input_1[0][0]
_____
_____
conv1/conv (Conv2D)          (None, 112, 112, 64) 9408        zero_padding2d[0]
[0]
_____
_____
conv1/bn (BatchNormalization) (None, 112, 112, 64) 256         conv1/conv[0][0]
_____
_____
conv1/relu (Activation)      (None, 112, 112, 64) 0           conv1/bn[0][0]
_____
_____
```

_____
zero_padding2d_1 (ZeroPadding2D (None, 114, 114, 64) 0   conv1/relu[0][0]
_____
_____
pool1 (MaxPooling2D)   (None, 56, 56, 64)   0   zero_padding2d_1[0]
[0]
_____
_____
conv2_block1_0_bn (BatchNormali (None, 56, 56, 64)   256   pool1[0][0]
_____
_____
conv2_block1_0_relu (Activation (None, 56, 56, 64)   0   conv2_block1_0_bn
[0][0]
_____
_____
conv2_block1_1_conv (Conv2D)   (None, 56, 56, 128) 8192   conv2_block1_0_relu
[0][0]
_____
_____
conv2_block1_1_bn (BatchNormali (None, 56, 56, 128) 512   conv2_block1_1_conv
[0][0]
_____
_____
conv2_block1_1_relu (Activation (None, 56, 56, 128) 0   conv2_block1_1_bn
[0][0]
_____
_____
conv2_block1_2_conv (Conv2D)   (None, 56, 56, 32)   36864   conv2_block1_1_relu
[0][0]
_____
_____
conv2_block1_concat (Concatenat (None, 56, 56, 96)   0   pool1[0][0]
                                                                conv2_block1_2_conv
[0][0]
_____
_____
conv2_block2_0_bn (BatchNormali (None, 56, 56, 96)   384   conv2_block1_concat
[0][0]
_____
_____
conv2_block2_0_relu (Activation (None, 56, 56, 96)   0   conv2_block2_0_bn
[0][0]
_____
_____
conv2_block2_1_conv (Conv2D)   (None, 56, 56, 128) 12288   conv2_block2_0_relu
[0][0]
_____
_____
conv2_block2_1_bn (BatchNormali (None, 56, 56, 128) 512   conv2_block2_1_conv
[0][0]
_____
_____
conv2_block2_1_relu (Activation (None, 56, 56, 128) 0   conv2_block2_1_bn
[0][0]
_____
_____
conv2_block2_2_conv (Conv2D)   (None, 56, 56, 32)   36864   conv2_block2_1_relu
[0][0]
_____
_____
conv2_block2_concat (Concatenat (None, 56, 56, 128) 0   conv2_block1_concat
[0][0]
                                                                conv2_block2_2_conv
[0][0]

```
_____
_____
conv2_block3_0_bn (BatchNormali (None, 56, 56, 128)  512        conv2_block2_concat
[0][0]
_____
_____
conv2_block3_0_relu (Activation (None, 56, 56, 128)  0          conv2_block3_0_bn
[0][0]
_____
_____
conv2_block3_1_conv (Conv2D)    (None, 56, 56, 128)  16384      conv2_block3_0_relu
[0][0]
_____
_____
conv2_block3_1_bn (BatchNormali (None, 56, 56, 128)  512        conv2_block3_1_conv
[0][0]
_____
_____
conv2_block3_1_relu (Activation (None, 56, 56, 128)  0          conv2_block3_1_bn
[0][0]
_____
_____
conv2_block3_2_conv (Conv2D)    (None, 56, 56, 32)   36864      conv2_block3_1_relu
[0][0]
_____
_____
conv2_block3_concat (Concatenat (None, 56, 56, 160)  0          conv2_block2_concat
[0][0]
                                                                conv2_block3_2_conv
[0][0]
_____
_____
conv2_block4_0_bn (BatchNormali (None, 56, 56, 160)  640        conv2_block3_concat
[0][0]
_____
_____
conv2_block4_0_relu (Activation (None, 56, 56, 160)  0          conv2_block4_0_bn
[0][0]
_____
_____
conv2_block4_1_conv (Conv2D)    (None, 56, 56, 128)  20480      conv2_block4_0_relu
[0][0]
_____
_____
conv2_block4_1_bn (BatchNormali (None, 56, 56, 128)  512        conv2_block4_1_conv
[0][0]
_____
_____
conv2_block4_1_relu (Activation (None, 56, 56, 128)  0          conv2_block4_1_bn
[0][0]
_____
_____
conv2_block4_2_conv (Conv2D)    (None, 56, 56, 32)   36864      conv2_block4_1_relu
[0][0]
_____
_____
conv2_block4_concat (Concatenat (None, 56, 56, 192)  0          conv2_block3_concat
[0][0]
                                                                conv2_block4_2_conv
[0][0]
_____
_____
conv2_block5_0_bn (BatchNormali (None, 56, 56, 192)  768        conv2_block4_concat
[0][0]
```

```
_____
_____
conv2_block5_0_relu (Activation (None, 56, 56, 192)  0              conv2_block5_0_bn
[0][0]
_____
_____
conv2_block5_1_conv (Conv2D)    (None, 56, 56, 128)  24576          conv2_block5_0_relu
[0][0]
_____
_____
conv2_block5_1_bn (BatchNormali (None, 56, 56, 128)  512            conv2_block5_1_conv
[0][0]
_____
_____
conv2_block5_1_relu (Activation (None, 56, 56, 128)  0              conv2_block5_1_bn
[0][0]
_____
_____
conv2_block5_2_conv (Conv2D)    (None, 56, 56, 32)   36864          conv2_block5_1_relu
[0][0]
_____
_____
conv2_block5_concat (Concatenat (None, 56, 56, 224)  0              conv2_block4_concat
[0][0]

                                                                    conv2_block5_2_conv
[0][0]
_____
_____
conv2_block6_0_bn (BatchNormali (None, 56, 56, 224)  896            conv2_block5_concat
[0][0]
_____
_____
conv2_block6_0_relu (Activation (None, 56, 56, 224)  0              conv2_block6_0_bn
[0][0]
_____
_____
conv2_block6_1_conv (Conv2D)    (None, 56, 56, 128)  28672          conv2_block6_0_relu
[0][0]
_____
_____
conv2_block6_1_bn (BatchNormali (None, 56, 56, 128)  512            conv2_block6_1_conv
[0][0]
_____
_____
conv2_block6_1_relu (Activation (None, 56, 56, 128)  0              conv2_block6_1_bn
[0][0]
_____
_____
conv2_block6_2_conv (Conv2D)    (None, 56, 56, 32)   36864          conv2_block6_1_relu
[0][0]
_____
_____
conv2_block6_concat (Concatenat (None, 56, 56, 256)  0              conv2_block5_concat
[0][0]

                                                                    conv2_block6_2_conv
[0][0]
_____
_____
pool2_bn (BatchNormalization)   (None, 56, 56, 256)  1024           conv2_block6_concat
[0][0]
_____
_____
pool2_relu (Activation)         (None, 56, 56, 256)  0              pool2_bn[0][0]
_____
```

```
_____
pool2_conv (Conv2D)              (None, 56, 56, 128)   32768       pool2_relu[0][0]
_____
pool2_pool (AveragePooling2D)    (None, 28, 28, 128)   0           pool2_conv[0][0]
_____
conv3_block1_0_bn (BatchNormali  (None, 28, 28, 128)   512         pool2_pool[0][0]
_____
conv3_block1_0_relu (Activation  (None, 28, 28, 128)   0           conv3_block1_0_bn
[0][0]
_____
conv3_block1_1_conv (Conv2D)     (None, 28, 28, 128)   16384       conv3_block1_0_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_conv (Conv2D)     (None, 28, 28, 32)    36864       conv3_block1_1_relu
[0][0]
_____
conv3_block1_concat (Concatenat  (None, 28, 28, 160)   0           pool2_pool[0][0]
                                                                   conv3_block1_2_conv
[0][0]
_____
conv3_block2_0_bn (BatchNormali  (None, 28, 28, 160)   640         conv3_block1_concat
[0][0]
_____
conv3_block2_0_relu (Activation  (None, 28, 28, 160)   0           conv3_block2_0_bn
[0][0]
_____
conv3_block2_1_conv (Conv2D)     (None, 28, 28, 128)   20480       conv3_block2_0_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_conv (Conv2D)     (None, 28, 28, 32)    36864       conv3_block2_1_relu
[0][0]
_____
conv3_block2_concat (Concatenat  (None, 28, 28, 192)   0           conv3_block1_concat
[0][0]
                                                                   conv3_block2_2_conv
[0][0]
_____
```

_____
conv3_block3_0_bn (BatchNormali (None, 28, 28, 192) 768   conv3_block2_concat
[0][0]
_____
_____
conv3_block3_0_relu (Activation (None, 28, 28, 192) 0   conv3_block3_0_bn
[0][0]
_____
_____
conv3_block3_1_conv (Conv2D)   (None, 28, 28, 128) 24576   conv3_block3_0_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_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block3_1_relu
[0][0]
_____
_____
conv3_block3_concat (Concatenat (None, 28, 28, 224) 0   conv3_block2_concat
[0][0]

                                                                  conv3_block3_2_conv
[0][0]
_____
_____
conv3_block4_0_bn (BatchNormali (None, 28, 28, 224) 896   conv3_block3_concat
[0][0]
_____
_____
conv3_block4_0_relu (Activation (None, 28, 28, 224) 0   conv3_block4_0_bn
[0][0]
_____
_____
conv3_block4_1_conv (Conv2D)   (None, 28, 28, 128) 28672   conv3_block4_0_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_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block4_1_relu
[0][0]
_____
_____
conv3_block4_concat (Concatenat (None, 28, 28, 256) 0   conv3_block3_concat
[0][0]

                                                                  conv3_block4_2_conv
[0][0]
_____
_____
conv3_block5_0_bn (BatchNormali (None, 28, 28, 256) 1024   conv3_block4_concat
[0][0]
_____

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_____
conv3_block5_0_relu (Activation  (None, 28, 28, 256)  0          conv3_block5_0_bn
[0][0]
_____
_____
conv3_block5_1_conv (Conv2D)     (None, 28, 28, 128)  32768      conv3_block5_0_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_conv (Conv2D)     (None, 28, 28, 32)   36864      conv3_block5_1_relu
[0][0]
_____
_____
conv3_block5_concat (Concatenat  (None, 28, 28, 288)  0          conv3_block4_concat
[0][0]

                                                                 conv3_block5_2_conv
[0][0]
_____
_____
conv3_block6_0_bn (BatchNormali  (None, 28, 28, 288)  1152       conv3_block5_concat
[0][0]
_____
_____
conv3_block6_0_relu (Activation  (None, 28, 28, 288)  0          conv3_block6_0_bn
[0][0]
_____
_____
conv3_block6_1_conv (Conv2D)     (None, 28, 28, 128)  36864      conv3_block6_0_relu
[0][0]
_____
_____
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_conv (Conv2D)     (None, 28, 28, 32)   36864      conv3_block6_1_relu
[0][0]
_____
_____
conv3_block6_concat (Concatenat  (None, 28, 28, 320)  0          conv3_block5_concat
[0][0]

                                                                 conv3_block6_2_conv
[0][0]
_____
_____
conv3_block7_0_bn (BatchNormali  (None, 28, 28, 320)  1280       conv3_block6_concat
[0][0]
_____
_____
conv3_block7_0_relu (Activation  (None, 28, 28, 320)  0          conv3_block7_0_bn
[0][0]
_____
```

```
_____
conv3_block7_1_conv (Conv2D)      (None, 28, 28, 128)   40960        conv3_block7_0_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_conv (Conv2D)      (None, 28, 28, 32)    36864        conv3_block7_1_relu
[0][0]
_____
conv3_block7_concat (Concatenat   (None, 28, 28, 352)   0            conv3_block6_concat
[0][0]

                                                                     conv3_block7_2_conv
[0][0]
_____
conv3_block8_0_bn (BatchNormali   (None, 28, 28, 352)   1408         conv3_block7_concat
[0][0]
_____
conv3_block8_0_relu (Activation   (None, 28, 28, 352)   0            conv3_block8_0_bn
[0][0]
_____
conv3_block8_1_conv (Conv2D)      (None, 28, 28, 128)   45056        conv3_block8_0_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_conv (Conv2D)      (None, 28, 28, 32)    36864        conv3_block8_1_relu
[0][0]
_____
conv3_block8_concat (Concatenat   (None, 28, 28, 384)   0            conv3_block7_concat
[0][0]

                                                                     conv3_block8_2_conv
[0][0]
_____
conv3_block9_0_bn (BatchNormali   (None, 28, 28, 384)   1536         conv3_block8_concat
[0][0]
_____
conv3_block9_0_relu (Activation   (None, 28, 28, 384)   0            conv3_block9_0_bn
[0][0]
_____
conv3_block9_1_conv (Conv2D)      (None, 28, 28, 128)   49152        conv3_block9_0_relu
[0][0]
_____
```

_____
conv3_block9_1_bn (BatchNormali (None, 28, 28, 128) 512   conv3_block9_1_conv
[0][0]
_____

_____
conv3_block9_1_relu (Activation (None, 28, 28, 128) 0   conv3_block9_1_bn
[0][0]
_____

_____
conv3_block9_2_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block9_1_relu
[0][0]
_____

_____
conv3_block9_concat (Concatenat (None, 28, 28, 416) 0   conv3_block8_concat
[0][0]

                                                                   conv3_block9_2_conv
[0][0]
_____

_____
conv3_block10_0_bn (BatchNormal (None, 28, 28, 416) 1664   conv3_block9_concat
[0][0]
_____

_____
conv3_block10_0_relu (Activatio (None, 28, 28, 416) 0   conv3_block10_0_bn
[0][0]
_____

_____
conv3_block10_1_conv (Conv2D)   (None, 28, 28, 128) 53248   conv3_block10_0_rel
u[0][0]
_____

_____
conv3_block10_1_bn (BatchNormal (None, 28, 28, 128) 512   conv3_block10_1_con
v[0][0]
_____

_____
conv3_block10_1_relu (Activatio (None, 28, 28, 128) 0   conv3_block10_1_bn
[0][0]
_____

_____
conv3_block10_2_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block10_1_rel
u[0][0]
_____

_____
conv3_block10_concat (Concatena (None, 28, 28, 448) 0   conv3_block9_concat
[0][0]

                                                                   conv3_block10_2_con
v[0][0]
_____

_____
conv3_block11_0_bn (BatchNormal (None, 28, 28, 448) 1792   conv3_block10_conca
t[0][0]
_____

_____
conv3_block11_0_relu (Activatio (None, 28, 28, 448) 0   conv3_block11_0_bn
[0][0]
_____

_____
conv3_block11_1_conv (Conv2D)   (None, 28, 28, 128) 57344   conv3_block11_0_rel
u[0][0]
_____

_____
conv3_block11_1_bn (BatchNormal (None, 28, 28, 128) 512   conv3_block11_1_con
v[0][0]
_____

_____
conv3_block11_1_relu (Activatio (None, 28, 28, 128) 0   conv3_block11_1_bn
[0][0]
_____
_____
conv3_block11_2_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block11_1_rel
u[0][0]
_____
_____
conv3_block11_concat (Concatena (None, 28, 28, 480) 0   conv3_block10_conca
t[0][0]

                                                                 conv3_block11_2_con
v[0][0]
_____
_____
conv3_block12_0_bn (BatchNormal (None, 28, 28, 480) 1920   conv3_block11_conca
t[0][0]
_____
_____
conv3_block12_0_relu (Activatio (None, 28, 28, 480) 0   conv3_block12_0_bn
[0][0]
_____
_____
conv3_block12_1_conv (Conv2D)   (None, 28, 28, 128) 61440   conv3_block12_0_rel
u[0][0]
_____
_____
conv3_block12_1_bn (BatchNormal (None, 28, 28, 128) 512   conv3_block12_1_con
v[0][0]
_____
_____
conv3_block12_1_relu (Activatio (None, 28, 28, 128) 0   conv3_block12_1_bn
[0][0]
_____
_____
conv3_block12_2_conv (Conv2D)   (None, 28, 28, 32)   36864   conv3_block12_1_rel
u[0][0]
_____
_____
conv3_block12_concat (Concatena (None, 28, 28, 512) 0   conv3_block11_conca
t[0][0]

                                                                 conv3_block12_2_con
v[0][0]
_____
_____
pool3_bn (BatchNormalization)   (None, 28, 28, 512) 2048   conv3_block12_conca
t[0][0]
_____
_____
pool3_relu (Activation)   (None, 28, 28, 512) 0   pool3_bn[0][0]
_____
_____
pool3_conv (Conv2D)   (None, 28, 28, 256) 131072   pool3_relu[0][0]
_____
_____
pool3_pool (AveragePooling2D)   (None, 14, 14, 256) 0   pool3_conv[0][0]
_____
_____
conv4_block1_0_bn (BatchNormali (None, 14, 14, 256) 1024   pool3_pool[0][0]
_____
_____
conv4_block1_0_relu (Activation (None, 14, 14, 256) 0   conv4_block1_0_bn
[0][0]
_____

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_____
conv4_block1_1_conv (Conv2D)      (None, 14, 14, 128)  32768      conv4_block1_0_relu
[0][0]
_____
_____
conv4_block1_1_bn (BatchNormali  (None, 14, 14, 128)  512        conv4_block1_1_conv
[0][0]
_____
_____
conv4_block1_1_relu (Activation  (None, 14, 14, 128)  0          conv4_block1_1_bn
[0][0]
_____
_____
conv4_block1_2_conv (Conv2D)      (None, 14, 14, 32)   36864      conv4_block1_1_relu
[0][0]
_____
_____
conv4_block1_concat (Concatenat  (None, 14, 14, 288)  0          pool3_pool[0][0]
                                                                 conv4_block1_2_conv

[0][0]
_____
_____
conv4_block2_0_bn (BatchNormali  (None, 14, 14, 288)  1152       conv4_block1_concat
[0][0]
_____
_____
conv4_block2_0_relu (Activation  (None, 14, 14, 288)  0          conv4_block2_0_bn
[0][0]
_____
_____
conv4_block2_1_conv (Conv2D)      (None, 14, 14, 128)  36864      conv4_block2_0_relu
[0][0]
_____
_____
conv4_block2_1_bn (BatchNormali  (None, 14, 14, 128)  512        conv4_block2_1_conv
[0][0]
_____
_____
conv4_block2_1_relu (Activation  (None, 14, 14, 128)  0          conv4_block2_1_bn
[0][0]
_____
_____
conv4_block2_2_conv (Conv2D)      (None, 14, 14, 32)   36864      conv4_block2_1_relu
[0][0]
_____
_____
conv4_block2_concat (Concatenat  (None, 14, 14, 320)  0          conv4_block1_concat
[0][0]
                                                                 conv4_block2_2_conv

[0][0]
_____
_____
conv4_block3_0_bn (BatchNormali  (None, 14, 14, 320)  1280       conv4_block2_concat
[0][0]
_____
_____
conv4_block3_0_relu (Activation  (None, 14, 14, 320)  0          conv4_block3_0_bn
[0][0]
_____
_____
conv4_block3_1_conv (Conv2D)      (None, 14, 14, 128)  40960      conv4_block3_0_relu
[0][0]
_____
_____
```

```
conv4_block3_1_bn (BatchNormali (None, 14, 14, 128)  512          conv4_block3_1_conv
[0][0]
_____
conv4_block3_1_relu (Activation (None, 14, 14, 128)  0            conv4_block3_1_bn
[0][0]
_____
conv4_block3_2_conv (Conv2D)    (None, 14, 14, 32)   36864        conv4_block3_1_relu
[0][0]
_____
conv4_block3_concat (Concatenat (None, 14, 14, 352)  0            conv4_block2_concat
[0][0]
                                                                  conv4_block3_2_conv
[0][0]
_____
conv4_block4_0_bn (BatchNormali (None, 14, 14, 352)  1408         conv4_block3_concat
[0][0]
_____
conv4_block4_0_relu (Activation (None, 14, 14, 352)  0            conv4_block4_0_bn
[0][0]
_____
conv4_block4_1_conv (Conv2D)    (None, 14, 14, 128)  45056        conv4_block4_0_relu
[0][0]
_____
conv4_block4_1_bn (BatchNormali (None, 14, 14, 128)  512          conv4_block4_1_conv
[0][0]
_____
conv4_block4_1_relu (Activation (None, 14, 14, 128)  0            conv4_block4_1_bn
[0][0]
_____
conv4_block4_2_conv (Conv2D)    (None, 14, 14, 32)   36864        conv4_block4_1_relu
[0][0]
_____
conv4_block4_concat (Concatenat (None, 14, 14, 384)  0            conv4_block3_concat
[0][0]
                                                                  conv4_block4_2_conv
[0][0]
_____
conv4_block5_0_bn (BatchNormali (None, 14, 14, 384)  1536         conv4_block4_concat
[0][0]
_____
conv4_block5_0_relu (Activation (None, 14, 14, 384)  0            conv4_block5_0_bn
[0][0]
_____
conv4_block5_1_conv (Conv2D)    (None, 14, 14, 128)  49152        conv4_block5_0_relu
[0][0]
_____
conv4_block5_1_bn (BatchNormali (None, 14, 14, 128)  512          conv4_block5_1_conv
[0][0]
_____
```

conv4_block5_1_relu (Activation (None, 14, 14, 128) 0   conv4_block5_1_bn
[0][0]
_____

conv4_block5_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block5_1_relu
[0][0]
_____

conv4_block5_concat (Concatenat (None, 14, 14, 416) 0   conv4_block4_concat
[0][0]

                                                                    conv4_block5_2_conv
[0][0]
_____

conv4_block6_0_bn (BatchNormali (None, 14, 14, 416) 1664   conv4_block5_concat
[0][0]
_____

conv4_block6_0_relu (Activation (None, 14, 14, 416) 0   conv4_block6_0_bn
[0][0]
_____

conv4_block6_1_conv (Conv2D)   (None, 14, 14, 128) 53248   conv4_block6_0_relu
[0][0]
_____

conv4_block6_1_bn (BatchNormali (None, 14, 14, 128) 512   conv4_block6_1_conv
[0][0]
_____

conv4_block6_1_relu (Activation (None, 14, 14, 128) 0   conv4_block6_1_bn
[0][0]
_____

conv4_block6_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block6_1_relu
[0][0]
_____

conv4_block6_concat (Concatenat (None, 14, 14, 448) 0   conv4_block5_concat
[0][0]

                                                                    conv4_block6_2_conv
[0][0]
_____

conv4_block7_0_bn (BatchNormali (None, 14, 14, 448) 1792   conv4_block6_concat
[0][0]
_____

conv4_block7_0_relu (Activation (None, 14, 14, 448) 0   conv4_block7_0_bn
[0][0]
_____

conv4_block7_1_conv (Conv2D)   (None, 14, 14, 128) 57344   conv4_block7_0_relu
[0][0]
_____

conv4_block7_1_bn (BatchNormali (None, 14, 14, 128) 512   conv4_block7_1_conv
[0][0]
_____

conv4_block7_1_relu (Activation (None, 14, 14, 128) 0   conv4_block7_1_bn
[0][0]
_____

```
conv4_block7_2_conv (Conv2D)     (None, 14, 14, 32)    36864        conv4_block7_1_relu
[0][0]
_____
_____
conv4_block7_concat (Concatenat  (None, 14, 14, 480)   0            conv4_block6_concat
[0][0]

                                                                    conv4_block7_2_conv
[0][0]
_____
_____
conv4_block8_0_bn (BatchNormali  (None, 14, 14, 480)   1920         conv4_block7_concat
[0][0]
_____
_____
conv4_block8_0_relu (Activation  (None, 14, 14, 480)   0            conv4_block8_0_bn
[0][0]
_____
_____
conv4_block8_1_conv (Conv2D)     (None, 14, 14, 128)   61440        conv4_block8_0_relu
[0][0]
_____
_____
conv4_block8_1_bn (BatchNormali  (None, 14, 14, 128)   512          conv4_block8_1_conv
[0][0]
_____
_____
conv4_block8_1_relu (Activation  (None, 14, 14, 128)   0            conv4_block8_1_bn
[0][0]
_____
_____
conv4_block8_2_conv (Conv2D)     (None, 14, 14, 32)    36864        conv4_block8_1_relu
[0][0]
_____
_____
conv4_block8_concat (Concatenat  (None, 14, 14, 512)   0            conv4_block7_concat
[0][0]

                                                                    conv4_block8_2_conv
[0][0]
_____
_____
conv4_block9_0_bn (BatchNormali  (None, 14, 14, 512)   2048         conv4_block8_concat
[0][0]
_____
_____
conv4_block9_0_relu (Activation  (None, 14, 14, 512)   0            conv4_block9_0_bn
[0][0]
_____
_____
conv4_block9_1_conv (Conv2D)     (None, 14, 14, 128)   65536        conv4_block9_0_relu
[0][0]
_____
_____
conv4_block9_1_bn (BatchNormali  (None, 14, 14, 128)   512          conv4_block9_1_conv
[0][0]
_____
_____
conv4_block9_1_relu (Activation  (None, 14, 14, 128)   0            conv4_block9_1_bn
[0][0]
_____
_____
conv4_block9_2_conv (Conv2D)     (None, 14, 14, 32)    36864        conv4_block9_1_relu
[0][0]
_____
_____
```

```
conv4_block9_concat (Concatenat (None, 14, 14, 544)  0          conv4_block8_concat
[0][0]
                                                                conv4_block9_2_conv
[0][0]
_____
conv4_block10_0_bn (BatchNormal (None, 14, 14, 544)  2176       conv4_block9_concat
[0][0]
_____
conv4_block10_0_relu (Activatio (None, 14, 14, 544)  0          conv4_block10_0_bn
[0][0]
_____
conv4_block10_1_conv (Conv2D)   (None, 14, 14, 128)  69632      conv4_block10_0_rel
u[0][0]
_____
conv4_block10_1_bn (BatchNormal (None, 14, 14, 128)  512        conv4_block10_1_con
v[0][0]
_____
conv4_block10_1_relu (Activatio (None, 14, 14, 128)  0          conv4_block10_1_bn
[0][0]
_____
conv4_block10_2_conv (Conv2D)   (None, 14, 14, 32)   36864      conv4_block10_1_rel
u[0][0]
_____
conv4_block10_concat (Concatena (None, 14, 14, 576)  0          conv4_block9_concat
[0][0]
                                                                conv4_block10_2_con
v[0][0]
_____
conv4_block11_0_bn (BatchNormal (None, 14, 14, 576)  2304       conv4_block10_conca
t[0][0]
_____
conv4_block11_0_relu (Activatio (None, 14, 14, 576)  0          conv4_block11_0_bn
[0][0]
_____
conv4_block11_1_conv (Conv2D)   (None, 14, 14, 128)  73728      conv4_block11_0_rel
u[0][0]
_____
conv4_block11_1_bn (BatchNormal (None, 14, 14, 128)  512        conv4_block11_1_con
v[0][0]
_____
conv4_block11_1_relu (Activatio (None, 14, 14, 128)  0          conv4_block11_1_bn
[0][0]
_____
conv4_block11_2_conv (Conv2D)   (None, 14, 14, 32)   36864      conv4_block11_1_rel
u[0][0]
_____
conv4_block11_concat (Concatena (None, 14, 14, 608)  0          conv4_block10_conca
t[0][0]
                                                                conv4_block11_2_con
v[0][0]
```

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_____
_____
conv4_block12_0_bn (BatchNormal (None, 14, 14, 608)  2432         conv4_block11_conca
t[0][0]
_____
_____
conv4_block12_0_relu (Activatio (None, 14, 14, 608)  0            conv4_block12_0_bn
[0][0]
_____
_____
conv4_block12_1_conv (Conv2D)    (None, 14, 14, 128)  77824        conv4_block12_0_rel
u[0][0]
_____
_____
conv4_block12_1_bn (BatchNormal (None, 14, 14, 128)  512          conv4_block12_1_con
v[0][0]
_____
_____
conv4_block12_1_relu (Activatio (None, 14, 14, 128)  0            conv4_block12_1_bn
[0][0]
_____
_____
conv4_block12_2_conv (Conv2D)    (None, 14, 14, 32)   36864        conv4_block12_1_rel
u[0][0]
_____
_____
conv4_block12_concat (Concatena (None, 14, 14, 640)  0            conv4_block11_conca
t[0][0]
                                                                  conv4_block12_2_con
v[0][0]
_____
_____
conv4_block13_0_bn (BatchNormal (None, 14, 14, 640)  2560         conv4_block12_conca
t[0][0]
_____
_____
conv4_block13_0_relu (Activatio (None, 14, 14, 640)  0            conv4_block13_0_bn
[0][0]
_____
_____
conv4_block13_1_conv (Conv2D)    (None, 14, 14, 128)  81920        conv4_block13_0_rel
u[0][0]
_____
_____
conv4_block13_1_bn (BatchNormal (None, 14, 14, 128)  512          conv4_block13_1_con
v[0][0]
_____
_____
conv4_block13_1_relu (Activatio (None, 14, 14, 128)  0            conv4_block13_1_bn
[0][0]
_____
_____
conv4_block13_2_conv (Conv2D)    (None, 14, 14, 32)   36864        conv4_block13_1_rel
u[0][0]
_____
_____
conv4_block13_concat (Concatena (None, 14, 14, 672)  0            conv4_block12_conca
t[0][0]
                                                                  conv4_block13_2_con
v[0][0]
_____
_____
conv4_block14_0_bn (BatchNormal (None, 14, 14, 672)  2688         conv4_block13_conca
t[0][0]
```

_____
_____
conv4_block14_0_relu (Activatio (None, 14, 14, 672)   0   conv4_block14_0_bn
[0][0]
_____
_____
conv4_block14_1_conv (Conv2D)   (None, 14, 14, 128)   86016   conv4_block14_0_rel
u[0][0]
_____
_____
conv4_block14_1_bn (BatchNormal (None, 14, 14, 128)   512   conv4_block14_1_con
v[0][0]
_____
_____
conv4_block14_1_relu (Activatio (None, 14, 14, 128)   0   conv4_block14_1_bn
[0][0]
_____
_____
conv4_block14_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block14_1_rel
u[0][0]
_____
_____
conv4_block14_concat (Concatena (None, 14, 14, 704)   0   conv4_block13_conca
t[0][0]

                                                                  conv4_block14_2_con
v[0][0]
_____
_____
conv4_block15_0_bn (BatchNormal (None, 14, 14, 704)   2816   conv4_block14_conca
t[0][0]
_____
_____
conv4_block15_0_relu (Activatio (None, 14, 14, 704)   0   conv4_block15_0_bn
[0][0]
_____
_____
conv4_block15_1_conv (Conv2D)   (None, 14, 14, 128)   90112   conv4_block15_0_rel
u[0][0]
_____
_____
conv4_block15_1_bn (BatchNormal (None, 14, 14, 128)   512   conv4_block15_1_con
v[0][0]
_____
_____
conv4_block15_1_relu (Activatio (None, 14, 14, 128)   0   conv4_block15_1_bn
[0][0]
_____
_____
conv4_block15_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block15_1_rel
u[0][0]
_____
_____
conv4_block15_concat (Concatena (None, 14, 14, 736)   0   conv4_block14_conca
t[0][0]

                                                                  conv4_block15_2_con
v[0][0]
_____
_____
conv4_block16_0_bn (BatchNormal (None, 14, 14, 736)   2944   conv4_block15_conca
t[0][0]
_____
_____
conv4_block16_0_relu (Activatio (None, 14, 14, 736)   0   conv4_block16_0_bn
[0][0]

```
_____
_____
conv4_block16_1_conv (Conv2D)    (None, 14, 14, 128)  94208      conv4_block16_0_rel
u[0][0]
_____
_____
conv4_block16_1_bn (BatchNormal  (None, 14, 14, 128)  512        conv4_block16_1_con
v[0][0]
_____
_____
conv4_block16_1_relu (Activatio  (None, 14, 14, 128)  0          conv4_block16_1_bn
[0][0]
_____
_____
conv4_block16_2_conv (Conv2D)    (None, 14, 14, 32)   36864      conv4_block16_1_rel
u[0][0]
_____
_____
conv4_block16_concat (Concatena  (None, 14, 14, 768)  0          conv4_block15_conca
t[0][0]

                                                                 conv4_block16_2_con
v[0][0]
_____
_____
conv4_block17_0_bn (BatchNormal  (None, 14, 14, 768)  3072       conv4_block16_conca
t[0][0]
_____
_____
conv4_block17_0_relu (Activatio  (None, 14, 14, 768)  0          conv4_block17_0_bn
[0][0]
_____
_____
conv4_block17_1_conv (Conv2D)    (None, 14, 14, 128)  98304      conv4_block17_0_rel
u[0][0]
_____
_____
conv4_block17_1_bn (BatchNormal  (None, 14, 14, 128)  512        conv4_block17_1_con
v[0][0]
_____
_____
conv4_block17_1_relu (Activatio  (None, 14, 14, 128)  0          conv4_block17_1_bn
[0][0]
_____
_____
conv4_block17_2_conv (Conv2D)    (None, 14, 14, 32)   36864      conv4_block17_1_rel
u[0][0]
_____
_____
conv4_block17_concat (Concatena  (None, 14, 14, 800)  0          conv4_block16_conca
t[0][0]

                                                                 conv4_block17_2_con
v[0][0]
_____
_____
conv4_block18_0_bn (BatchNormal  (None, 14, 14, 800)  3200       conv4_block17_conca
t[0][0]
_____
_____
conv4_block18_0_relu (Activatio  (None, 14, 14, 800)  0          conv4_block18_0_bn
[0][0]
_____
_____
conv4_block18_1_conv (Conv2D)    (None, 14, 14, 128)  102400     conv4_block18_0_rel
u[0][0]
```

```
_____
_____
conv4_block18_1_bn (BatchNormal (None, 14, 14, 128)  512          conv4_block18_1_con
v[0][0]
_____
_____
conv4_block18_1_relu (Activatio (None, 14, 14, 128)  0            conv4_block18_1_bn
[0][0]
_____
_____
conv4_block18_2_conv (Conv2D)   (None, 14, 14, 32)   36864        conv4_block18_1_rel
u[0][0]
_____
_____
conv4_block18_concat (Concatena (None, 14, 14, 832)  0            conv4_block17_conca
t[0][0]
                                                                  conv4_block18_2_con
v[0][0]
_____
_____
conv4_block19_0_bn (BatchNormal (None, 14, 14, 832)  3328         conv4_block18_conca
t[0][0]
_____
_____
conv4_block19_0_relu (Activatio (None, 14, 14, 832)  0            conv4_block19_0_bn
[0][0]
_____
_____
conv4_block19_1_conv (Conv2D)   (None, 14, 14, 128)  106496       conv4_block19_0_rel
u[0][0]
_____
_____
conv4_block19_1_bn (BatchNormal (None, 14, 14, 128)  512          conv4_block19_1_con
v[0][0]
_____
_____
conv4_block19_1_relu (Activatio (None, 14, 14, 128)  0            conv4_block19_1_bn
[0][0]
_____
_____
conv4_block19_2_conv (Conv2D)   (None, 14, 14, 32)   36864        conv4_block19_1_rel
u[0][0]
_____
_____
conv4_block19_concat (Concatena (None, 14, 14, 864)  0            conv4_block18_conca
t[0][0]
                                                                  conv4_block19_2_con
v[0][0]
_____
_____
conv4_block20_0_bn (BatchNormal (None, 14, 14, 864)  3456         conv4_block19_conca
t[0][0]
_____
_____
conv4_block20_0_relu (Activatio (None, 14, 14, 864)  0            conv4_block20_0_bn
[0][0]
_____
_____
conv4_block20_1_conv (Conv2D)   (None, 14, 14, 128)  110592       conv4_block20_0_rel
u[0][0]
_____
_____
conv4_block20_1_bn (BatchNormal (None, 14, 14, 128)  512          conv4_block20_1_con
v[0][0]
```

_____
_____
conv4_block20_1_relu (Activatio (None, 14, 14, 128)   0   conv4_block20_1_bn
[0][0]
_____
_____
conv4_block20_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block20_1_rel
u[0][0]
_____
_____
conv4_block20_concat (Concatena (None, 14, 14, 896)   0   conv4_block19_conca
t[0][0]

v[0][0]
_____
_____
conv4_block21_0_bn (BatchNormal (None, 14, 14, 896)   3584   conv4_block20_conca
t[0][0]
_____
_____
conv4_block21_0_relu (Activatio (None, 14, 14, 896)   0   conv4_block21_0_bn
[0][0]
_____
_____
conv4_block21_1_conv (Conv2D)   (None, 14, 14, 128)   114688   conv4_block21_0_rel
u[0][0]
_____
_____
conv4_block21_1_bn (BatchNormal (None, 14, 14, 128)   512   conv4_block21_1_con
v[0][0]
_____
_____
conv4_block21_1_relu (Activatio (None, 14, 14, 128)   0   conv4_block21_1_bn
[0][0]
_____
_____
conv4_block21_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block21_1_rel
u[0][0]
_____
_____
conv4_block21_concat (Concatena (None, 14, 14, 928)   0   conv4_block20_conca
t[0][0]

v[0][0]
_____
_____
conv4_block22_0_bn (BatchNormal (None, 14, 14, 928)   3712   conv4_block21_conca
t[0][0]
_____
_____
conv4_block22_0_relu (Activatio (None, 14, 14, 928)   0   conv4_block22_0_bn
[0][0]
_____
_____
conv4_block22_1_conv (Conv2D)   (None, 14, 14, 128)   118784   conv4_block22_0_rel
u[0][0]
_____
_____
conv4_block22_1_bn (BatchNormal (None, 14, 14, 128)   512   conv4_block22_1_con
v[0][0]
_____
_____
conv4_block22_1_relu (Activatio (None, 14, 14, 128)   0   conv4_block22_1_bn
[0][0]

_____
_____
conv4_block22_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block22_1_rel
u[0][0]
_____
_____
conv4_block22_concat (Concatena   (None, 14, 14, 960)   0   conv4_block21_conca
t[0][0]

v[0][0]   conv4_block22_2_con
_____
_____
conv4_block23_0_bn (BatchNormal   (None, 14, 14, 960)   3840   conv4_block22_conca
t[0][0]
_____
_____
conv4_block23_0_relu (Activatio   (None, 14, 14, 960)   0   conv4_block23_0_bn
[0][0]
_____
_____
conv4_block23_1_conv (Conv2D)   (None, 14, 14, 128)   122880   conv4_block23_0_rel
u[0][0]
_____
_____
conv4_block23_1_bn (BatchNormal   (None, 14, 14, 128)   512   conv4_block23_1_con
v[0][0]
_____
_____
conv4_block23_1_relu (Activatio   (None, 14, 14, 128)   0   conv4_block23_1_bn
[0][0]
_____
_____
conv4_block23_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block23_1_rel
u[0][0]
_____
_____
conv4_block23_concat (Concatena   (None, 14, 14, 992)   0   conv4_block22_conca
t[0][0]

v[0][0]   conv4_block23_2_con
_____
_____
conv4_block24_0_bn (BatchNormal   (None, 14, 14, 992)   3968   conv4_block23_conca
t[0][0]
_____
_____
conv4_block24_0_relu (Activatio   (None, 14, 14, 992)   0   conv4_block24_0_bn
[0][0]
_____
_____
conv4_block24_1_conv (Conv2D)   (None, 14, 14, 128)   126976   conv4_block24_0_rel
u[0][0]
_____
_____
conv4_block24_1_bn (BatchNormal   (None, 14, 14, 128)   512   conv4_block24_1_con
v[0][0]
_____
_____
conv4_block24_1_relu (Activatio   (None, 14, 14, 128)   0   conv4_block24_1_bn
[0][0]
_____
_____
conv4_block24_2_conv (Conv2D)   (None, 14, 14, 32)   36864   conv4_block24_1_rel
u[0][0]

_____
_____

Layer	Output Shape	Param	Connected to
conv4_block24_concat (Concatenat[0][0]	(None, 14, 14, 1024)	0	conv4_block23_conca conv4_block24_2_con v[0][0]
pool4_bn (BatchNormalization)	(None, 14, 14, 1024)	4096	conv4_block24_conca t[0][0]
pool4_relu (Activation)	(None, 14, 14, 1024)	0	pool4_bn[0][0]
pool4_conv (Conv2D)	(None, 14, 14, 512)	524288	pool4_relu[0][0]
pool4_pool (AveragePooling2D)	(None, 7, 7, 512)	0	pool4_conv[0][0]
conv5_block1_0_bn (BatchNormali	(None, 7, 7, 512)	2048	pool4_pool[0][0]
conv5_block1_0_relu (Activation[0][0]	(None, 7, 7, 512)	0	conv5_block1_0_bn
conv5_block1_1_conv (Conv2D)[0][0]	(None, 7, 7, 128)	65536	conv5_block1_0_relu
conv5_block1_1_bn (BatchNormali[0][0]	(None, 7, 7, 128)	512	conv5_block1_1_conv
conv5_block1_1_relu (Activation[0][0]	(None, 7, 7, 128)	0	conv5_block1_1_bn
conv5_block1_2_conv (Conv2D)[0][0]	(None, 7, 7, 32)	36864	conv5_block1_1_relu
conv5_block1_concat (Concatenat[0][0]	(None, 7, 7, 544)	0	pool4_pool[0][0] conv5_block1_2_conv
conv5_block2_0_bn (BatchNormali[0][0]	(None, 7, 7, 544)	2176	conv5_block1_concat
conv5_block2_0_relu (Activation[0][0]	(None, 7, 7, 544)	0	conv5_block2_0_bn
conv5_block2_1_conv (Conv2D)[0][0]	(None, 7, 7, 128)	69632	conv5_block2_0_relu
conv5_block2_1_bn (BatchNormali[0][0]	(None, 7, 7, 128)	512	conv5_block2_1_conv

```
_____
conv5_block2_1_relu (Activation (None, 7, 7, 128)     0          conv5_block2_1_bn
[0][0]
_____
_____
conv5_block2_2_conv (Conv2D)    (None, 7, 7, 32)      36864      conv5_block2_1_relu
[0][0]
_____
_____
conv5_block2_concat (Concatenat (None, 7, 7, 576)     0          conv5_block1_concat
[0][0]

[0][0]                                                           conv5_block2_2_conv
                                                                 [0][0]
_____
_____
conv5_block3_0_bn (BatchNormali (None, 7, 7, 576)     2304       conv5_block2_concat
[0][0]
_____
_____
conv5_block3_0_relu (Activation (None, 7, 7, 576)     0          conv5_block3_0_bn
[0][0]
_____
_____
conv5_block3_1_conv (Conv2D)    (None, 7, 7, 128)     73728      conv5_block3_0_relu
[0][0]
_____
_____
conv5_block3_1_bn (BatchNormali (None, 7, 7, 128)     512        conv5_block3_1_conv
[0][0]
_____
_____
conv5_block3_1_relu (Activation (None, 7, 7, 128)     0          conv5_block3_1_bn
[0][0]
_____
_____
conv5_block3_2_conv (Conv2D)    (None, 7, 7, 32)      36864      conv5_block3_1_relu
[0][0]
_____
_____
conv5_block3_concat (Concatenat (None, 7, 7, 608)     0          conv5_block2_concat
[0][0]

[0][0]                                                           conv5_block3_2_conv
                                                                 [0][0]
_____
_____
conv5_block4_0_bn (BatchNormali (None, 7, 7, 608)     2432       conv5_block3_concat
[0][0]
_____
_____
conv5_block4_0_relu (Activation (None, 7, 7, 608)     0          conv5_block4_0_bn
[0][0]
_____
_____
conv5_block4_1_conv (Conv2D)    (None, 7, 7, 128)     77824      conv5_block4_0_relu
[0][0]
_____
_____
conv5_block4_1_bn (BatchNormali (None, 7, 7, 128)     512        conv5_block4_1_conv
[0][0]
_____
_____
conv5_block4_1_relu (Activation (None, 7, 7, 128)     0          conv5_block4_1_bn
[0][0]
_____
```

_____
conv5_block4_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block4_1_relu
[0][0]
_____

_____
conv5_block4_concat (Concatenat   (None, 7, 7, 640)   0   conv5_block3_concat
[0][0]

                                                                    conv5_block4_2_conv
[0][0]
_____

_____
conv5_block5_0_bn (BatchNormali   (None, 7, 7, 640)   2560   conv5_block4_concat
[0][0]
_____

_____
conv5_block5_0_relu (Activation   (None, 7, 7, 640)   0   conv5_block5_0_bn
[0][0]
_____

_____
conv5_block5_1_conv (Conv2D)   (None, 7, 7, 128)   81920   conv5_block5_0_relu
[0][0]
_____

_____
conv5_block5_1_bn (BatchNormali   (None, 7, 7, 128)   512   conv5_block5_1_conv
[0][0]
_____

_____
conv5_block5_1_relu (Activation   (None, 7, 7, 128)   0   conv5_block5_1_bn
[0][0]
_____

_____
conv5_block5_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block5_1_relu
[0][0]
_____

_____
conv5_block5_concat (Concatenat   (None, 7, 7, 672)   0   conv5_block4_concat
[0][0]

                                                                    conv5_block5_2_conv
[0][0]
_____

_____
conv5_block6_0_bn (BatchNormali   (None, 7, 7, 672)   2688   conv5_block5_concat
[0][0]
_____

_____
conv5_block6_0_relu (Activation   (None, 7, 7, 672)   0   conv5_block6_0_bn
[0][0]
_____

_____
conv5_block6_1_conv (Conv2D)   (None, 7, 7, 128)   86016   conv5_block6_0_relu
[0][0]
_____

_____
conv5_block6_1_bn (BatchNormali   (None, 7, 7, 128)   512   conv5_block6_1_conv
[0][0]
_____

_____
conv5_block6_1_relu (Activation   (None, 7, 7, 128)   0   conv5_block6_1_bn
[0][0]
_____

_____
conv5_block6_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block6_1_relu
[0][0]
_____

_____
conv5_block6_concat (Concatenat (None, 7, 7, 704)   0   conv5_block5_concat
[0][0]

                                                                   conv5_block6_2_conv
[0][0]
_____
_____
conv5_block7_0_bn (BatchNormali (None, 7, 7, 704)   2816   conv5_block6_concat
[0][0]
_____
_____
conv5_block7_0_relu (Activation (None, 7, 7, 704)   0   conv5_block7_0_bn
[0][0]
_____
_____
conv5_block7_1_conv (Conv2D)   (None, 7, 7, 128)   90112   conv5_block7_0_relu
[0][0]
_____
_____
conv5_block7_1_bn (BatchNormali (None, 7, 7, 128)   512   conv5_block7_1_conv
[0][0]
_____
_____
conv5_block7_1_relu (Activation (None, 7, 7, 128)   0   conv5_block7_1_bn
[0][0]
_____
_____
conv5_block7_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block7_1_relu
[0][0]
_____
_____
conv5_block7_concat (Concatenat (None, 7, 7, 736)   0   conv5_block6_concat
[0][0]

                                                                   conv5_block7_2_conv
[0][0]
_____
_____
conv5_block8_0_bn (BatchNormali (None, 7, 7, 736)   2944   conv5_block7_concat
[0][0]
_____
_____
conv5_block8_0_relu (Activation (None, 7, 7, 736)   0   conv5_block8_0_bn
[0][0]
_____
_____
conv5_block8_1_conv (Conv2D)   (None, 7, 7, 128)   94208   conv5_block8_0_relu
[0][0]
_____
_____
conv5_block8_1_bn (BatchNormali (None, 7, 7, 128)   512   conv5_block8_1_conv
[0][0]
_____
_____
conv5_block8_1_relu (Activation (None, 7, 7, 128)   0   conv5_block8_1_bn
[0][0]
_____
_____
conv5_block8_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block8_1_relu
[0][0]
_____
_____
conv5_block8_concat (Concatenat (None, 7, 7, 768)   0   conv5_block7_concat
[0][0]

                                                                   conv5_block8_2_conv

```
                                                 [0][0]
_____
_____
conv5_block9_0_bn (BatchNormali (None, 7, 7, 768)    3072        conv5_block8_concat
[0][0]
_____
_____
conv5_block9_0_relu (Activation (None, 7, 7, 768)    0           conv5_block9_0_bn
[0][0]
_____
_____
conv5_block9_1_conv (Conv2D)    (None, 7, 7, 128)    98304       conv5_block9_0_relu
[0][0]
_____
_____
conv5_block9_1_bn (BatchNormali (None, 7, 7, 128)    512         conv5_block9_1_conv
[0][0]
_____
_____
conv5_block9_1_relu (Activation (None, 7, 7, 128)    0           conv5_block9_1_bn
[0][0]
_____
_____
conv5_block9_2_conv (Conv2D)    (None, 7, 7, 32)     36864       conv5_block9_1_relu
[0][0]
_____
_____
conv5_block9_concat (Concatenat (None, 7, 7, 800)    0           conv5_block8_concat
[0][0]
                                                                 conv5_block9_2_conv
[0][0]
_____
_____
conv5_block10_0_bn (BatchNormal (None, 7, 7, 800)    3200        conv5_block9_concat
[0][0]
_____
_____
conv5_block10_0_relu (Activatio (None, 7, 7, 800)    0           conv5_block10_0_bn
[0][0]
_____
_____
conv5_block10_1_conv (Conv2D)   (None, 7, 7, 128)    102400      conv5_block10_0_rel
u[0][0]
_____
_____
conv5_block10_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block10_1_con
v[0][0]
_____
_____
conv5_block10_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block10_1_bn
[0][0]
_____
_____
conv5_block10_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block10_1_rel
u[0][0]
_____
_____
conv5_block10_concat (Concatena (None, 7, 7, 832)    0           conv5_block9_concat
[0][0]
                                                                 conv5_block10_2_con
v[0][0]
_____
_____
conv5_block11_0_bn (BatchNormal (None, 7, 7, 832)    3328        conv5_block10_conca
```

t[0][0]
_____

_____
conv5_block11_0_relu (Activatio (None, 7, 7, 832)   0   conv5_block11_0_bn
[0][0]
_____

_____
conv5_block11_1_conv (Conv2D)   (None, 7, 7, 128)   106496   conv5_block11_0_rel
u[0][0]
_____

_____
conv5_block11_1_bn (BatchNormal (None, 7, 7, 128)   512   conv5_block11_1_con
v[0][0]
_____

_____
conv5_block11_1_relu (Activatio (None, 7, 7, 128)   0   conv5_block11_1_bn
[0][0]
_____

_____
conv5_block11_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block11_1_rel
u[0][0]
_____

_____
conv5_block11_concat (Concatena (None, 7, 7, 864)   0   conv5_block10_conca
t[0][0]

                                                                 conv5_block11_2_con
v[0][0]
_____

_____
conv5_block12_0_bn (BatchNormal (None, 7, 7, 864)   3456   conv5_block11_conca
t[0][0]
_____

_____
conv5_block12_0_relu (Activatio (None, 7, 7, 864)   0   conv5_block12_0_bn
[0][0]
_____

_____
conv5_block12_1_conv (Conv2D)   (None, 7, 7, 128)   110592   conv5_block12_0_rel
u[0][0]
_____

_____
conv5_block12_1_bn (BatchNormal (None, 7, 7, 128)   512   conv5_block12_1_con
v[0][0]
_____

_____
conv5_block12_1_relu (Activatio (None, 7, 7, 128)   0   conv5_block12_1_bn
[0][0]
_____

_____
conv5_block12_2_conv (Conv2D)   (None, 7, 7, 32)   36864   conv5_block12_1_rel
u[0][0]
_____

_____
conv5_block12_concat (Concatena (None, 7, 7, 896)   0   conv5_block11_conca
t[0][0]

                                                                 conv5_block12_2_con
v[0][0]
_____

_____
conv5_block13_0_bn (BatchNormal (None, 7, 7, 896)   3584   conv5_block12_conca
t[0][0]
_____

_____
conv5_block13_0_relu (Activatio (None, 7, 7, 896)   0   conv5_block13_0_bn

```
[0][0]
_____
_____
conv5_block13_1_conv (Conv2D)    (None, 7, 7, 128)    114688    conv5_block13_0_rel
u[0][0]
_____
_____
conv5_block13_1_bn (BatchNormal  (None, 7, 7, 128)    512       conv5_block13_1_con
v[0][0]
_____
_____
conv5_block13_1_relu (Activatio  (None, 7, 7, 128)    0         conv5_block13_1_bn
[0][0]
_____
_____
conv5_block13_2_conv (Conv2D)    (None, 7, 7, 32)     36864     conv5_block13_1_rel
u[0][0]
_____
_____
conv5_block13_concat (Concatena  (None, 7, 7, 928)    0         conv5_block12_conca
t[0][0]
                                                                conv5_block13_2_con
v[0][0]
_____
_____
conv5_block14_0_bn (BatchNormal  (None, 7, 7, 928)    3712      conv5_block13_conca
t[0][0]
_____
_____
conv5_block14_0_relu (Activatio  (None, 7, 7, 928)    0         conv5_block14_0_bn
[0][0]
_____
_____
conv5_block14_1_conv (Conv2D)    (None, 7, 7, 128)    118784    conv5_block14_0_rel
u[0][0]
_____
_____
conv5_block14_1_bn (BatchNormal  (None, 7, 7, 128)    512       conv5_block14_1_con
v[0][0]
_____
_____
conv5_block14_1_relu (Activatio  (None, 7, 7, 128)    0         conv5_block14_1_bn
[0][0]
_____
_____
conv5_block14_2_conv (Conv2D)    (None, 7, 7, 32)     36864     conv5_block14_1_rel
u[0][0]
_____
_____
conv5_block14_concat (Concatena  (None, 7, 7, 960)    0         conv5_block13_conca
t[0][0]
                                                                conv5_block14_2_con
v[0][0]
_____
_____
conv5_block15_0_bn (BatchNormal  (None, 7, 7, 960)    3840      conv5_block14_conca
t[0][0]
_____
_____
conv5_block15_0_relu (Activatio  (None, 7, 7, 960)    0         conv5_block15_0_bn
[0][0]
_____
_____
conv5_block15_1_conv (Conv2D)    (None, 7, 7, 128)    122880    conv5_block15_0_rel
```

```
u[0][0]
_____
_____
conv5_block15_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block15_1_con
v[0][0]
_____
_____
conv5_block15_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block15_1_bn
[0][0]
_____
_____
conv5_block15_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block15_1_rel
u[0][0]
_____
_____
conv5_block15_concat (Concatena (None, 7, 7, 992)    0           conv5_block14_conca
t[0][0]

                                                                 conv5_block15_2_con
v[0][0]
_____
_____
conv5_block16_0_bn (BatchNormal (None, 7, 7, 992)    3968        conv5_block15_conca
t[0][0]
_____
_____
conv5_block16_0_relu (Activatio (None, 7, 7, 992)    0           conv5_block16_0_bn
[0][0]
_____
_____
conv5_block16_1_conv (Conv2D)   (None, 7, 7, 128)    126976      conv5_block16_0_rel
u[0][0]
_____
_____
conv5_block16_1_bn (BatchNormal (None, 7, 7, 128)    512         conv5_block16_1_con
v[0][0]
_____
_____
conv5_block16_1_relu (Activatio (None, 7, 7, 128)    0           conv5_block16_1_bn
[0][0]
_____
_____
conv5_block16_2_conv (Conv2D)   (None, 7, 7, 32)     36864       conv5_block16_1_rel
u[0][0]
_____
_____
conv5_block16_concat (Concatena (None, 7, 7, 1024)   0           conv5_block15_conca
t[0][0]

                                                                 conv5_block16_2_con
v[0][0]
_____
_____
bn (BatchNormalization)         (None, 7, 7, 1024)   4096        conv5_block16_conca
t[0][0]
_____
_____
relu (Activation)               (None, 7, 7, 1024)   0           bn[0][0]
_____
_____
flatten (Flatten)               (None, 50176)        0           relu[0][0]
_____
_____
dense (Dense)                   (None, 2)            100354      flatten[0][0]
=================================================================================
==============
```

```
Total params: 7,137,858
Trainable params: 100,354
Non-trainable params: 7,037,504
```
_____
_____

In [9]:
```python
model.compile(
    loss='categorical_crossentropy',
    optimizer='adam',
    metrics=['accuracy']
)
```

In [10]:
```python
from 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 [11]:
```python
training_set = train_datagen.flow_from_directory('E:\\chest_xray\\train',
                                                 target_size = (224, 224),
                                                 batch_size = 32,
                                                 class_mode = 'categorical')
```

Found 5216 images belonging to 2 classes.

In [12]:
```python
test_set = test_datagen.flow_from_directory('E:\\chest_xray\\test',
                                            target_size = (224, 224),
                                            batch_size = 32,
                                            class_mode = 'categorical')
```

Found 624 images belonging to 2 classes.

In [13]:
```python
r = model.fit_generator(
    training_set,
    validation_data=test_set,
    epochs=5,
    steps_per_epoch=len(training_set),
    validation_steps=len(test_set)
)
```

```
WARNING:tensorflow:From C:\Users\MCHOME\AppData\Local\Temp/ipykernel_9644/675562961.
py:6: Model.fit_generator (from tensorflow.python.keras.engine.training) is deprecat
ed and will be removed in a future version.
Instructions for updating:
Please use Model.fit, which supports generators.
Epoch 1/5
163/163 [==============================] - 1464s 9s/step - loss: 0.7259 - accuracy:
0.9145 - val_loss: 2.6290 - val_accuracy: 0.7837
Epoch 2/5
163/163 [==============================] - 1492s 9s/step - loss: 0.3737 - accuracy:
0.9471 - val_loss: 0.8508 - val_accuracy: 0.9199
Epoch 3/5
163/163 [==============================] - 1251s 8s/step - loss: 0.4713 - accuracy:
0.9484 - val_loss: 2.7446 - val_accuracy: 0.8221
Epoch 4/5
```

```
163/163 [==============================] - 747s 5s/step - loss: 0.3571 - accuracy:
0.9599 - val_loss: 1.1820 - val_accuracy: 0.9183
Epoch 5/5
163/163 [==============================] - 734s 5s/step - loss: 0.3009 - accuracy:
0.9647 - val_loss: 1.9438 - val_accuracy: 0.8782
```
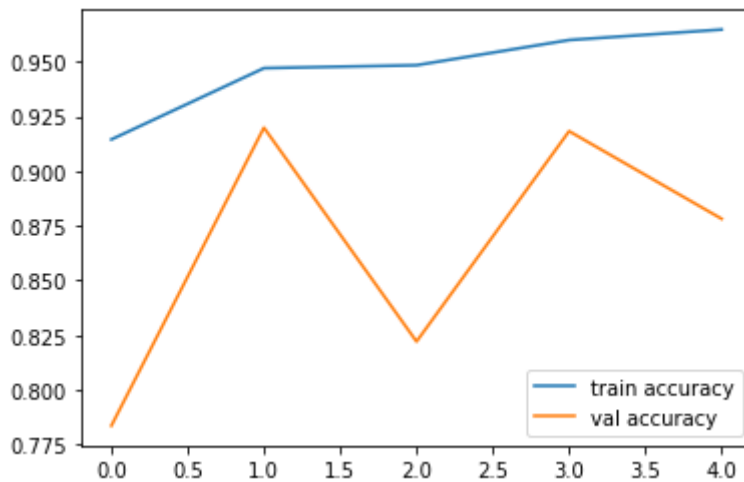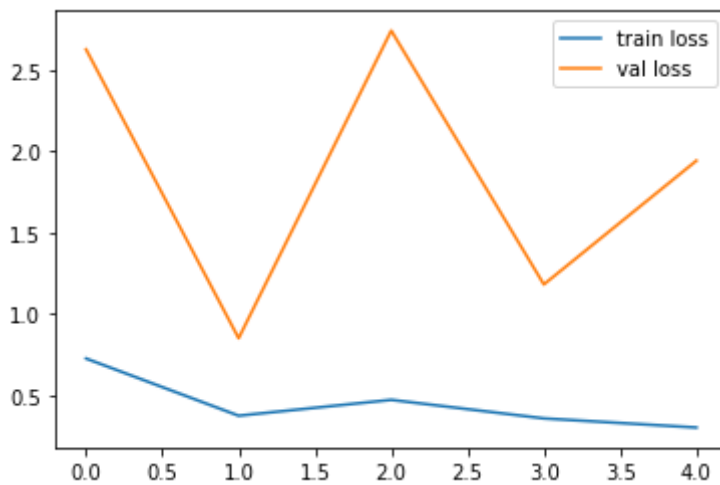
In [14]:
```python
plt.plot(r.history['loss'], label='train loss')
plt.plot(r.history['val_loss'], label='val loss')
plt.legend()
plt.show()
plt.savefig('LossVal_loss')

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



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

In [15]:
```python
import tensorflow as tf

from keras.models import load_model

model.save('E:\\chest_xray\\val\\model_densenet121.h5')
```

In [ ]:

In [ ]:

In [ ]: