```
In [1]:  # Import libraries
         import os,cv2
         import time
         import numpy as np
         import matplotlib.pyplot as plt

         from sklearn.utils import shuffle
         from sklearn.model_selection import train_test_split
         from keras.preprocessing import image
         from keras.utils import np_utils
         from keras.models import Sequential
         from keras.layers import Input
         from keras.layers.core import Dense, Dropout, Activation, Flatten
         from keras.layers.convolutional import Convolution2D, MaxPooling2D
         from keras import callbacks
         from keras import backend as K
         K.set_image_data_format('channels_last')
         from sklearn.metrics import classification_report,confusion_matrix
         import itertools
         from keras.models import Model
         from tensorflow.keras.applications.efficientnet import EfficientNetB0
         from tensorflow.keras.applications.inception_v3 import decode_predictions
```

Set path for application

```
In [2]:  data_path = 'D:/Harold/MyDNN/DataSet/Chest_xray_seperate'
         data_dir_list = os.listdir(data_path)
         print(data_path)
```

```
D:/Harold/MyDNN/DataSet/Chest_xray_seperate
```

Set Image Size and Epocs

```
In [3]:  img_rows=128
         img_cols=128
         num_channel=3
         num_epoch=100
```

Define the number of classes

```
In [4]:  num_classes = 2

         img_data_list=[]
```

In [5]:
```python
def preprocess_input(x):
    x[:, :, :, 0] -= 103.939
    x[:, :, :, 1] -= 116.779
    x[:, :, :, 2] -= 123.68
    # 'RGB'->'BGR'
    x = x[:, :, :, ::-1]
    return x

def data_preperation():
    for dataset in data_dir_list:
        img_list=os.listdir(data_path+'/'+ dataset)
        print ('Loading the images of dataset-'+'{}\n'.format(dataset))
        for img in img_list:
            img_path = data_path + '/'+ dataset + '/'+ img
            img = image.load_img(img_path, target_size=(224, 224))
            x = image.img_to_array(img)
            x = np.expand_dims(x, axis=0)
            x = preprocess_input(x)
#             print('Input image shape:', x.shape)
            img_data_list.append(x)
        print('Loading Complete')

#     for dataset in data_dir_list:
#         img_list=os.listdir(data_path+'/'+ dataset)
#         print ('Loading the images of dataset-'+'{}\n'.format(dataset))
#         for img in img_list:
#             img_path = data_path + '/'+ dataset + '/'+ img
#             img = image.load_img(img_path, target_size=(224, 224))
#             x = image.img_to_array(img)
#             x = np.expand_dims(x, axis=0)
#             x = preprocess_input(x)
# #             print('Input image shape:', x.shape)
#             img_data_list.append(x)
#         print('Loading Complete')

def display_loss_accuracy(hist):
    train_loss=hist.history['loss']
    val_loss=hist.history['val_loss']
    train_acc=hist.history['accuracy']
    val_acc=hist.history['val_accuracy']
    xc=range(num_epoch)

    plt.figure(1,figsize=(7,5))
    plt.plot(xc,train_loss)
    plt.plot(xc,val_loss)
    plt.xlabel('num of Epochs')
    plt.ylabel('loss')
    plt.title('train_loss vs val_loss')
    plt.grid(True)
    plt.legend(['train','val'])
    #print plt.style.available # use bmh, classic,ggplot for big pictures
    plt.style.use(['classic'])

    plt.figure(2,figsize=(7,5))
    plt.plot(xc,train_acc)
    plt.plot(xc,val_acc)
    plt.xlabel('num of Epochs')
    plt.ylabel('accuracy')
    plt.title('train_acc vs val_acc')
    plt.grid(True)
    plt.legend(['train','val'],loc=4)
    #print plt.style.available # use bmh, classic,ggplot for big pictures
    plt.style.use(['classic'])
```

```python
def get_featuremaps(model, layer_idx, X_batch):
    get_activations = K.function([model.layers[0].input, K.learning_phase()],[model.layers[layer_idx].output,])
    activations = get_activations([X_batch,0])
    return activations

def plot_featuremap_activations(activations):
    print (np.shape(activations))
    feature_maps = activations[0][0]
    print (np.shape(feature_maps))
    print (feature_maps.shape)

    fig=plt.figure(figsize=(16,16))
    plt.imshow(feature_maps[:,:,filter_num],cmap='gray')
    plt.savefig("featuremaps-layer-{}".format(layer_num) + "-filternum-{}".format(filter_num)+'.jpg')

    num_of_featuremaps=feature_maps.shape[2]
    fig=plt.figure(figsize=(16,16))
    plt.title("featuremaps-layer-{}".format(layer_num))
    subplot_num=int(np.ceil(np.sqrt(num_of_featuremaps)))
    for i in range(int(num_of_featuremaps)):
        ax = fig.add_subplot(subplot_num, subplot_num, i+1)
        #ax.imshow(output_image[0,:,:,i],interpolation='nearest' ) #to see the first filter
        ax.imshow(feature_maps[:,:,i],cmap='gray')
        plt.xticks([])
        plt.yticks([])
        plt.tight_layout()
    plt.show()
    fig.savefig("featuremaps-layer-{}".format(layer_num) + '.jpg')

# Plotting the confusion matrix
def plot_confusion_matrix(cm, classes,
                          normalize=False,
                          title='Confusion matrix',
                          cmap=plt.cm.Blues):
    """
    This function prints and plots the confusion matrix.
    Normalization can be applied by setting `normalize=True`.
    """
    plt.figure()
    plt.imshow(cm, interpolation='nearest', cmap=cmap)
    plt.title(title)
    plt.colorbar()
    tick_marks = np.arange(len(classes))
    plt.xticks(tick_marks, classes, rotation=45)
    plt.yticks(tick_marks, classes)

    if normalize:
        cm = cm.astype('float') / cm.sum(axis=1)[:, np.newaxis]
        print("Normalized confusion matrix")
    else:
        print('Confusion matrix, without normalization')

    print(cm)

    thresh = cm.max() / 2.
    for i, j in itertools.product(range(cm.shape[0]), range(cm.shape[1])):
        plt.text(j, i, cm[i, j],
                 horizontalalignment="center",
                 color="white" if cm[i, j] > thresh else "black")
```

```
            plt.tight_layout()
            plt.ylabel('True label')
            plt.xlabel('Predicted label')
            plt.show()
```

Data Preperation

```
In [6]:  # Calling Data Preperation
         data_preperation()
```

```
Loading the images of dataset-NORMAL

Loading Complete
Loading the images of dataset-PNEUMONIA

Loading Complete
```

```
In [7]:  print (len(img_data_list))
         img_data = np.array(img_data_list)
         #img_data = img_data.astype('float32')
         print (img_data.shape)
         img_data=np.rollaxis(img_data,1,0)
         print (img_data.shape)
         img_data=img_data[0]
         print (img_data.shape)
```

```
5856
(5856, 1, 224, 224, 3)
(1, 5856, 224, 224, 3)
(5856, 224, 224, 3)
```

Assiging Labels

```
In [8]:  num_of_samples = img_data.shape[0]
         labels = np.ones((num_of_samples,),dtype='int64')

         labels[0:1582]=0
         labels[1583:5856]=1

         names = ['normal','pneumonia']
```

Creating clasas labels to one-hot encoding

```
In [9]:  # convert class labels to on-hot encoding
         Y = np_utils.to_categorical(labels, num_classes)
```

Split Data set into training and validation set

```
In [10]:  #Shuffle the dataset
          x,y = shuffle(img_data,Y, random_state=2)
          # Split the dataset
          X_train, X_test, y_train, y_test = train_test_split(x, y, test_size=0.2, random_sta
          te=2)
```

Model Definition

Training the classifier alone

In [11]:
```python
image_input = Input(shape=(224, 224, 3))
model = EfficientNetB0(input_tensor=image_input, include_top=True,weights='imagenet')
model.summary()
last_layer = model.get_layer('avg_pool').output
x= Flatten(name='flatten')(last_layer)
out = Dense(num_classes, activation='softmax', name='output_layer')(x)
custom_resnet_model = Model(inputs=image_input,outputs= out)
custom_resnet_model.summary()
```

```
Model: "efficientnetb0"
_____
_____
Layer (type)                    Output Shape         Param #      Connected to
=================================================================================
==================
input_1 (InputLayer)            [(None, 224, 224, 3)  0
_____

rescaling (Rescaling)           (None, 224, 224, 3)   0            input_1[0][0]
_____

normalization (Normalization)   (None, 224, 224, 3)   7            rescaling[0][0]
_____

stem_conv_pad (ZeroPadding2D)   (None, 225, 225, 3)   0            normalization
[0][0]
_____

stem_conv (Conv2D)              (None, 112, 112, 32)  864          stem_conv_pad
[0][0]
_____

stem_bn (BatchNormalization)    (None, 112, 112, 32)  128          stem_conv[0][0]
_____

stem_activation (Activation)    (None, 112, 112, 32)  0            stem_bn[0][0]
_____

block1a_dwconv (DepthwiseConv2D (None, 112, 112, 32)  288          stem_activation
[0][0]
_____

block1a_bn (BatchNormalization) (None, 112, 112, 32)  128          block1a_dwconv
[0][0]
_____

block1a_activation (Activation) (None, 112, 112, 32)  0            block1a_bn
[0][0]
_____

block1a_se_squeeze (GlobalAvera (None, 32)            0            block1a_activat
ion[0][0]
_____

block1a_se_reshape (Reshape)    (None, 1, 1, 32)      0            block1a_se_sque
eze[0][0]
_____

block1a_se_reduce (Conv2D)      (None, 1, 1, 8)       264          block1a_se_resh
ape[0][0]
_____

block1a_se_expand (Conv2D)      (None, 1, 1, 32)      288          block1a_se_redu
ce[0][0]
_____

block1a_se_excite (Multiply)    (None, 112, 112, 32)  0            block1a_activat
ion[0][0]
                                                                   block1a_se_expa
nd[0][0]
_____
_____
```

```
block1a_project_conv (Conv2D)    (None, 112, 112, 16) 512         block1a_se_exci
                                                                  te[0][0]
_____
block1a_project_bn (BatchNormal  (None, 112, 112, 16) 64          block1a_project
_conv[0][0]
_____
block2a_expand_conv (Conv2D)     (None, 112, 112, 96) 1536        block1a_project
_bn[0][0]
_____
block2a_expand_bn (BatchNormali  (None, 112, 112, 96) 384         block2a_expand_
conv[0][0]
_____
block2a_expand_activation (Acti  (None, 112, 112, 96) 0           block2a_expand_
bn[0][0]
_____
block2a_dwconv_pad (ZeroPadding  (None, 113, 113, 96) 0           block2a_expand_
activation[0][0]
_____
block2a_dwconv (DepthwiseConv2D  (None, 56, 56, 96)   864         block2a_dwconv_
pad[0][0]
_____
block2a_bn (BatchNormalization)  (None, 56, 56, 96)   384         block2a_dwconv
[0][0]
_____
block2a_activation (Activation)  (None, 56, 56, 96)   0           block2a_bn
[0][0]
_____
block2a_se_squeeze (GlobalAvera  (None, 96)           0           block2a_activat
ion[0][0]
_____
block2a_se_reshape (Reshape)     (None, 1, 1, 96)     0           block2a_se_sque
eze[0][0]
_____
block2a_se_reduce (Conv2D)       (None, 1, 1, 4)      388         block2a_se_resh
ape[0][0]
_____
block2a_se_expand (Conv2D)       (None, 1, 1, 96)     480         block2a_se_redu
ce[0][0]
_____
block2a_se_excite (Multiply)     (None, 56, 56, 96)   0           block2a_activat
ion[0][0]

                                                                  block2a_se_expa
nd[0][0]
_____
block2a_project_conv (Conv2D)    (None, 56, 56, 24)   2304        block2a_se_exci
te[0][0]
_____
block2a_project_bn (BatchNormal  (None, 56, 56, 24)   96          block2a_project
_conv[0][0]
```

```
_____
block2b_expand_conv (Conv2D)      (None, 56, 56, 144)  3456        block2a_project
_bn[0][0]
_____

_____
block2b_expand_bn (BatchNormali   (None, 56, 56, 144)  576         block2b_expand_
conv[0][0]
_____

_____
block2b_expand_activation (Acti   (None, 56, 56, 144)  0           block2b_expand_
bn[0][0]
_____

_____
block2b_dwconv (DepthwiseConv2D   (None, 56, 56, 144)  1296        block2b_expand_
activation[0][0]
_____

_____
block2b_bn (BatchNormalization)   (None, 56, 56, 144)  576         block2b_dwconv
[0][0]
_____

_____
block2b_activation (Activation)   (None, 56, 56, 144)  0           block2b_bn
[0][0]
_____

_____
block2b_se_squeeze (GlobalAvera   (None, 144)          0           block2b_activat
ion[0][0]
_____

_____
block2b_se_reshape (Reshape)      (None, 1, 1, 144)    0           block2b_se_sque
eze[0][0]
_____

_____
block2b_se_reduce (Conv2D)        (None, 1, 1, 6)      870         block2b_se_resh
ape[0][0]
_____

_____
block2b_se_expand (Conv2D)        (None, 1, 1, 144)    1008        block2b_se_redu
ce[0][0]
_____

_____
block2b_se_excite (Multiply)      (None, 56, 56, 144)  0           block2b_activat
ion[0][0]

                                                                  block2b_se_expa
nd[0][0]
_____

_____
block2b_project_conv (Conv2D)     (None, 56, 56, 24)   3456        block2b_se_exci
te[0][0]
_____

_____
block2b_project_bn (BatchNormal   (None, 56, 56, 24)   96          block2b_project
_conv[0][0]
_____

_____
block2b_drop (Dropout)            (None, 56, 56, 24)   0           block2b_project
_bn[0][0]
_____

_____
block2b_add (Add)                 (None, 56, 56, 24)   0           block2b_drop
[0][0]

                                                                  block2a_project
_bn[0][0]
```

```
_____

_____
block3a_expand_conv (Conv2D)    (None, 56, 56, 144)  3456       block2b_add
[0][0]
_____

_____
block3a_expand_bn (BatchNormali (None, 56, 56, 144)  576        block3a_expand_
conv[0][0]
_____

_____
block3a_expand_activation (Acti (None, 56, 56, 144)  0          block3a_expand_
bn[0][0]
_____

_____
block3a_dwconv_pad (ZeroPadding (None, 59, 59, 144)  0          block3a_expand_
activation[0][0]
_____

_____
block3a_dwconv (DepthwiseConv2D (None, 28, 28, 144)  3600       block3a_dwconv_
pad[0][0]
_____

_____
block3a_bn (BatchNormalization) (None, 28, 28, 144)  576        block3a_dwconv
[0][0]
_____

_____
block3a_activation (Activation) (None, 28, 28, 144)  0          block3a_bn
[0][0]
_____

_____
block3a_se_squeeze (GlobalAvera (None, 144)          0          block3a_activat
ion[0][0]
_____

_____
block3a_se_reshape (Reshape)    (None, 1, 1, 144)    0          block3a_se_sque
eze[0][0]
_____

_____
block3a_se_reduce (Conv2D)      (None, 1, 1, 6)      870        block3a_se_resh
ape[0][0]
_____

_____
block3a_se_expand (Conv2D)      (None, 1, 1, 144)    1008       block3a_se_redu
ce[0][0]
_____

_____
block3a_se_excite (Multiply)    (None, 28, 28, 144)  0          block3a_activat
ion[0][0]

                                                                block3a_se_expa
nd[0][0]
_____

_____
block3a_project_conv (Conv2D)   (None, 28, 28, 40)   5760       block3a_se_exci
te[0][0]
_____

_____
block3a_project_bn (BatchNormal (None, 28, 28, 40)   160        block3a_project
_conv[0][0]
_____

_____
block3b_expand_conv (Conv2D)    (None, 28, 28, 240)  9600       block3a_project
_bn[0][0]
_____

_____
```

```
block3b_expand_bn (BatchNormali (None, 28, 28, 240)  960        block3b_expand_
conv[0][0]
_____
block3b_expand_activation (Acti (None, 28, 28, 240)  0          block3b_expand_
bn[0][0]
_____
block3b_dwconv (DepthwiseConv2D (None, 28, 28, 240)  6000       block3b_expand_
activation[0][0]
_____
block3b_bn (BatchNormalization) (None, 28, 28, 240)  960        block3b_dwconv
[0][0]
_____
block3b_activation (Activation) (None, 28, 28, 240)  0          block3b_bn
[0][0]
_____
block3b_se_squeeze (GlobalAvera (None, 240)          0          block3b_activat
ion[0][0]
_____
block3b_se_reshape (Reshape)    (None, 1, 1, 240)    0          block3b_se_sque
eze[0][0]
_____
block3b_se_reduce (Conv2D)      (None, 1, 1, 10)     2410       block3b_se_resh
ape[0][0]
_____
block3b_se_expand (Conv2D)      (None, 1, 1, 240)    2640       block3b_se_redu
ce[0][0]
_____
block3b_se_excite (Multiply)    (None, 28, 28, 240)  0          block3b_activat
ion[0][0]

                                                                block3b_se_expa
nd[0][0]
_____
block3b_project_conv (Conv2D)   (None, 28, 28, 40)   9600       block3b_se_exci
te[0][0]
_____
block3b_project_bn (BatchNormal (None, 28, 28, 40)   160        block3b_project
_conv[0][0]
_____
block3b_drop (Dropout)          (None, 28, 28, 40)   0          block3b_project
_bn[0][0]
_____
block3b_add (Add)               (None, 28, 28, 40)   0          block3b_drop
[0][0]

                                                                block3a_project
_bn[0][0]
_____
block4a_expand_conv (Conv2D)    (None, 28, 28, 240)  9600       block3b_add
[0][0]
_____
_____
```

```
block4a_expand_bn (BatchNormali (None, 28, 28, 240)  960         block4a_expand_
conv[0][0]
_____
block4a_expand_activation (Acti (None, 28, 28, 240)  0           block4a_expand_
bn[0][0]
_____
block4a_dwconv_pad (ZeroPadding (None, 29, 29, 240)  0           block4a_expand_
activation[0][0]
_____
block4a_dwconv (DepthwiseConv2D (None, 14, 14, 240)  2160        block4a_dwconv_
pad[0][0]
_____
block4a_bn (BatchNormalization) (None, 14, 14, 240)  960         block4a_dwconv
[0][0]
_____
block4a_activation (Activation) (None, 14, 14, 240)  0           block4a_bn
[0][0]
_____
block4a_se_squeeze (GlobalAvera (None, 240)          0           block4a_activat
ion[0][0]
_____
block4a_se_reshape (Reshape)    (None, 1, 1, 240)    0           block4a_se_sque
eze[0][0]
_____
block4a_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block4a_se_resh
ape[0][0]
_____
block4a_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block4a_se_redu
ce[0][0]
_____
block4a_se_excite (Multiply)    (None, 14, 14, 240)  0           block4a_activat
ion[0][0]

                                                                 block4a_se_expa
nd[0][0]
_____
block4a_project_conv (Conv2D)   (None, 14, 14, 80)   19200       block4a_se_exci
te[0][0]
_____
block4a_project_bn (BatchNormal (None, 14, 14, 80)   320         block4a_project
_conv[0][0]
_____
block4b_expand_conv (Conv2D)    (None, 14, 14, 480)  38400       block4a_project
_bn[0][0]
_____
block4b_expand_bn (BatchNormali (None, 14, 14, 480)  1920        block4b_expand_
conv[0][0]
_____
block4b_expand_activation (Acti (None, 14, 14, 480)  0           block4b_expand_
bn[0][0]
```

```
_____
block4b_dwconv (DepthwiseConv2D (None, 14, 14, 480)  4320        block4b_expand_
                                                                 activation[0][0]
_____

_____
block4b_bn (BatchNormalization) (None, 14, 14, 480)  1920        block4b_dwconv
                                                                 [0][0]
_____

_____
block4b_activation (Activation) (None, 14, 14, 480)  0           block4b_bn
                                                                 [0][0]
_____

_____
block4b_se_squeeze (GlobalAvera (None, 480)          0           block4b_activat
                                                                 ion[0][0]
_____

_____
block4b_se_reshape (Reshape)    (None, 1, 1, 480)    0           block4b_se_sque
                                                                 eze[0][0]
_____

_____
block4b_se_reduce (Conv2D)      (None, 1, 1, 20)     9620        block4b_se_resh
                                                                 ape[0][0]
_____

_____
block4b_se_expand (Conv2D)      (None, 1, 1, 480)    10080       block4b_se_redu
                                                                 ce[0][0]
_____

_____
block4b_se_excite (Multiply)    (None, 14, 14, 480)  0           block4b_activat
                                                                 ion[0][0]

                                                                 block4b_se_expa
nd[0][0]
_____

_____
block4b_project_conv (Conv2D)   (None, 14, 14, 80)   38400       block4b_se_exci
                                                                 te[0][0]
_____

_____
block4b_project_bn (BatchNormal (None, 14, 14, 80)   320         block4b_project
                                                                 _conv[0][0]
_____

_____
block4b_drop (Dropout)          (None, 14, 14, 80)   0           block4b_project
                                                                 _bn[0][0]
_____

_____
block4b_add (Add)               (None, 14, 14, 80)   0           block4b_drop
                                                                 [0][0]

                                                                 block4a_project
_bn[0][0]
_____

_____
block4c_expand_conv (Conv2D)    (None, 14, 14, 480)  38400       block4b_add
                                                                 [0][0]
_____

_____
block4c_expand_bn (BatchNormali (None, 14, 14, 480)  1920        block4c_expand_
                                                                 conv[0][0]
_____

_____
block4c_expand_activation (Acti (None, 14, 14, 480)  0           block4c_expand_
                                                                 bn[0][0]
```

```
_____
block4c_dwconv (DepthwiseConv2D (None, 14, 14, 480)  4320        block4c_expand_
activation[0][0]
_____
_____
block4c_bn (BatchNormalization) (None, 14, 14, 480)  1920        block4c_dwconv
[0][0]
_____
_____
block4c_activation (Activation) (None, 14, 14, 480)  0           block4c_bn
[0][0]
_____
_____
block4c_se_squeeze (GlobalAvera (None, 480)          0           block4c_activat
ion[0][0]
_____
_____
block4c_se_reshape (Reshape)    (None, 1, 1, 480)    0           block4c_se_sque
eze[0][0]
_____
_____
block4c_se_reduce (Conv2D)      (None, 1, 1, 20)     9620        block4c_se_resh
ape[0][0]
_____
_____
block4c_se_expand (Conv2D)      (None, 1, 1, 480)    10080       block4c_se_redu
ce[0][0]
_____
_____
block4c_se_excite (Multiply)    (None, 14, 14, 480)  0           block4c_activat
ion[0][0]

                                                                 block4c_se_expa
nd[0][0]
_____
_____
block4c_project_conv (Conv2D)   (None, 14, 14, 80)   38400       block4c_se_exci
te[0][0]
_____
_____
block4c_project_bn (BatchNormal (None, 14, 14, 80)   320         block4c_project
_conv[0][0]
_____
_____
block4c_drop (Dropout)          (None, 14, 14, 80)   0           block4c_project
_bn[0][0]
_____
_____
block4c_add (Add)               (None, 14, 14, 80)   0           block4c_drop
[0][0]

                                                                 block4b_add
[0][0]
_____
_____
block5a_expand_conv (Conv2D)    (None, 14, 14, 480)  38400       block4c_add
[0][0]
_____
_____
block5a_expand_bn (BatchNormali (None, 14, 14, 480)  1920        block5a_expand_
conv[0][0]
_____
_____
block5a_expand_activation (Acti (None, 14, 14, 480)  0           block5a_expand_
bn[0][0]
```

```
_____

_____
block5a_dwconv (DepthwiseConv2D (None, 14, 14, 480) 12000       block5a_expand_
activation[0][0]
_____

_____
block5a_bn (BatchNormalization) (None, 14, 14, 480) 1920        block5a_dwconv
[0][0]
_____

_____
block5a_activation (Activation) (None, 14, 14, 480) 0           block5a_bn
[0][0]
_____

_____
block5a_se_squeeze (GlobalAvera (None, 480)          0           block5a_activat
ion[0][0]
_____

_____
block5a_se_reshape (Reshape)    (None, 1, 1, 480)   0           block5a_se_sque
eze[0][0]
_____

_____
block5a_se_reduce (Conv2D)      (None, 1, 1, 20)    9620        block5a_se_resh
ape[0][0]
_____

_____
block5a_se_expand (Conv2D)      (None, 1, 1, 480)   10080       block5a_se_redu
ce[0][0]
_____

_____
block5a_se_excite (Multiply)    (None, 14, 14, 480) 0           block5a_activat
ion[0][0]

                                                                block5a_se_expa
nd[0][0]
_____

_____
block5a_project_conv (Conv2D)   (None, 14, 14, 112) 53760       block5a_se_exci
te[0][0]
_____

_____
block5a_project_bn (BatchNormal (None, 14, 14, 112) 448         block5a_project
_conv[0][0]
_____

_____
block5b_expand_conv (Conv2D)    (None, 14, 14, 672) 75264       block5a_project
_bn[0][0]
_____

_____
block5b_expand_bn (BatchNormali (None, 14, 14, 672) 2688        block5b_expand_
conv[0][0]
_____

_____
block5b_expand_activation (Acti (None, 14, 14, 672) 0           block5b_expand_
bn[0][0]
_____

_____
block5b_dwconv (DepthwiseConv2D (None, 14, 14, 672) 16800       block5b_expand_
activation[0][0]
_____

_____
block5b_bn (BatchNormalization) (None, 14, 14, 672) 2688        block5b_dwconv
[0][0]
_____

_____
```

```
block5b_activation (Activation) (None, 14, 14, 672)  0            block5b_bn
[0][0]
_____
block5b_se_squeeze (GlobalAvera (None, 672)           0            block5b_activat
ion[0][0]
_____
block5b_se_reshape (Reshape)    (None, 1, 1, 672)     0            block5b_se_sque
eze[0][0]
_____
block5b_se_reduce (Conv2D)      (None, 1, 1, 28)      18844        block5b_se_resh
ape[0][0]
_____
block5b_se_expand (Conv2D)      (None, 1, 1, 672)     19488        block5b_se_redu
ce[0][0]
_____
block5b_se_excite (Multiply)    (None, 14, 14, 672)   0            block5b_activat
ion[0][0]

                                                                   block5b_se_expa
nd[0][0]
_____
block5b_project_conv (Conv2D)   (None, 14, 14, 112)   75264        block5b_se_exci
te[0][0]
_____
block5b_project_bn (BatchNormal (None, 14, 14, 112)   448          block5b_project
_conv[0][0]
_____
block5b_drop (Dropout)          (None, 14, 14, 112)   0            block5b_project
_bn[0][0]
_____
block5b_add (Add)               (None, 14, 14, 112)   0            block5b_drop
[0][0]

                                                                   block5a_project
_bn[0][0]
_____
block5c_expand_conv (Conv2D)    (None, 14, 14, 672)   75264        block5b_add
[0][0]
_____
block5c_expand_bn (BatchNormali (None, 14, 14, 672)   2688         block5c_expand_
conv[0][0]
_____
block5c_expand_activation (Acti (None, 14, 14, 672)   0            block5c_expand_
bn[0][0]
_____
block5c_dwconv (DepthwiseConv2D (None, 14, 14, 672)   16800        block5c_expand_
activation[0][0]
_____
block5c_bn (BatchNormalization) (None, 14, 14, 672)   2688         block5c_dwconv
[0][0]
_____
```

```
block5c_activation (Activation)  (None, 14, 14, 672)  0          block5c_bn
[0][0]
_____
block5c_se_squeeze (GlobalAvera  (None, 672)           0          block5c_activat
ion[0][0]
_____
block5c_se_reshape (Reshape)     (None, 1, 1, 672)     0          block5c_se_sque
eze[0][0]
_____
block5c_se_reduce (Conv2D)       (None, 1, 1, 28)      18844      block5c_se_resh
ape[0][0]
_____
block5c_se_expand (Conv2D)       (None, 1, 1, 672)     19488      block5c_se_redu
ce[0][0]
_____
block5c_se_excite (Multiply)     (None, 14, 14, 672)   0          block5c_activat
ion[0][0]

                                                                   block5c_se_expa
nd[0][0]
_____
block5c_project_conv (Conv2D)    (None, 14, 14, 112)   75264      block5c_se_exci
te[0][0]
_____
block5c_project_bn (BatchNormal  (None, 14, 14, 112)   448        block5c_project
_conv[0][0]
_____
block5c_drop (Dropout)           (None, 14, 14, 112)   0          block5c_project
_bn[0][0]
_____
block5c_add (Add)                (None, 14, 14, 112)   0          block5c_drop
[0][0]

                                                                   block5b_add
[0][0]
_____
block6a_expand_conv (Conv2D)     (None, 14, 14, 672)   75264      block5c_add
[0][0]
_____
block6a_expand_bn (BatchNormali  (None, 14, 14, 672)   2688       block6a_expand_
conv[0][0]
_____
block6a_expand_activation (Acti  (None, 14, 14, 672)   0          block6a_expand_
bn[0][0]
_____
block6a_dwconv_pad (ZeroPadding  (None, 17, 17, 672)   0          block6a_expand_
activation[0][0]
_____
block6a_dwconv (DepthwiseConv2D  (None, 7, 7, 672)     16800      block6a_dwconv_
pad[0][0]
_____
_____
```

```
block6a_bn (BatchNormalization) (None, 7, 7, 672)    2688         block6a_dwconv
[0][0]
_____
block6a_activation (Activation) (None, 7, 7, 672)    0            block6a_bn
[0][0]
_____
block6a_se_squeeze (GlobalAvera (None, 672)           0            block6a_activat
ion[0][0]
_____
block6a_se_reshape (Reshape)    (None, 1, 1, 672)    0            block6a_se_sque
eze[0][0]
_____
block6a_se_reduce (Conv2D)      (None, 1, 1, 28)     18844        block6a_se_resh
ape[0][0]
_____
block6a_se_expand (Conv2D)      (None, 1, 1, 672)    19488        block6a_se_redu
ce[0][0]
_____
block6a_se_excite (Multiply)    (None, 7, 7, 672)    0            block6a_activat
ion[0][0]

                                                                  block6a_se_expa
nd[0][0]
_____
block6a_project_conv (Conv2D)   (None, 7, 7, 192)    129024       block6a_se_exci
te[0][0]
_____
block6a_project_bn (BatchNormal (None, 7, 7, 192)    768          block6a_project
_conv[0][0]
_____
block6b_expand_conv (Conv2D)    (None, 7, 7, 1152)   221184       block6a_project
_bn[0][0]
_____
block6b_expand_bn (BatchNormali (None, 7, 7, 1152)   4608         block6b_expand_
conv[0][0]
_____
block6b_expand_activation (Acti (None, 7, 7, 1152)   0            block6b_expand_
bn[0][0]
_____
block6b_dwconv (DepthwiseConv2D (None, 7, 7, 1152)   28800        block6b_expand_
activation[0][0]
_____
block6b_bn (BatchNormalization) (None, 7, 7, 1152)   4608         block6b_dwconv
[0][0]
_____
block6b_activation (Activation) (None, 7, 7, 1152)   0            block6b_bn
[0][0]
_____
block6b_se_squeeze (GlobalAvera (None, 1152)         0            block6b_activat
ion[0][0]
```

```
_____
block6b_se_reshape (Reshape)    (None, 1, 1, 1152)   0          block6b_se_sque
eze[0][0]
_____
block6b_se_reduce (Conv2D)      (None, 1, 1, 48)     55344      block6b_se_resh
ape[0][0]
_____
block6b_se_expand (Conv2D)      (None, 1, 1, 1152)   56448      block6b_se_redu
ce[0][0]
_____
block6b_se_excite (Multiply)    (None, 7, 7, 1152)   0          block6b_activat
ion[0][0]

                                                                 block6b_se_expa
nd[0][0]
_____
block6b_project_conv (Conv2D)   (None, 7, 7, 192)    221184     block6b_se_exci
te[0][0]
_____
block6b_project_bn (BatchNormal (None, 7, 7, 192)    768        block6b_project
_conv[0][0]
_____
block6b_drop (Dropout)          (None, 7, 7, 192)    0          block6b_project
_bn[0][0]
_____
block6b_add (Add)               (None, 7, 7, 192)    0          block6b_drop
[0][0]

                                                                 block6a_project
_bn[0][0]
_____
block6c_expand_conv (Conv2D)    (None, 7, 7, 1152)   221184     block6b_add
[0][0]
_____
block6c_expand_bn (BatchNormali (None, 7, 7, 1152)   4608       block6c_expand_
conv[0][0]
_____
block6c_expand_activation (Acti (None, 7, 7, 1152)   0          block6c_expand_
bn[0][0]
_____
block6c_dwconv (DepthwiseConv2D (None, 7, 7, 1152)   28800      block6c_expand_
activation[0][0]
_____
block6c_bn (BatchNormalization) (None, 7, 7, 1152)   4608       block6c_dwconv
[0][0]
_____
block6c_activation (Activation) (None, 7, 7, 1152)   0          block6c_bn
[0][0]
_____
block6c_se_squeeze (GlobalAvera (None, 1152)         0          block6c_activat
ion[0][0]
```

```
_____
_____

block6c_se_reshape (Reshape)    (None, 1, 1, 1152)   0         block6c_se_sque
eze[0][0]
_____
_____

block6c_se_reduce (Conv2D)      (None, 1, 1, 48)     55344     block6c_se_resh
ape[0][0]
_____
_____

block6c_se_expand (Conv2D)      (None, 1, 1, 1152)   56448     block6c_se_redu
ce[0][0]
_____
_____

block6c_se_excite (Multiply)    (None, 7, 7, 1152)   0         block6c_activat
ion[0][0]

                                                               block6c_se_expa
nd[0][0]
_____
_____

block6c_project_conv (Conv2D)   (None, 7, 7, 192)    221184    block6c_se_exci
te[0][0]
_____
_____

block6c_project_bn (BatchNormal (None, 7, 7, 192)    768       block6c_project
_conv[0][0]
_____
_____

block6c_drop (Dropout)          (None, 7, 7, 192)    0         block6c_project
_bn[0][0]
_____
_____

block6c_add (Add)               (None, 7, 7, 192)    0         block6c_drop
[0][0]
                                                               block6b_add
[0][0]
_____
_____

block6d_expand_conv (Conv2D)    (None, 7, 7, 1152)   221184    block6c_add
[0][0]
_____
_____

block6d_expand_bn (BatchNormali (None, 7, 7, 1152)   4608      block6d_expand_
conv[0][0]
_____
_____

block6d_expand_activation (Acti (None, 7, 7, 1152)   0         block6d_expand_
bn[0][0]
_____
_____

block6d_dwconv (DepthwiseConv2D (None, 7, 7, 1152)   28800     block6d_expand_
activation[0][0]
_____
_____

block6d_bn (BatchNormalization) (None, 7, 7, 1152)   4608      block6d_dwconv
[0][0]
_____
_____

block6d_activation (Activation) (None, 7, 7, 1152)   0         block6d_bn
[0][0]
_____
_____

block6d_se_squeeze (GlobalAvera (None, 1152)         0         block6d_activat
ion[0][0]
```

```
                                          _____
_____
block6d_se_reshape (Reshape)    (None, 1, 1, 1152)   0           block6d_se_sque
eze[0][0]
                                          _____
_____
block6d_se_reduce (Conv2D)      (None, 1, 1, 48)      55344       block6d_se_resh
ape[0][0]
                                          _____
_____
block6d_se_expand (Conv2D)      (None, 1, 1, 1152)    56448       block6d_se_redu
ce[0][0]
                                          _____
_____
block6d_se_excite (Multiply)    (None, 7, 7, 1152)    0           block6d_activat
ion[0][0]

                                                                  block6d_se_expa
nd[0][0]
                                          _____
_____
block6d_project_conv (Conv2D)   (None, 7, 7, 192)     221184      block6d_se_exci
te[0][0]
                                          _____
_____
block6d_project_bn (BatchNormal (None, 7, 7, 192)     768         block6d_project
_conv[0][0]
                                          _____
_____
block6d_drop (Dropout)          (None, 7, 7, 192)     0           block6d_project
_bn[0][0]
                                          _____
_____
block6d_add (Add)               (None, 7, 7, 192)     0           block6d_drop
[0][0]

                                                                  block6c_add
[0][0]
                                          _____
_____
block7a_expand_conv (Conv2D)    (None, 7, 7, 1152)    221184      block6d_add
[0][0]
                                          _____
_____
block7a_expand_bn (BatchNormali (None, 7, 7, 1152)    4608        block7a_expand_
conv[0][0]
                                          _____
_____
block7a_expand_activation (Acti (None, 7, 7, 1152)    0           block7a_expand_
bn[0][0]
                                          _____
_____
block7a_dwconv (DepthwiseConv2D (None, 7, 7, 1152)    10368       block7a_expand_
activation[0][0]
                                          _____
_____
block7a_bn (BatchNormalization) (None, 7, 7, 1152)    4608        block7a_dwconv
[0][0]
                                          _____
_____
block7a_activation (Activation) (None, 7, 7, 1152)    0           block7a_bn
[0][0]
                                          _____
_____
block7a_se_squeeze (GlobalAvera (None, 1152)          0           block7a_activat
ion[0][0]
```

```
_____

block7a_se_reshape (Reshape)    (None, 1, 1, 1152)   0          block7a_se_sque
eze[0][0]
_____

block7a_se_reduce (Conv2D)      (None, 1, 1, 48)     55344      block7a_se_resh
ape[0][0]
_____

block7a_se_expand (Conv2D)      (None, 1, 1, 1152)   56448      block7a_se_redu
ce[0][0]
_____

block7a_se_excite (Multiply)    (None, 7, 7, 1152)   0          block7a_activat
ion[0][0]

                                                                block7a_se_expa
nd[0][0]
_____

block7a_project_conv (Conv2D)   (None, 7, 7, 320)    368640     block7a_se_exci
te[0][0]
_____

block7a_project_bn (BatchNormal (None, 7, 7, 320)    1280       block7a_project
_conv[0][0]
_____

top_conv (Conv2D)               (None, 7, 7, 1280)   409600     block7a_project
_bn[0][0]
_____

top_bn (BatchNormalization)     (None, 7, 7, 1280)   5120       top_conv[0][0]
_____

top_activation (Activation)     (None, 7, 7, 1280)   0          top_bn[0][0]
_____

avg_pool (GlobalAveragePooling2 (None, 1280)         0          top_activation
[0][0]
_____

top_dropout (Dropout)           (None, 1280)         0          avg_pool[0][0]
_____

predictions (Dense)             (None, 1000)         1281000    top_dropout
[0][0]
================================================================================
================
Total params: 5,330,571
Trainable params: 5,288,548
Non-trainable params: 42,023
_____

Model: "functional_1"
_____

Layer (type)                    Output Shape         Param #    Connected to
================================================================================
================
input_1 (InputLayer)            [(None, 224, 224, 3) 0
_____

rescaling (Rescaling)           (None, 224, 224, 3)  0          input_1[0][0]
```

```
_____
_____
normalization (Normalization)  (None, 224, 224, 3)  7       rescaling[0][0]
_____
_____
stem_conv_pad (ZeroPadding2D)  (None, 225, 225, 3)  0       normalization
[0][0]
_____
_____
stem_conv (Conv2D)             (None, 112, 112, 32) 864     stem_conv_pad
[0][0]
_____
_____
stem_bn (BatchNormalization)   (None, 112, 112, 32) 128     stem_conv[0][0]
_____
_____
stem_activation (Activation)   (None, 112, 112, 32) 0       stem_bn[0][0]
_____
_____
block1a_dwconv (DepthwiseConv2D (None, 112, 112, 32) 288    stem_activation
[0][0]
_____
_____
block1a_bn (BatchNormalization) (None, 112, 112, 32) 128    block1a_dwconv
[0][0]
_____
_____
block1a_activation (Activation) (None, 112, 112, 32) 0      block1a_bn
[0][0]
_____
_____
block1a_se_squeeze (GlobalAvera (None, 32)           0      block1a_activat
ion[0][0]
_____
_____
block1a_se_reshape (Reshape)   (None, 1, 1, 32)     0       block1a_se_sque
eze[0][0]
_____
_____
block1a_se_reduce (Conv2D)     (None, 1, 1, 8)      264     block1a_se_resh
ape[0][0]
_____
_____
block1a_se_expand (Conv2D)     (None, 1, 1, 32)     288     block1a_se_redu
ce[0][0]
_____
_____
block1a_se_excite (Multiply)   (None, 112, 112, 32) 0       block1a_activat
ion[0][0]

                                                            block1a_se_expa
nd[0][0]
_____
_____
block1a_project_conv (Conv2D)  (None, 112, 112, 16) 512     block1a_se_exci
te[0][0]
_____
_____
block1a_project_bn (BatchNormal (None, 112, 112, 16) 64     block1a_project
_conv[0][0]
_____
_____
block2a_expand_conv (Conv2D)   (None, 112, 112, 96) 1536    block1a_project
_bn[0][0]
_____
```

```
_____
block2a_expand_bn (BatchNormali (None, 112, 112, 96) 384         block2a_expand_
conv[0][0]
_____

_____
block2a_expand_activation (Acti (None, 112, 112, 96) 0           block2a_expand_
bn[0][0]
_____

_____
block2a_dwconv_pad (ZeroPadding (None, 113, 113, 96) 0           block2a_expand_
activation[0][0]
_____

_____
block2a_dwconv (DepthwiseConv2D (None, 56, 56, 96)   864         block2a_dwconv_
pad[0][0]
_____

_____
block2a_bn (BatchNormalization) (None, 56, 56, 96)   384         block2a_dwconv
[0][0]
_____

_____
block2a_activation (Activation) (None, 56, 56, 96)   0           block2a_bn
[0][0]
_____

_____
block2a_se_squeeze (GlobalAvera (None, 96)           0           block2a_activat
ion[0][0]
_____

_____
block2a_se_reshape (Reshape)    (None, 1, 1, 96)     0           block2a_se_sque
eze[0][0]
_____

_____
block2a_se_reduce (Conv2D)      (None, 1, 1, 4)      388         block2a_se_resh
ape[0][0]
_____

_____
block2a_se_expand (Conv2D)      (None, 1, 1, 96)     480         block2a_se_redu
ce[0][0]
_____

_____
block2a_se_excite (Multiply)    (None, 56, 56, 96)   0           block2a_activat
ion[0][0]

                                                                 block2a_se_expa
nd[0][0]
_____

_____
block2a_project_conv (Conv2D)   (None, 56, 56, 24)   2304        block2a_se_exci
te[0][0]
_____

_____
block2a_project_bn (BatchNormal (None, 56, 56, 24)   96          block2a_project
_conv[0][0]
_____

_____
block2b_expand_conv (Conv2D)    (None, 56, 56, 144)  3456        block2a_project
_bn[0][0]
_____

_____
block2b_expand_bn (BatchNormali (None, 56, 56, 144)  576         block2b_expand_
conv[0][0]
_____

_____
block2b_expand_activation (Acti (None, 56, 56, 144)  0           block2b_expand_
```

```
                                                    bn[0][0]
_____
block2b_dwconv (DepthwiseConv2D (None, 56, 56, 144)  1296        block2b_expand_
                                                                 activation[0][0]
_____
block2b_bn (BatchNormalization) (None, 56, 56, 144)  576         block2b_dwconv
                                                                 [0][0]
_____
block2b_activation (Activation) (None, 56, 56, 144)  0           block2b_bn
                                                                 [0][0]
_____
block2b_se_squeeze (GlobalAvera (None, 144)           0           block2b_activat
                                                                 ion[0][0]
_____
block2b_se_reshape (Reshape)    (None, 1, 1, 144)     0           block2b_se_sque
                                                                 eze[0][0]
_____
block2b_se_reduce (Conv2D)      (None, 1, 1, 6)       870         block2b_se_resh
                                                                 ape[0][0]
_____
block2b_se_expand (Conv2D)      (None, 1, 1, 144)     1008        block2b_se_redu
                                                                 ce[0][0]
_____
block2b_se_excite (Multiply)    (None, 56, 56, 144)  0           block2b_activat
                                                                 ion[0][0]

                                                                 block2b_se_expa

                                                                 nd[0][0]
_____
block2b_project_conv (Conv2D)   (None, 56, 56, 24)   3456        block2b_se_exci
                                                                 te[0][0]
_____
block2b_project_bn (BatchNormal (None, 56, 56, 24)   96          block2b_project
                                                                 _conv[0][0]
_____
block2b_drop (Dropout)          (None, 56, 56, 24)   0           block2b_project
                                                                 _bn[0][0]
_____
block2b_add (Add)               (None, 56, 56, 24)   0           block2b_drop
                                                                 [0][0]

                                                                 block2a_project

                                                                 _bn[0][0]
_____
block3a_expand_conv (Conv2D)    (None, 56, 56, 144)  3456        block2b_add
                                                                 [0][0]
_____
block3a_expand_bn (BatchNormali (None, 56, 56, 144)  576         block3a_expand_
                                                                 conv[0][0]
_____
block3a_expand_activation (Acti (None, 56, 56, 144)  0           block3a_expand_
```

```
                              bn[0][0]
_____
_____
block3a_dwconv_pad (ZeroPadding (None, 59, 59, 144)   0          block3a_expand_
                              activation[0][0]
_____
_____
block3a_dwconv (DepthwiseConv2D (None, 28, 28, 144)   3600       block3a_dwconv_
                              pad[0][0]
_____
_____
block3a_bn (BatchNormalization) (None, 28, 28, 144)   576        block3a_dwconv
                              [0][0]
_____
_____
block3a_activation (Activation) (None, 28, 28, 144)   0          block3a_bn
                              [0][0]
_____
_____
block3a_se_squeeze (GlobalAvera (None, 144)           0          block3a_activat
                              ion[0][0]
_____
_____
block3a_se_reshape (Reshape)    (None, 1, 1, 144)     0          block3a_se_sque
                              eze[0][0]
_____
_____
block3a_se_reduce (Conv2D)      (None, 1, 1, 6)       870        block3a_se_resh
                              ape[0][0]
_____
_____
block3a_se_expand (Conv2D)      (None, 1, 1, 144)     1008       block3a_se_redu
                              ce[0][0]
_____
_____
block3a_se_excite (Multiply)    (None, 28, 28, 144)   0          block3a_activat
                              ion[0][0]

                                                                 block3a_se_expa
                              nd[0][0]
_____
_____
block3a_project_conv (Conv2D)   (None, 28, 28, 40)    5760       block3a_se_exci
                              te[0][0]
_____
_____
block3a_project_bn (BatchNormal (None, 28, 28, 40)    160        block3a_project
                              _conv[0][0]
_____
_____
block3b_expand_conv (Conv2D)    (None, 28, 28, 240)   9600       block3a_project
                              _bn[0][0]
_____
_____
block3b_expand_bn (BatchNormali (None, 28, 28, 240)   960        block3b_expand_
                              conv[0][0]
_____
_____
block3b_expand_activation (Acti (None, 28, 28, 240)   0          block3b_expand_
                              bn[0][0]
_____
_____
block3b_dwconv (DepthwiseConv2D (None, 28, 28, 240)   6000       block3b_expand_
                              activation[0][0]
_____
```

```
_____
block3b_bn (BatchNormalization) (None, 28, 28, 240)  960          block3b_dwconv
[0][0]
_____
_____
block3b_activation (Activation) (None, 28, 28, 240)  0            block3b_bn
[0][0]
_____
_____
block3b_se_squeeze (GlobalAvera (None, 240)           0            block3b_activat
ion[0][0]
_____
_____
block3b_se_reshape (Reshape)    (None, 1, 1, 240)     0            block3b_se_sque
eze[0][0]
_____
_____
block3b_se_reduce (Conv2D)      (None, 1, 1, 10)      2410         block3b_se_resh
ape[0][0]
_____
_____
block3b_se_expand (Conv2D)      (None, 1, 1, 240)     2640         block3b_se_redu
ce[0][0]
_____
_____
block3b_se_excite (Multiply)    (None, 28, 28, 240)   0            block3b_activat
ion[0][0]
                                                                   block3b_se_expa
nd[0][0]
_____
_____
block3b_project_conv (Conv2D)   (None, 28, 28, 40)    9600         block3b_se_exci
te[0][0]
_____
_____
block3b_project_bn (BatchNormal (None, 28, 28, 40)    160          block3b_project
_conv[0][0]
_____
_____
block3b_drop (Dropout)          (None, 28, 28, 40)    0            block3b_project
_bn[0][0]
_____
_____
block3b_add (Add)               (None, 28, 28, 40)    0            block3b_drop
[0][0]
                                                                   block3a_project
_bn[0][0]
_____
_____
block4a_expand_conv (Conv2D)    (None, 28, 28, 240)   9600         block3b_add
[0][0]
_____
_____
block4a_expand_bn (BatchNormali (None, 28, 28, 240)   960          block4a_expand_
conv[0][0]
_____
_____
block4a_expand_activation (Acti (None, 28, 28, 240)   0            block4a_expand_
bn[0][0]
_____
_____
block4a_dwconv_pad (ZeroPadding (None, 29, 29, 240)   0            block4a_expand_
activation[0][0]
_____
```

```
_____
block4a_dwconv (DepthwiseConv2D (None, 14, 14, 240) 2160        block4a_dwconv_
pad[0][0]
_____

_____
block4a_bn (BatchNormalization) (None, 14, 14, 240) 960         block4a_dwconv
[0][0]
_____

_____
block4a_activation (Activation) (None, 14, 14, 240) 0           block4a_bn
[0][0]
_____

_____
block4a_se_squeeze (GlobalAvera (None, 240)          0           block4a_activat
ion[0][0]
_____

_____
block4a_se_reshape (Reshape)    (None, 1, 1, 240)    0           block4a_se_sque
eze[0][0]
_____

_____
block4a_se_reduce (Conv2D)      (None, 1, 1, 10)     2410        block4a_se_resh
ape[0][0]
_____

_____
block4a_se_expand (Conv2D)      (None, 1, 1, 240)    2640        block4a_se_redu
ce[0][0]
_____

_____
block4a_se_excite (Multiply)    (None, 14, 14, 240)  0           block4a_activat
ion[0][0]
                                                                 block4a_se_expa
nd[0][0]
_____

_____
block4a_project_conv (Conv2D)   (None, 14, 14, 80)   19200       block4a_se_exci
te[0][0]
_____

_____
block4a_project_bn (BatchNormal (None, 14, 14, 80)   320         block4a_project
_conv[0][0]
_____

_____
block4b_expand_conv (Conv2D)    (None, 14, 14, 480)  38400       block4a_project
_bn[0][0]
_____

_____
block4b_expand_bn (BatchNormali (None, 14, 14, 480)  1920        block4b_expand_
conv[0][0]
_____

_____
block4b_expand_activation (Acti (None, 14, 14, 480)  0           block4b_expand_
bn[0][0]
_____

_____
block4b_dwconv (DepthwiseConv2D (None, 14, 14, 480)  4320        block4b_expand_
activation[0][0]
_____

_____
block4b_bn (BatchNormalization) (None, 14, 14, 480)  1920        block4b_dwconv
[0][0]
_____

_____
block4b_activation (Activation) (None, 14, 14, 480)  0           block4b_bn
```

```
                                                             [0][0]
_____
block4b_se_squeeze (GlobalAvera (None, 480)          0          block4b_activat
ion[0][0]
_____
block4b_se_reshape (Reshape)    (None, 1, 1, 480)    0          block4b_se_sque
eze[0][0]
_____
block4b_se_reduce (Conv2D)      (None, 1, 1, 20)     9620       block4b_se_resh
ape[0][0]
_____
block4b_se_expand (Conv2D)      (None, 1, 1, 480)    10080      block4b_se_redu
ce[0][0]
_____
block4b_se_excite (Multiply)    (None, 14, 14, 480)  0          block4b_activat
ion[0][0]

                                                                block4b_se_expa
nd[0][0]
_____
block4b_project_conv (Conv2D)   (None, 14, 14, 80)   38400      block4b_se_exci
te[0][0]
_____
block4b_project_bn (BatchNormal (None, 14, 14, 80)   320        block4b_project
_conv[0][0]
_____
block4b_drop (Dropout)          (None, 14, 14, 80)   0          block4b_project
_bn[0][0]
_____
block4b_add (Add)               (None, 14, 14, 80)   0          block4b_drop
[0][0]

                                                                block4a_project
_bn[0][0]
_____
block4c_expand_conv (Conv2D)    (None, 14, 14, 480)  38400      block4b_add
[0][0]
_____
block4c_expand_bn (BatchNormali (None, 14, 14, 480)  1920       block4c_expand_
conv[0][0]
_____
block4c_expand_activation (Acti (None, 14, 14, 480)  0          block4c_expand_
bn[0][0]
_____
block4c_dwconv (DepthwiseConv2D (None, 14, 14, 480)  4320       block4c_expand_
activation[0][0]
_____
block4c_bn (BatchNormalization) (None, 14, 14, 480)  1920       block4c_dwconv
[0][0]
_____
block4c_activation (Activation) (None, 14, 14, 480)  0          block4c_bn
```

```
                                                         [0][0]
_____
_____
block4c_se_squeeze (GlobalAvera (None, 480)          0           block4c_activat
ion[0][0]
_____
_____
block4c_se_reshape (Reshape)    (None, 1, 1, 480)    0           block4c_se_sque
eze[0][0]
_____
_____
block4c_se_reduce (Conv2D)      (None, 1, 1, 20)     9620        block4c_se_resh
ape[0][0]
_____
_____
block4c_se_expand (Conv2D)      (None, 1, 1, 480)    10080       block4c_se_redu
ce[0][0]
_____
_____
block4c_se_excite (Multiply)    (None, 14, 14, 480)  0           block4c_activat
ion[0][0]

                                                                 block4c_se_expa
nd[0][0]
_____
_____
block4c_project_conv (Conv2D)   (None, 14, 14, 80)   38400       block4c_se_exci
te[0][0]
_____
_____
block4c_project_bn (BatchNormal (None, 14, 14, 80)   320         block4c_project
_conv[0][0]
_____
_____
block4c_drop (Dropout)          (None, 14, 14, 80)   0           block4c_project
_bn[0][0]
_____
_____
block4c_add (Add)               (None, 14, 14, 80)   0           block4c_drop
[0][0]

                                                                 block4b_add
[0][0]
_____
_____
block5a_expand_conv (Conv2D)    (None, 14, 14, 480)  38400       block4c_add
[0][0]
_____
_____
block5a_expand_bn (BatchNormali (None, 14, 14, 480)  1920        block5a_expand_
conv[0][0]
_____
_____
block5a_expand_activation (Acti (None, 14, 14, 480)  0           block5a_expand_
bn[0][0]
_____
_____
block5a_dwconv (DepthwiseConv2D (None, 14, 14, 480)  12000       block5a_expand_
activation[0][0]
_____
_____
block5a_bn (BatchNormalization) (None, 14, 14, 480)  1920        block5a_dwconv
[0][0]
_____
_____
block5a_activation (Activation) (None, 14, 14, 480)  0           block5a_bn
```

```
                                    [0][0]
_____
_____
block5a_se_squeeze (GlobalAvera (None, 480)          0          block5a_activat
ion[0][0]
_____
_____
block5a_se_reshape (Reshape)    (None, 1, 1, 480)    0          block5a_se_sque
eze[0][0]
_____
_____
block5a_se_reduce (Conv2D)      (None, 1, 1, 20)     9620       block5a_se_resh
ape[0][0]
_____
_____
block5a_se_expand (Conv2D)      (None, 1, 1, 480)    10080      block5a_se_redu
ce[0][0]
_____
_____
block5a_se_excite (Multiply)    (None, 14, 14, 480)  0          block5a_activat
ion[0][0]

                                                               block5a_se_expa
nd[0][0]
_____
_____
block5a_project_conv (Conv2D)   (None, 14, 14, 112)  53760      block5a_se_exci
te[0][0]
_____
_____
block5a_project_bn (BatchNormal (None, 14, 14, 112)  448        block5a_project
_conv[0][0]
_____
_____
block5b_expand_conv (Conv2D)    (None, 14, 14, 672)  75264      block5a_project
_bn[0][0]
_____
_____
block5b_expand_bn (BatchNormali (None, 14, 14, 672)  2688       block5b_expand_
conv[0][0]
_____
_____
block5b_expand_activation (Acti (None, 14, 14, 672)  0          block5b_expand_
bn[0][0]
_____
_____
block5b_dwconv (DepthwiseConv2D (None, 14, 14, 672)  16800      block5b_expand_
activation[0][0]
_____
_____
block5b_bn (BatchNormalization) (None, 14, 14, 672)  2688       block5b_dwconv
[0][0]
_____
_____
block5b_activation (Activation) (None, 14, 14, 672)  0          block5b_bn
[0][0]
_____
_____
block5b_se_squeeze (GlobalAvera (None, 672)          0          block5b_activat
ion[0][0]
_____
_____
block5b_se_reshape (Reshape)    (None, 1, 1, 672)    0          block5b_se_sque
eze[0][0]
_____
```

```
_____
block5b_se_reduce (Conv2D)      (None, 1, 1, 28)    18844      block5b_se_resh
ape[0][0]
_____
_____
block5b_se_expand (Conv2D)      (None, 1, 1, 672)   19488      block5b_se_redu
ce[0][0]
_____
_____
block5b_se_excite (Multiply)    (None, 14, 14, 672) 0          block5b_activat
ion[0][0]

                                                               block5b_se_expa
nd[0][0]
_____
_____
block5b_project_conv (Conv2D)   (None, 14, 14, 112) 75264      block5b_se_exci
te[0][0]
_____
_____
block5b_project_bn (BatchNormal (None, 14, 14, 112) 448        block5b_project
_conv[0][0]
_____
_____
block5b_drop (Dropout)          (None, 14, 14, 112) 0          block5b_project
_bn[0][0]
_____
_____
block5b_add (Add)               (None, 14, 14, 112) 0          block5b_drop
[0][0]

                                                               block5a_project
_bn[0][0]
_____
_____
block5c_expand_conv (Conv2D)    (None, 14, 14, 672) 75264      block5b_add
[0][0]
_____
_____
block5c_expand_bn (BatchNormali (None, 14, 14, 672) 2688       block5c_expand_
conv[0][0]
_____
_____
block5c_expand_activation (Acti (None, 14, 14, 672) 0          block5c_expand_
bn[0][0]
_____
_____
block5c_dwconv (DepthwiseConv2D (None, 14, 14, 672) 16800      block5c_expand_
activation[0][0]
_____
_____
block5c_bn (BatchNormalization) (None, 14, 14, 672) 2688       block5c_dwconv
[0][0]
_____
_____
block5c_activation (Activation) (None, 14, 14, 672) 0          block5c_bn
[0][0]
_____
_____
block5c_se_squeeze (GlobalAvera (None, 672)         0          block5c_activat
ion[0][0]
_____
_____
block5c_se_reshape (Reshape)    (None, 1, 1, 672)   0          block5c_se_sque
eze[0][0]
_____
```

```
_____
block5c_se_reduce (Conv2D)        (None, 1, 1, 28)     18844       block5c_se_resh
ape[0][0]
_____
_____
block5c_se_expand (Conv2D)        (None, 1, 1, 672)    19488       block5c_se_redu
ce[0][0]
_____
_____
block5c_se_excite (Multiply)      (None, 14, 14, 672)  0           block5c_activat
ion[0][0]

                                                                  block5c_se_expa
nd[0][0]
_____
_____
block5c_project_conv (Conv2D)     (None, 14, 14, 112)  75264       block5c_se_exci
te[0][0]
_____
_____
block5c_project_bn (BatchNormal   (None, 14, 14, 112)  448         block5c_project
_conv[0][0]
_____
_____
block5c_drop (Dropout)            (None, 14, 14, 112)  0           block5c_project
_bn[0][0]
_____
_____
block5c_add (Add)                 (None, 14, 14, 112)  0           block5c_drop
[0][0]

                                                                  block5b_add
[0][0]
_____
_____
block6a_expand_conv (Conv2D)      (None, 14, 14, 672)  75264       block5c_add
[0][0]
_____
_____
block6a_expand_bn (BatchNormali   (None, 14, 14, 672)  2688        block6a_expand_
conv[0][0]
_____
_____
block6a_expand_activation (Acti   (None, 14, 14, 672)  0           block6a_expand_
bn[0][0]
_____
_____
block6a_dwconv_pad (ZeroPadding   (None, 17, 17, 672)  0           block6a_expand_
activation[0][0]
_____
_____
block6a_dwconv (DepthwiseConv2D   (None, 7, 7, 672)    16800       block6a_dwconv_
pad[0][0]
_____
_____
block6a_bn (BatchNormalization)   (None, 7, 7, 672)    2688        block6a_dwconv
[0][0]
_____
_____
block6a_activation (Activation)   (None, 7, 7, 672)    0           block6a_bn
[0][0]
_____
_____
block6a_se_squeeze (GlobalAvera   (None, 672)          0           block6a_activat
ion[0][0]
_____
```

```
_____
block6a_se_reshape (Reshape)    (None, 1, 1, 672)    0           block6a_se_sque
eze[0][0]
_____

_____
block6a_se_reduce (Conv2D)      (None, 1, 1, 28)     18844       block6a_se_resh
ape[0][0]
_____

_____
block6a_se_expand (Conv2D)      (None, 1, 1, 672)    19488       block6a_se_redu
ce[0][0]
_____

_____
block6a_se_excite (Multiply)    (None, 7, 7, 672)    0           block6a_activat
ion[0][0]

                                                                 block6a_se_expa
nd[0][0]
_____

_____
block6a_project_conv (Conv2D)   (None, 7, 7, 192)    129024      block6a_se_exci
te[0][0]
_____

_____
block6a_project_bn (BatchNormal (None, 7, 7, 192)    768         block6a_project
_conv[0][0]
_____

_____
block6b_expand_conv (Conv2D)    (None, 7, 7, 1152)   221184      block6a_project
_bn[0][0]
_____

_____
block6b_expand_bn (BatchNormali (None, 7, 7, 1152)   4608        block6b_expand_
conv[0][0]
_____

_____
block6b_expand_activation (Acti (None, 7, 7, 1152)   0           block6b_expand_
bn[0][0]
_____

_____
block6b_dwconv (DepthwiseConv2D (None, 7, 7, 1152)   28800       block6b_expand_
activation[0][0]
_____

_____
block6b_bn (BatchNormalization) (None, 7, 7, 1152)   4608        block6b_dwconv
[0][0]
_____

_____
block6b_activation (Activation) (None, 7, 7, 1152)   0           block6b_bn
[0][0]
_____

_____
block6b_se_squeeze (GlobalAvera (None, 1152)         0           block6b_activat
ion[0][0]
_____

_____
block6b_se_reshape (Reshape)    (None, 1, 1, 1152)   0           block6b_se_sque
eze[0][0]
_____

_____
block6b_se_reduce (Conv2D)      (None, 1, 1, 48)     55344       block6b_se_resh
ape[0][0]
_____

_____
block6b_se_expand (Conv2D)      (None, 1, 1, 1152)   56448       block6b_se_redu
```

```
                                                             ce[0][0]
_____
block6b_se_excite (Multiply)      (None, 7, 7, 1152)   0          block6b_activat
                                                                  ion[0][0]
                                                                  block6b_se_expa
                                                                  nd[0][0]
_____
block6b_project_conv (Conv2D)     (None, 7, 7, 192)    221184     block6b_se_exci
                                                                  te[0][0]
_____
block6b_project_bn (BatchNormal   (None, 7, 7, 192)    768        block6b_project
                                                                  _conv[0][0]
_____
block6b_drop (Dropout)            (None, 7, 7, 192)    0          block6b_project
                                                                  _bn[0][0]
_____
block6b_add (Add)                 (None, 7, 7, 192)    0          block6b_drop
                                                                  [0][0]
                                                                  block6a_project
                                                                  _bn[0][0]
_____
block6c_expand_conv (Conv2D)      (None, 7, 7, 1152)   221184     block6b_add
                                                                  [0][0]
_____
block6c_expand_bn (BatchNormali   (None, 7, 7, 1152)   4608       block6c_expand_
                                                                  conv[0][0]
_____
block6c_expand_activation (Acti   (None, 7, 7, 1152)   0          block6c_expand_
                                                                  bn[0][0]
_____
block6c_dwconv (DepthwiseConv2D   (None, 7, 7, 1152)   28800      block6c_expand_
                                                                  activation[0][0]
_____
block6c_bn (BatchNormalization)   (None, 7, 7, 1152)   4608       block6c_dwconv
                                                                  [0][0]
_____
block6c_activation (Activation)   (None, 7, 7, 1152)   0          block6c_bn
                                                                  [0][0]
_____
block6c_se_squeeze (GlobalAvera   (None, 1152)         0          block6c_activat
                                                                  ion[0][0]
_____
block6c_se_reshape (Reshape)      (None, 1, 1, 1152)   0          block6c_se_sque
                                                                  eze[0][0]
_____
block6c_se_reduce (Conv2D)        (None, 1, 1, 48)     55344      block6c_se_resh
                                                                  ape[0][0]
_____
block6c_se_expand (Conv2D)        (None, 1, 1, 1152)   56448      block6c_se_redu
```

```
                              ce[0][0]
_____
_____
block6c_se_excite (Multiply)     (None, 7, 7, 1152)   0           block6c_activat
ion[0][0]

                                                                  block6c_se_expa
nd[0][0]
_____
_____
block6c_project_conv (Conv2D)    (None, 7, 7, 192)    221184      block6c_se_exci
te[0][0]
_____
_____
block6c_project_bn (BatchNormal  (None, 7, 7, 192)    768         block6c_project
_conv[0][0]
_____
_____
block6c_drop (Dropout)           (None, 7, 7, 192)    0           block6c_project
_bn[0][0]
_____
_____
block6c_add (Add)                (None, 7, 7, 192)    0           block6c_drop
[0][0]

                                                                  block6b_add
[0][0]
_____
_____
block6d_expand_conv (Conv2D)     (None, 7, 7, 1152)   221184      block6c_add
[0][0]
_____
_____
block6d_expand_bn (BatchNormali  (None, 7, 7, 1152)   4608        block6d_expand_
conv[0][0]
_____
_____
block6d_expand_activation (Acti  (None, 7, 7, 1152)   0           block6d_expand_
bn[0][0]
_____
_____
block6d_dwconv (DepthwiseConv2D  (None, 7, 7, 1152)   28800       block6d_expand_
activation[0][0]
_____
_____
block6d_bn (BatchNormalization)  (None, 7, 7, 1152)   4608        block6d_dwconv
[0][0]
_____
_____
block6d_activation (Activation)  (None, 7, 7, 1152)   0           block6d_bn
[0][0]
_____
_____
block6d_se_squeeze (GlobalAvera  (None, 1152)         0           block6d_activat
ion[0][0]
_____
_____
block6d_se_reshape (Reshape)     (None, 1, 1, 1152)   0           block6d_se_sque
eze[0][0]
_____
_____
block6d_se_reduce (Conv2D)       (None, 1, 1, 48)     55344       block6d_se_resh
ape[0][0]
_____
_____
block6d_se_expand (Conv2D)       (None, 1, 1, 1152)   56448       block6d_se_redu
```

```
                           ce[0][0]
_____
block6d_se_excite (Multiply)     (None, 7, 7, 1152)   0           block6d_activat
ion[0][0]

                                                                  block6d_se_expa
nd[0][0]
_____
block6d_project_conv (Conv2D)    (None, 7, 7, 192)    221184      block6d_se_exci
te[0][0]
_____
block6d_project_bn (BatchNormal  (None, 7, 7, 192)    768         block6d_project
_conv[0][0]
_____
block6d_drop (Dropout)           (None, 7, 7, 192)    0           block6d_project
_bn[0][0]
_____
block6d_add (Add)                (None, 7, 7, 192)    0           block6d_drop
[0][0]

                                                                  block6c_add
[0][0]
_____
block7a_expand_conv (Conv2D)     (None, 7, 7, 1152)   221184      block6d_add
[0][0]
_____
block7a_expand_bn (BatchNormali  (None, 7, 7, 1152)   4608        block7a_expand_
conv[0][0]
_____
block7a_expand_activation (Acti  (None, 7, 7, 1152)   0           block7a_expand_
bn[0][0]
_____
block7a_dwconv (DepthwiseConv2D  (None, 7, 7, 1152)   10368       block7a_expand_
activation[0][0]
_____
block7a_bn (BatchNormalization)  (None, 7, 7, 1152)   4608        block7a_dwconv
[0][0]
_____
block7a_activation (Activation)  (None, 7, 7, 1152)   0           block7a_bn
[0][0]
_____
block7a_se_squeeze (GlobalAvera  (None, 1152)         0           block7a_activat
ion[0][0]
_____
block7a_se_reshape (Reshape)     (None, 1, 1, 1152)   0           block7a_se_sque
eze[0][0]
_____
block7a_se_reduce (Conv2D)       (None, 1, 1, 48)     55344       block7a_se_resh
ape[0][0]
_____
block7a_se_expand (Conv2D)       (None, 1, 1, 1152)   56448       block7a_se_redu
```

```
                        ce[0][0]
                        _____
                        block7a_se_excite (Multiply)    (None, 7, 7, 1152)    0         block7a_activat
                        ion[0][0]

                                                                                         block7a_se_expa
                        nd[0][0]
                        _____
                        block7a_project_conv (Conv2D)   (None, 7, 7, 320)     368640    block7a_se_exci
                        te[0][0]
                        _____
                        block7a_project_bn (BatchNormal  (None, 7, 7, 320)     1280      block7a_project
                        _conv[0][0]
                        _____
                        top_conv (Conv2D)               (None, 7, 7, 1280)    409600    block7a_project
                        _bn[0][0]
                        _____
                        top_bn (BatchNormalization)     (None, 7, 7, 1280)    5120      top_conv[0][0]
                        _____
                        top_activation (Activation)     (None, 7, 7, 1280)    0         top_bn[0][0]
                        _____
                        avg_pool (GlobalAveragePooling2  (None, 1280)          0         top_activation
                        [0][0]
                        _____
```

In [12]:
```
for layer in custom_resnet_model.layers[:-1]:
    layer.trainable = False

custom_resnet_model.layers[-1].trainable
```

Out[12]: True

In [13]:
```
custom_resnet_model.compile(loss='categorical_crossentropy',optimizer='adam',metric
s=['accuracy'])
```

In [14]:
```python
t=time.time()
hist = custom_resnet_model.fit(X_train, y_train, batch_size=32, epochs=num_epoch, v
erbose=1, validation_data=(X_test, y_test))
print('Training time: %s' % (t - time.time()))
(loss, accuracy) = custom_resnet_model.evaluate(X_test, y_test, batch_size=10, verb
ose=1)
print("[INFO] loss={:.4f}, accuracy: {:.4f}%".format(loss,accuracy * 100))
```

```
Epoch 1/100
147/147 [==============================] - 10s 67ms/step - loss: 0.2773 - accura
cy: 0.8845 - val_loss: 0.1604 - val_accuracy: 0.9403
Epoch 2/100
147/147 [==============================] - 8s 56ms/step - loss: 0.1834 - accurac
y: 0.9313 - val_loss: 0.1341 - val_accuracy: 0.9497
Epoch 3/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1541 - accurac
y: 0.9443 - val_loss: 0.1338 - val_accuracy: 0.9514
Epoch 4/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1407 - accurac
y: 0.9498 - val_loss: 0.1146 - val_accuracy: 0.9548
Epoch 5/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1303 - accurac
y: 0.9522 - val_loss: 0.1142 - val_accuracy: 0.9590
Epoch 6/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1272 - accurac
y: 0.9537 - val_loss: 0.1158 - val_accuracy: 0.9608
Epoch 7/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1209 - accurac
y: 0.9573 - val_loss: 0.1075 - val_accuracy: 0.9608
Epoch 8/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1171 - accurac
y: 0.9586 - val_loss: 0.1077 - val_accuracy: 0.9616
Epoch 9/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1102 - accurac
y: 0.9571 - val_loss: 0.1019 - val_accuracy: 0.9616
Epoch 10/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1122 - accurac
y: 0.9582 - val_loss: 0.1016 - val_accuracy: 0.9616
Epoch 11/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1082 - accurac
y: 0.9596 - val_loss: 0.1034 - val_accuracy: 0.9625
Epoch 12/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1036 - accurac
y: 0.9643 - val_loss: 0.0983 - val_accuracy: 0.9642
Epoch 13/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1028 - accurac
y: 0.9607 - val_loss: 0.1088 - val_accuracy: 0.9573
Epoch 14/100
147/147 [==============================] - 8s 57ms/step - loss: 0.1038 - accurac
y: 0.9637 - val_loss: 0.1113 - val_accuracy: 0.9582
Epoch 15/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0960 - accurac
y: 0.9667 - val_loss: 0.0955 - val_accuracy: 0.9650
Epoch 16/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0958 - accurac
y: 0.9654 - val_loss: 0.0941 - val_accuracy: 0.96670.0966 - accura
Epoch 17/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0946 - accurac
y: 0.9654 - val_loss: 0.0990 - val_accuracy: 0.9616
Epoch 18/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0953 - accurac
y: 0.9661 - val_loss: 0.0937 - val_accuracy: 0.9659
Epoch 19/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0896 - accurac
y: 0.9686 - val_loss: 0.0941 - val_accuracy: 0.9684
Epoch 20/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0922 - accurac
y: 0.9637 - val_loss: 0.0929 - val_accuracy: 0.9667
Epoch 21/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0914 - accurac
y: 0.9641 - val_loss: 0.0918 - val_accuracy: 0.9684
```

```
Epoch 22/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0900 - accurac
y: 0.9690 - val_loss: 0.0917 - val_accuracy: 0.9684
Epoch 23/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0860 - accurac
y: 0.9673 - val_loss: 0.0922 - val_accuracy: 0.9676
Epoch 24/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0893 - accurac
y: 0.9673 - val_loss: 0.0908 - val_accuracy: 0.9659
Epoch 25/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0885 - accurac
y: 0.9684 - val_loss: 0.0911 - val_accuracy: 0.9676
Epoch 26/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0859 - accurac
y: 0.9675 - val_loss: 0.0901 - val_accuracy: 0.9659
Epoch 27/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0849 - accurac
y: 0.9695 - val_loss: 0.0925 - val_accuracy: 0.9676
Epoch 28/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0816 - accurac
y: 0.9695 - val_loss: 0.0898 - val_accuracy: 0.9701
Epoch 29/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0813 - accurac
y: 0.9688 - val_loss: 0.0890 - val_accuracy: 0.9650
Epoch 30/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0780 - accurac
y: 0.9725 - val_loss: 0.0886 - val_accuracy: 0.9684
Epoch 31/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0832 - accurac
y: 0.9684 - val_loss: 0.0878 - val_accuracy: 0.9676
Epoch 32/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0806 - accurac
y: 0.9729 - val_loss: 0.0886 - val_accuracy: 0.9667
Epoch 33/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0810 - accurac
y: 0.9699 - val_loss: 0.0874 - val_accuracy: 0.9676
Epoch 34/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0794 - accurac
y: 0.9686 - val_loss: 0.0884 - val_accuracy: 0.9667
Epoch 35/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0787 - accurac
y: 0.9701 - val_loss: 0.0955 - val_accuracy: 0.9667
Epoch 36/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0741 - accurac
y: 0.9729 - val_loss: 0.0895 - val_accuracy: 0.9684
Epoch 37/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0763 - accurac
y: 0.9688 - val_loss: 0.0881 - val_accuracy: 0.9693
Epoch 38/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0788 - accurac
y: 0.9720 - val_loss: 0.0945 - val_accuracy: 0.9676
Epoch 39/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0775 - accurac
y: 0.9725 - val_loss: 0.0891 - val_accuracy: 0.9693
Epoch 40/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0775 - accurac
y: 0.9708 - val_loss: 0.0882 - val_accuracy: 0.9684
Epoch 41/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0786 - accurac
y: 0.9710 - val_loss: 0.0867 - val_accuracy: 0.9667
Epoch 42/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0738 - accurac
y: 0.9752 - val_loss: 0.0855 - val_accuracy: 0.9676
Epoch 43/100
```

```
147/147 [==============================] - 8s 57ms/step - loss: 0.0762 - accurac
y: 0.9714 - val_loss: 0.0879 - val_accuracy: 0.9693
Epoch 44/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0764 - accurac
y: 0.9710 - val_loss: 0.0871 - val_accuracy: 0.9667
Epoch 45/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0710 - accurac
y: 0.9761 - val_loss: 0.0897 - val_accuracy: 0.9710
Epoch 46/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0732 - accurac
y: 0.9725 - val_loss: 0.0878 - val_accuracy: 0.9676
Epoch 47/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0690 - accurac
y: 0.9720 - val_loss: 0.0878 - val_accuracy: 0.9676
Epoch 48/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0708 - accurac
y: 0.9746 - val_loss: 0.0866 - val_accuracy: 0.9676
Epoch 49/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0711 - accurac
y: 0.9746 - val_loss: 0.0878 - val_accuracy: 0.9684
Epoch 50/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0692 - accurac
y: 0.9754 - val_loss: 0.0878 - val_accuracy: 0.9667
Epoch 51/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0705 - accurac
y: 0.9765 - val_loss: 0.0877 - val_accuracy: 0.9684
Epoch 52/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0695 - accurac
y: 0.9729 - val_loss: 0.0917 - val_accuracy: 0.9684
Epoch 53/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0711 - accurac
y: 0.9740 - val_loss: 0.0931 - val_accuracy: 0.9676
Epoch 54/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0681 - accurac
y: 0.9735 - val_loss: 0.0887 - val_accuracy: 0.9693
Epoch 55/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0703 - accurac
y: 0.9733 - val_loss: 0.0948 - val_accuracy: 0.9667
Epoch 56/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0659 - accurac
y: 0.9750 - val_loss: 0.0872 - val_accuracy: 0.9676
Epoch 57/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0700 - accurac
y: 0.9740 - val_loss: 0.0922 - val_accuracy: 0.9676
Epoch 58/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0691 - accurac
y: 0.9735 - val_loss: 0.0884 - val_accuracy: 0.9676
Epoch 59/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0685 - accurac
y: 0.9737 - val_loss: 0.0883 - val_accuracy: 0.9693
Epoch 60/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0670 - accurac
y: 0.9761 - val_loss: 0.0884 - val_accuracy: 0.9693
Epoch 61/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0713 - accurac
y: 0.9750 - val_loss: 0.0867 - val_accuracy: 0.9693
Epoch 62/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0664 - accurac
y: 0.9750 - val_loss: 0.0859 - val_accuracy: 0.9693
Epoch 63/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0686 - accurac
y: 0.9744 - val_loss: 0.0912 - val_accuracy: 0.9693
Epoch 64/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0666 - accurac
```

```
y: 0.9737 - val_loss: 0.0882 - val_accuracy: 0.9693
Epoch 65/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0654 - accurac
y: 0.9767 - val_loss: 0.0869 - val_accuracy: 0.9693
Epoch 66/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0653 - accurac
y: 0.9757 - val_loss: 0.0887 - val_accuracy: 0.9676
Epoch 67/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0650 - accurac
y: 0.9761 - val_loss: 0.0861 - val_accuracy: 0.9693
Epoch 68/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0632 - accurac
y: 0.9754 - val_loss: 0.0858 - val_accuracy: 0.9693
Epoch 69/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0640 - accurac
y: 0.9763 - val_loss: 0.0855 - val_accuracy: 0.9693
Epoch 70/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0638 - accurac
y: 0.9787 - val_loss: 0.0867 - val_accuracy: 0.9693
Epoch 71/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0659 - accurac
y: 0.9757 - val_loss: 0.0881 - val_accuracy: 0.9701
Epoch 72/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0646 - accurac
y: 0.9765 - val_loss: 0.0877 - val_accuracy: 0.9676
Epoch 73/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0662 - accurac
y: 0.9759 - val_loss: 0.0867 - val_accuracy: 0.9676
Epoch 74/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0638 - accurac
y: 0.9767 - val_loss: 0.0866 - val_accuracy: 0.9684
Epoch 75/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0615 - accurac
y: 0.9776 - val_loss: 0.0862 - val_accuracy: 0.9701
Epoch 76/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0630 - accurac
y: 0.9761 - val_loss: 0.0871 - val_accuracy: 0.9693
Epoch 77/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0627 - accurac
y: 0.9757 - val_loss: 0.0865 - val_accuracy: 0.9710
Epoch 78/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0596 - accurac
y: 0.9784 - val_loss: 0.0871 - val_accuracy: 0.9693
Epoch 79/100
147/147 [==============================] - 8s 56ms/step - loss: 0.0629 - accurac
y: 0.9776 - val_loss: 0.0907 - val_accuracy: 0.9710
Epoch 80/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0580 - accurac
y: 0.9784 - val_loss: 0.0882 - val_accuracy: 0.9684
Epoch 81/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0616 - accurac
y: 0.9778 - val_loss: 0.0867 - val_accuracy: 0.9693
Epoch 82/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0600 - accurac
y: 0.9791 - val_loss: 0.0879 - val_accuracy: 0.9701
Epoch 83/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0642 - accurac
y: 0.9746 - val_loss: 0.0984 - val_accuracy: 0.9693
Epoch 84/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0605 - accurac
y: 0.9772 - val_loss: 0.0921 - val_accuracy: 0.9676
Epoch 85/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0628 - accurac
y: 0.9744 - val_loss: 0.0873 - val_accuracy: 0.9701
```

```
Epoch 86/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0612 - accurac
y: 0.9759 - val_loss: 0.0881 - val_accuracy: 0.9701
Epoch 87/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0602 - accurac
y: 0.9784 - val_loss: 0.0871 - val_accuracy: 0.9684
Epoch 88/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0629 - accurac
y: 0.9754 - val_loss: 0.0866 - val_accuracy: 0.9693
Epoch 89/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0575 - accurac
y: 0.9793 - val_loss: 0.0867 - val_accuracy: 0.9701
Epoch 90/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0597 - accurac
y: 0.9782 - val_loss: 0.0901 - val_accuracy: 0.9710
Epoch 91/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0622 - accurac
y: 0.9778 - val_loss: 0.0878 - val_accuracy: 0.9693
Epoch 92/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0613 - accurac
y: 0.9782 - val_loss: 0.0872 - val_accuracy: 0.9701
Epoch 93/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0587 - accurac
y: 0.9774 - val_loss: 0.0872 - val_accuracy: 0.9684
Epoch 94/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0577 - accurac
y: 0.9782 - val_loss: 0.0911 - val_accuracy: 0.9718
Epoch 95/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0626 - accurac
y: 0.9787 - val_loss: 0.0897 - val_accuracy: 0.9710
Epoch 96/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0537 - accurac
y: 0.9808 - val_loss: 0.0885 - val_accuracy: 0.9701
Epoch 97/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0577 - accurac
y: 0.9780 - val_loss: 0.0902 - val_accuracy: 0.9684
Epoch 98/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0599 - accurac
y: 0.9765 - val_loss: 0.0895 - val_accuracy: 0.9710
Epoch 99/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0576 - accurac
y: 0.9789 - val_loss: 0.0933 - val_accuracy: 0.9676
Epoch 100/100
147/147 [==============================] - 8s 57ms/step - loss: 0.0555 - accurac
y: 0.9791 - val_loss: 0.0901 - val_accuracy: 0.9693
Training time: -848.8196833133698
118/118 [==============================] - 3s 25ms/step - loss: 0.0901 - accurac
```

In [15]:
```python
(loss, accuracy) = custom_resnet_model.evaluate(X_test, y_test, batch_size=10, verb
ose=1)

print("[INFO] loss={:.4f}, accuracy: {:.4f}%".format(loss,accuracy * 100))
```

```
118/118 [==============================] - 3s 22ms/step - loss: 0.0901 - accurac
y: 0.9693
[INFO] loss=0.0901, accuracy: 96.9283%
```

visualizing losses and accuracy

In [16]: display_loss_accuracy(hist)
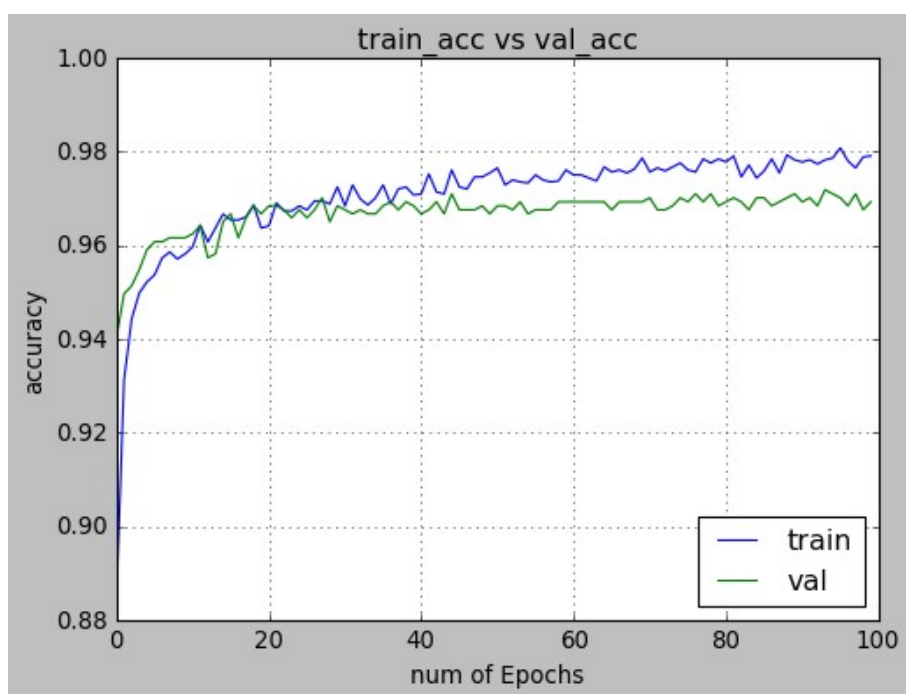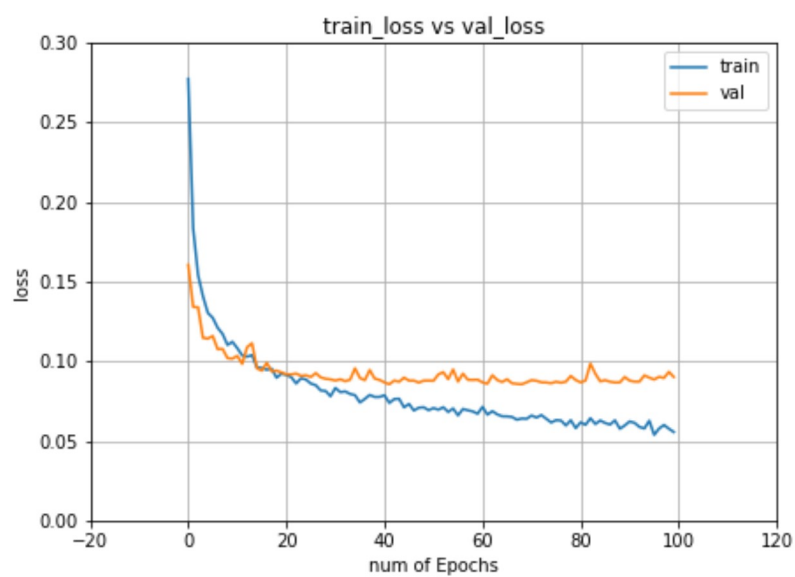
Evaluating the model

```
In [17]: score = custom_resnet_model.evaluate(X_test, y_test, verbose=0)
         print('Test Loss:', score[0])
         print('Test accuracy:', score[1])

         test_image = X_test[0:1]
         print (test_image.shape)

         print(model.predict(test_image))
         print(model.predict_classes(test_image))
         print(y_test[0:1])
```

```
Test Loss: 0.09007590264081955
Test accuracy: 0.9692832827568054
(1, 224, 224, 3)
[[1.14373943e-05 1.04924751e-04 2.51722900e-04 4.77186404e-04
  1.18551354e-04 2.09018617e-05 4.94372798e-05 3.72421637e-05
  2.81130688e-05 3.33237003e-05 5.39718130e-05 4.48332175e-05
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3.61663464e-04 4.45229030e-04 2.72112986e-04 2.87087892e-06
3.61288403e-04 6.21178304e-04 2.04670141e-05 7.67436577e-05
8.71896627e-05 6.25145214e-04 3.63889936e-04 1.31533103e-04
3.38180194e-04 1.70185650e-03 2.65352952e-04 1.38429314e-04
9.57641714e-06 5.85757953e-04 2.93099583e-04 2.71516124e-04
1.10013694e-04 2.12021041e-05 5.32478502e-04 1.58851806e-04
7.28346786e-05 7.45117213e-05 5.06315439e-04 7.12172943e-04
2.33235605e-05 4.29070642e-04 2.58522086e-05 1.45645684e-03
1.60161668e-04 2.95481477e-05 1.37279043e-04 6.89423759e-05
2.97003971e-05 1.15219445e-04 3.95013085e-05 7.65176228e-05
8.95155099e-05 1.20341807e-04 1.30225468e-04 9.33943084e-05
6.54157624e-03 2.40754762e-05 4.81955431e-05 4.00307385e-04
6.05372363e-04 3.09340947e-04 2.67484138e-04 1.92242232e-03
1.71189918e-03 1.99379836e-04 3.41214036e-05 8.55870836e-04
1.34391375e-04 9.12115065e-05 2.63787092e-06 2.00020131e-05
3.23024142e-04 4.57847527e-05 6.59130455e-04 1.43710384e-03
1.65375485e-03 9.48748726e-04 7.93987885e-04 7.88530568e-04
1.26306771e-03 1.57873219e-05 6.23157975e-05 5.07640434e-05
1.00583668e-04 2.63427868e-02 2.79214786e-04 4.11254296e-04
2.00241338e-03 2.15464479e-05 2.20117727e-04 5.20894673e-06
1.06383231e-04 3.89995228e-04 1.18828044e-04 1.47819592e-05
1.56530696e-05 1.03744633e-05 8.23242299e-04 1.07548170e-04
8.51472083e-04 1.68794504e-05 6.11567113e-04 1.31508459e-05
1.45642407e-05 1.70212661e-05 4.47813227e-06 2.96817211e-06
7.97575922e-06 9.19564045e-04 5.69658412e-04 1.06845036e-04
1.38349315e-05 6.94129221e-06 3.45503300e-04 4.58483337e-05
5.70481236e-04 3.14873498e-04 2.07158388e-04 7.35614376e-05
3.47069254e-05 2.23567567e-05 3.26645531e-04 2.17293986e-04
6.19800921e-05 6.93862268e-04 2.12625891e-05 3.41955456e-05
7.15996284e-05 4.02755650e-05 1.31912733e-04 1.87830556e-05
4.05132487e-05 8.79637955e-05 1.04369083e-03 1.91554471e-04
3.08821982e-05 3.44705804e-05 9.25602726e-05 2.59073931e-05
1.07711840e-05 6.71665708e-04 6.75932461e-05 6.22531879e-05
4.64484265e-06 7.00603268e-05 2.42308190e-04 1.96481833e-05
3.98481963e-04 2.74188315e-05 1.39456693e-04 5.24139730e-04
5.99602470e-04 9.94585389e-06 1.29866559e-04 8.90876327e-05
2.63735164e-05 2.77296203e-04 3.93479859e-05 9.76353040e-05
6.76064592e-05 3.16987825e-05 2.46331724e-03 8.19425768e-05
9.37245277e-05 1.14760885e-04 3.52426905e-05 9.93357971e-04
5.93172399e-06 1.44978758e-05 2.35269217e-05 2.61552759e-05
2.09589707e-05 6.33978652e-06 2.15005775e-06 5.56230952e-06
```

```
---------------------------------------------------------------------------
AttributeError                            Traceback (most recent call last)
<ipython-input-17-83421ec204f5> in <module>
      7
      8 print(model.predict(test_image))
----> 9 print(model.predict_classes(test_image))
```

Testing a new image

In [18]:
```python
test_image_path = 'D:/Harold/MyDNN/DataSet/Chest_xray_seperate/PNEUMONIA/person11_b
acteria_45.jpeg'
test_image = image.load_img(test_image_path, target_size=(224, 224))
x = image.img_to_array(test_image)
x = np.expand_dims(x, axis=0)
x = preprocess_input(x)
print (x.shape)


# if num_channel==1:
#     if (K.image_data_format() == 'channels_first'):
#         test_image= np.expand_dims(test_image, axis=0)
#         test_image= np.expand_dims(test_image, axis=0)
#         print (test_image.shape)
#     else:
#         test_image= np.expand_dims(test_image, axis=3)
#         test_image= np.expand_dims(test_image, axis=0)
#         print (test_image.shape)
# else:
#     if (K.image_data_format() == 'channels_first'):
#         test_image=np.rollaxis(test_image,2,0)
#         test_image= np.expand_dims(test_image, axis=0)
#         print (test_image.shape)
#     else:
#         test_image= np.expand_dims(test_image, axis=0)
#         print (test_image.shape)


# Predicting the test image
yhat = custom_resnet_model.predict(x)
print(yhat)
# print(custom_resnet_model.predict_classes(x))
label = decode_predictions(yhat)
# retrieve the most likely result, e.g. highest probability
label = label[0][0]
```

```
(1, 224, 224, 3)
[[0.00159899 0.998401  ]]
```

```
---------------------------------------------------------------------------
ValueError                                Traceback (most recent call last)
<ipython-input-18-505048f79341> in <module>
     30 print(yhat)
     31 # print(custom_resnet_model.predict_classes(x))
---> 32 label = decode_predictions(yhat)
     33 # retrieve the most likely result, e.g. highest probability
     34 label = label[0][0]

D:\Anaconda3\lib\site-packages\tensorflow\python\keras\applications\inception_v
3.py in decode_predictions(preds, top)
    412 @keras_export('keras.applications.inception_v3.decode_predictions')
    413 def decode_predictions(preds, top=5):
--> 414     return imagenet_utils.decode_predictions(preds, top=top)
    415
    416

D:\Anaconda3\lib\site-packages\tensorflow\python\keras\applications\imagenet_uti
ls.py in decode_predictions(preds, top)
    149                           'a batch of predictions '
    150                           '(i.e. a 2D array of shape (samples, 1000)). '
--> 151                           'Found array with shape: ' + str(preds.shape))
    152     if CLASS_INDEX is None:
    153         fpath = data_utils.get_file(

ValueError: `decode_predictions` expects a batch of predictions (i.e. a 2D array
of shape (samples, 1000)). Found array with shape: (1, 2)
```

Visualizing the intermediate layer

In [19]:
```python
from keras.models import Model
layer_outputs = [layer.output for layer in model.layers]
activation_model = Model(inputs=custom_resnet_model.input, outputs=layer_outputs)
activations = custom_resnet_model.predict(X_train[10].reshape(1,224,224,3))
print(activations.shape)
def display_activation(activations, col_size, row_size, act_index):
    activation = activations[0, act_index]
    activation_index=1
    fig, ax = plt.subplots(row_size, col_size, figsize=(row_size*2.5,col_size*1))
    for row in range(0,row_size):
        for col in range(0,col_size):
            ax[row][col].imshow(activation[0, :, :, activation_index], cmap='gray')
            activation_index += 1
plt.imshow(test_image)
plt.imshow(X_train[10][:,:,0]);
display_activation(activations, 8, 4, 1)
```

```
(1, 2)
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
<ipython-input-19-32e8200fb41b> in <module>
     14 plt.imshow(test_image)
     15 plt.imshow(X_train[10][:,:,0]);
---> 16 display_activation(activations, 8, 4, 1)

<ipython-input-19-32e8200fb41b> in display_activation(activations, col_size, row
_size, act_index)
     10     for row in range(0,row_size):
     11         for col in range(0,col_size):
---> 12             ax[row][col].imshow(activation[0, :, :, activation_index], c
map='gray')
     13             activation_index += 1
     14 plt.imshow(test_image)

IndexError: invalid index to scalar variable.
```
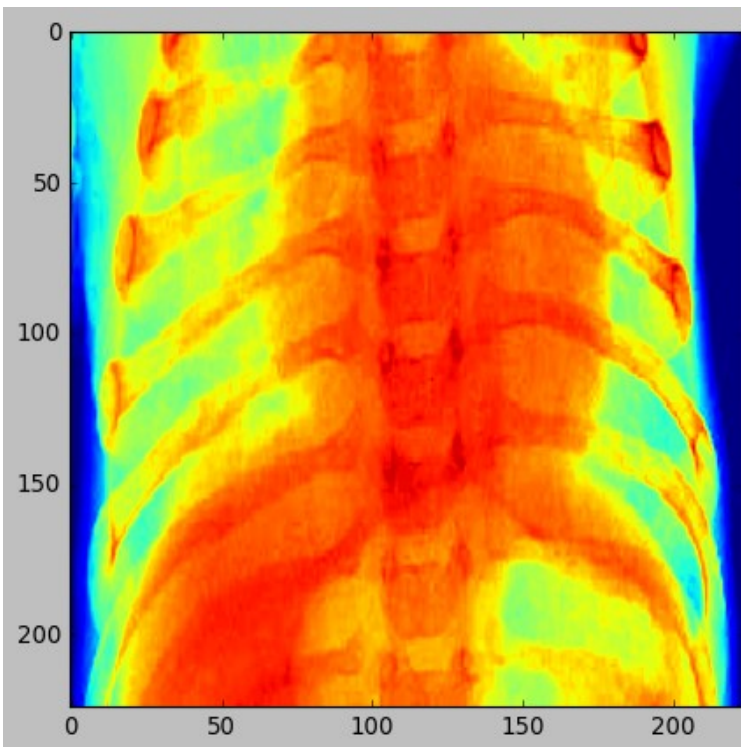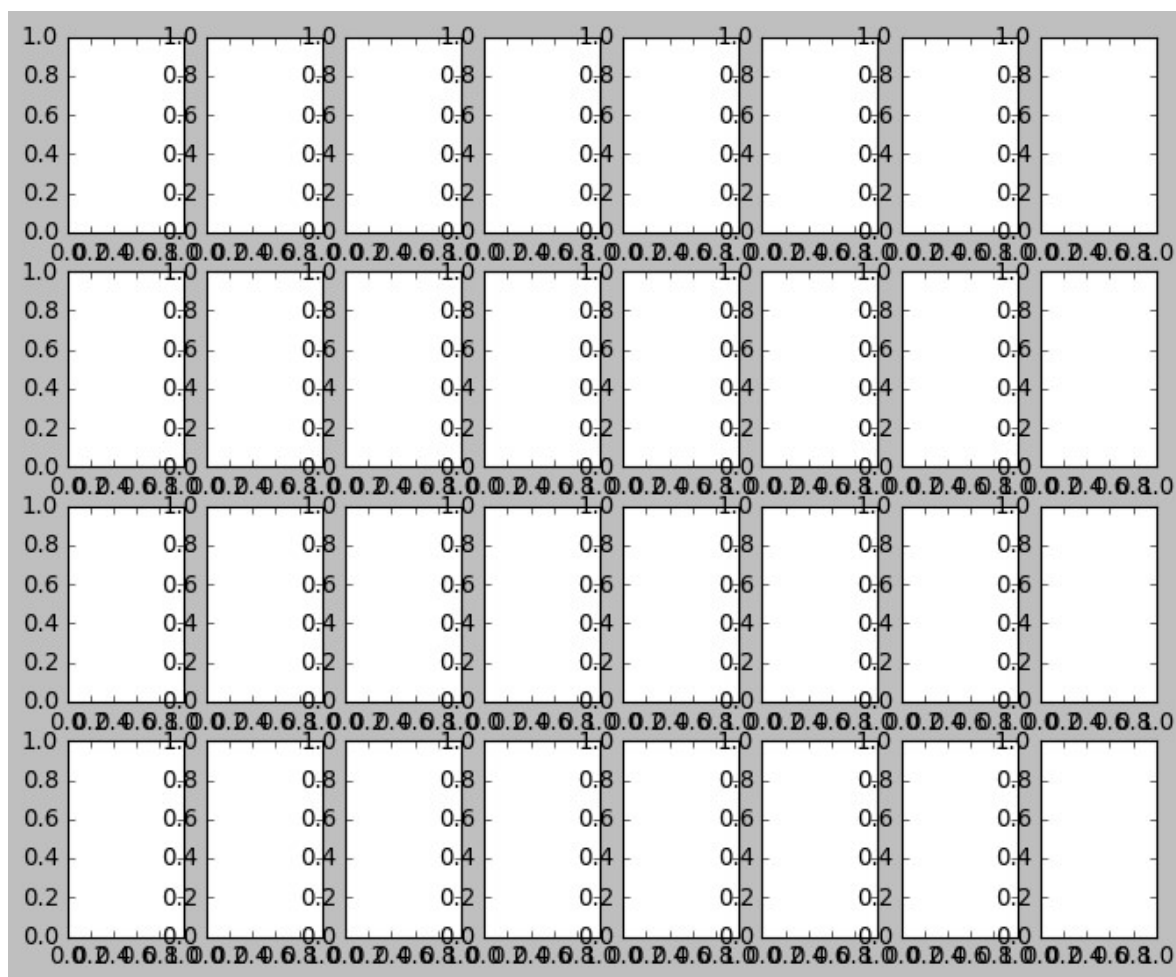
Confusion matrix

```
In [20]: Y_pred = custom_resnet_model.predict(X_test)
         print(Y_pred)
         y_pred = np.argmax(Y_pred, axis=1)
         print(y_pred)
         #y_pred = model.predict_classes(X_test)
         #print(y_pred)
         target_names = ['class 0(Normal)', 'class 1(Pneumonia)']
         print(classification_report(np.argmax(y_test,axis=1), y_pred,target_names=target_na
         mes))
         print(confusion_matrix(np.argmax(y_test,axis=1), y_pred))
```

```
[[6.5542844e-07 9.9999940e-01]
 [9.9147195e-01 8.5280919e-03]
 [1.9132092e-05 9.9998093e-01]
 ...
 [2.7467880e-07 9.9999976e-01]
 [8.9294559e-08 9.9999988e-01]
 [9.9940789e-01 5.9217890e-04]]
[1 0 1 ... 1 1 0]
                      precision    recall  f1-score   support

     class 0(Normal)       0.95      0.94      0.94       312
  class 1(Pneumonia)       0.98      0.98      0.98       860

            accuracy                           0.97      1172
           macro avg       0.96      0.96      0.96      1172
        weighted avg       0.97      0.97      0.97      1172

[[293  19]
 [ 17 843]]
```
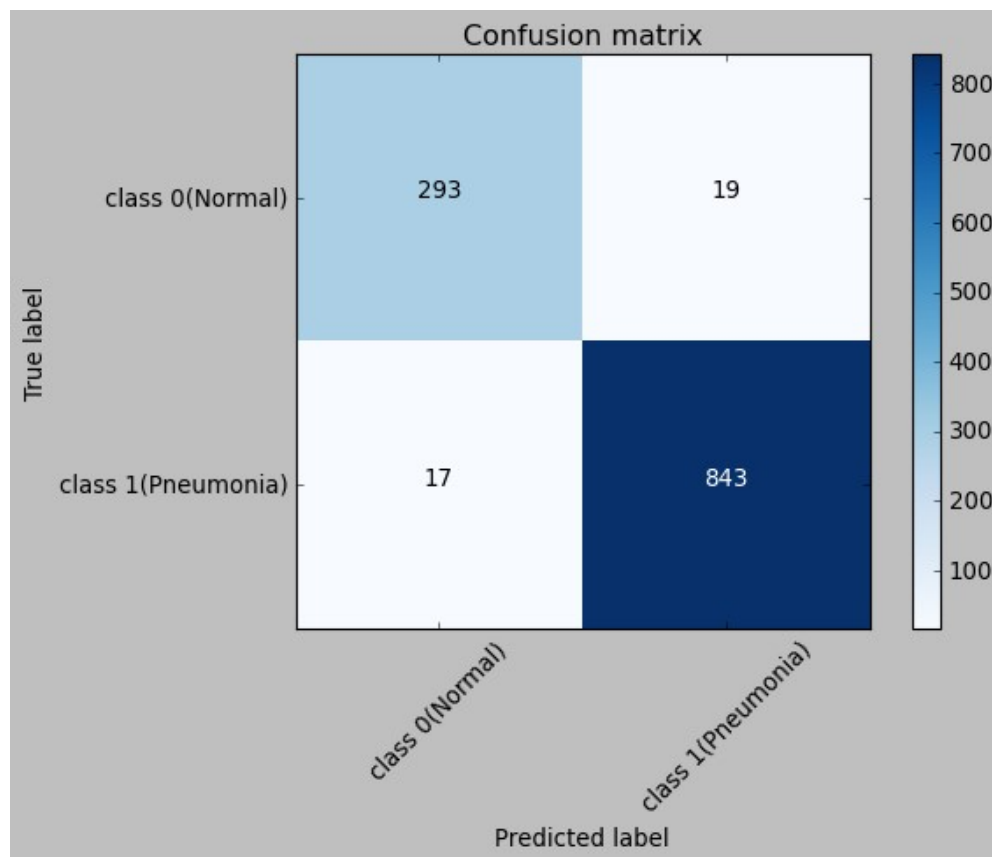
Compute confusion matrix

In [21]:
```python
# Compute confusion matrix
cnf_matrix = (confusion_matrix(np.argmax(y_test,axis=1), y_pred))

np.set_printoptions(precision=2)

# Plot non-normalized confusion matrix
plot_confusion_matrix(cnf_matrix, classes=target_names,
                        title='Confusion matrix')
```

Confusion matrix, without normalization
[[293 19]
 [17 843]]

In [ ]: