In [1]:
```
from keras.applications.resnet50 import ResNet50, preprocess_input
from keras.layers import Dense, Dropout
from keras.models import Model
from keras.optimizers import Adam, SGD
from keras.preprocessing.image import ImageDataGenerator, image
from keras.callbacks import EarlyStopping, ModelCheckpoint
from sklearn.metrics import confusion_matrix, classification_report, accuracy_score
from keras import backend as K
import numpy as np
import matplotlib.pyplot as plt
from PIL import ImageFile
ImageFile.LOAD_TRUNCATED_IMAGE = True
```

```
Using TensorFlow backend.
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:516: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:517: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:518: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:519: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:520: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\framework\dtypes.py:525: FutureWarning: Passing (type,
1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (type, (1,))
/ '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:541: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  _np_qint8 = np.dtype([("qint8", np.int8, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:542: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  _np_quint8 = np.dtype([("quint8", np.uint8, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:543: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  _np_qint16 = np.dtype([("qint16", np.int16, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:544: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  _np_quint16 = np.dtype([("quint16", np.uint16, 1)])
```

```
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:545: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  _np_qint32 = np.dtype([("qint32", np.int32, 1)])
C:\Users\shash\anaconda3\lib\site-packages\tensorboard\compat\tensorflow_stub\dtypes.py:550: FutureWarning: Passing
(type, 1) or '1type' as a synonym of type is deprecated; in a future version of numpy, it will be understood as (typ
e, (1,)) / '(1,)type'.
  np_resource = np.dtype([("resource", np.ubyte, 1)])
```

In [2]:
```
N_CLASSES = 7
EPOCHS = 15
PATIENCE = 5
TRAIN_PATH= r'S:\VIT AP\SummerInternship1\COVID 19\train'
VALID_PATH = r'S:\VIT AP\SummerInternship1\COVID 19\test'
MODEL_CHECK_WEIGHT_NAME = 'resnet_covid1.h5'
```

In [3]:
```
K.set_learning_phase(0)
model = ResNet50(input_shape=(224,224,3),include_top=False, weights='imagenet', pooling='avg')
K.set_learning_phase(1)
x = model.output
x = Dense(512, activation='relu')(x)
x = Dropout(0.5)(x)
x = Dense(512, activation='relu')(x)
x = Dropout(0.5)(x)
output = Dense(N_CLASSES, activation='softmax', name='custom_output')(x)
custom_resnet = Model(inputs=model.input, outputs = output)

for layer in model.layers:
    layer.trainable = False

custom_resnet.compile(Adam(lr=0.001), loss='categorical_crossentropy', metrics=['accuracy'])
custom_resnet.summary()
```

```
WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:153: The name
tf.get_default_graph is deprecated. Please use tf.compat.v1.get_default_graph instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:517: The name
tf.placeholder is deprecated. Please use tf.compat.v1.placeholder instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:4185: The name
tf.truncated_normal is deprecated. Please use tf.random.truncated_normal instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:174: The name
tf.get_default_session is deprecated. Please use tf.compat.v1.get_default_session instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:181: The name
tf.ConfigProto is deprecated. Please use tf.compat.v1.ConfigProto instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:1834: The name
tf.nn.fused_batch_norm is deprecated. Please use tf.compat.v1.nn.fused_batch_norm instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:3976: The name
tf.nn.max_pool is deprecated. Please use tf.nn.max_pool2d instead.

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow_backend.py:3445: calling
dropout (from tensorflow.python.ops.nn_ops) with keep_prob is deprecated and will be removed in a future version.
Instructions for updating:
Please use `rate` instead of `keep_prob`. Rate should be set to `rate = 1 - keep_prob`.
WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\optimizers.py:790: The name tf.train.Optimiz
er is deprecated. Please use tf.compat.v1.train.Optimizer instead.
```

Layer (type)	Output Shape	Param #	Connected to
input_1 (InputLayer)	(None, 224, 224, 3)	0	
conv1_pad (ZeroPadding2D)	(None, 230, 230, 3)	0	input_1[0][0]
conv1 (Conv2D)	(None, 112, 112, 64)	9472	conv1_pad[0][0]
bn_conv1 (BatchNormalization)	(None, 112, 112, 64)	256	conv1[0][0]
activation_1 (Activation)	(None, 112, 112, 64)	0	bn_conv1[0][0]

pool1_pad (ZeroPadding2D)	(None, 114, 114, 64)	0	activation_1[0][0]
max_pooling2d_1 (MaxPooling2D)	(None, 56, 56, 64)	0	pool1_pad[0][0]
res2a_branch2a (Conv2D)	(None, 56, 56, 64)	4160	max_pooling2d_1[0][0]
bn2a_branch2a (BatchNormalizati	(None, 56, 56, 64)	256	res2a_branch2a[0][0]
activation_2 (Activation)	(None, 56, 56, 64)	0	bn2a_branch2a[0][0]
res2a_branch2b (Conv2D)	(None, 56, 56, 64)	36928	activation_2[0][0]
bn2a_branch2b (BatchNormalizati	(None, 56, 56, 64)	256	res2a_branch2b[0][0]
activation_3 (Activation)	(None, 56, 56, 64)	0	bn2a_branch2b[0][0]
res2a_branch2c (Conv2D)	(None, 56, 56, 256)	16640	activation_3[0][0]
res2a_branch1 (Conv2D)	(None, 56, 56, 256)	16640	max_pooling2d_1[0][0]
bn2a_branch2c (BatchNormalizati	(None, 56, 56, 256)	1024	res2a_branch2c[0][0]
bn2a_branch1 (BatchNormalizatio	(None, 56, 56, 256)	1024	res2a_branch1[0][0]
add_1 (Add)	(None, 56, 56, 256)	0	bn2a_branch2c[0][0] bn2a_branch1[0][0]
activation_4 (Activation)	(None, 56, 56, 256)	0	add_1[0][0]
res2b_branch2a (Conv2D)	(None, 56, 56, 64)	16448	activation_4[0][0]
bn2b_branch2a (BatchNormalizati	(None, 56, 56, 64)	256	res2b_branch2a[0][0]
activation_5 (Activation)	(None, 56, 56, 64)	0	bn2b_branch2a[0][0]
res2b_branch2b (Conv2D)	(None, 56, 56, 64)	36928	activation_5[0][0]
bn2b_branch2b (BatchNormalizati	(None, 56, 56, 64)	256	res2b_branch2b[0][0]
activation_6 (Activation)	(None, 56, 56, 64)	0	bn2b_branch2b[0][0]
res2b_branch2c (Conv2D)	(None, 56, 56, 256)	16640	activation_6[0][0]

bn2b_branch2c (BatchNormalizati	(None, 56, 56, 256)	1024	res2b_branch2c[0][0]
add_2 (Add)	(None, 56, 56, 256)	0	bn2b_branch2c[0][0] activation_4[0][0]
activation_7 (Activation)	(None, 56, 56, 256)	0	add_2[0][0]
res2c_branch2a (Conv2D)	(None, 56, 56, 64)	16448	activation_7[0][0]
bn2c_branch2a (BatchNormalizati	(None, 56, 56, 64)	256	res2c_branch2a[0][0]
activation_8 (Activation)	(None, 56, 56, 64)	0	bn2c_branch2a[0][0]
res2c_branch2b (Conv2D)	(None, 56, 56, 64)	36928	activation_8[0][0]
bn2c_branch2b (BatchNormalizati	(None, 56, 56, 64)	256	res2c_branch2b[0][0]
activation_9 (Activation)	(None, 56, 56, 64)	0	bn2c_branch2b[0][0]
res2c_branch2c (Conv2D)	(None, 56, 56, 256)	16640	activation_9[0][0]
bn2c_branch2c (BatchNormalizati	(None, 56, 56, 256)	1024	res2c_branch2c[0][0]
add_3 (Add)	(None, 56, 56, 256)	0	bn2c_branch2c[0][0] activation_7[0][0]
activation_10 (Activation)	(None, 56, 56, 256)	0	add_3[0][0]
res3a_branch2a (Conv2D)	(None, 28, 28, 128)	32896	activation_10[0][0]
bn3a_branch2a (BatchNormalizati	(None, 28, 28, 128)	512	res3a_branch2a[0][0]
activation_11 (Activation)	(None, 28, 28, 128)	0	bn3a_branch2a[0][0]
res3a_branch2b (Conv2D)	(None, 28, 28, 128)	147584	activation_11[0][0]
bn3a_branch2b (BatchNormalizati	(None, 28, 28, 128)	512	res3a_branch2b[0][0]
activation_12 (Activation)	(None, 28, 28, 128)	0	bn3a_branch2b[0][0]
res3a_branch2c (Conv2D)	(None, 28, 28, 512)	66048	activation_12[0][0]

res3a_branch1 (Conv2D)	(None, 28, 28, 512)	131584	activation_10[0][0]
bn3a_branch2c (BatchNormalizati	(None, 28, 28, 512)	2048	res3a_branch2c[0][0]
bn3a_branch1 (BatchNormalizatio	(None, 28, 28, 512)	2048	res3a_branch1[0][0]
add_4 (Add)	(None, 28, 28, 512)	0	bn3a_branch2c[0][0] bn3a_branch1[0][0]
activation_13 (Activation)	(None, 28, 28, 512)	0	add_4[0][0]
res3b_branch2a (Conv2D)	(None, 28, 28, 128)	65664	activation_13[0][0]
bn3b_branch2a (BatchNormalizati	(None, 28, 28, 128)	512	res3b_branch2a[0][0]
activation_14 (Activation)	(None, 28, 28, 128)	0	bn3b_branch2a[0][0]
res3b_branch2b (Conv2D)	(None, 28, 28, 128)	147584	activation_14[0][0]
bn3b_branch2b (BatchNormalizati	(None, 28, 28, 128)	512	res3b_branch2b[0][0]
activation_15 (Activation)	(None, 28, 28, 128)	0	bn3b_branch2b[0][0]
res3b_branch2c (Conv2D)	(None, 28, 28, 512)	66048	activation_15[0][0]
bn3b_branch2c (BatchNormalizati	(None, 28, 28, 512)	2048	res3b_branch2c[0][0]
add_5 (Add)	(None, 28, 28, 512)	0	bn3b_branch2c[0][0] activation_13[0][0]
activation_16 (Activation)	(None, 28, 28, 512)	0	add_5[0][0]
res3c_branch2a (Conv2D)	(None, 28, 28, 128)	65664	activation_16[0][0]
bn3c_branch2a (BatchNormalizati	(None, 28, 28, 128)	512	res3c_branch2a[0][0]
activation_17 (Activation)	(None, 28, 28, 128)	0	bn3c_branch2a[0][0]
res3c_branch2b (Conv2D)	(None, 28, 28, 128)	147584	activation_17[0][0]
bn3c_branch2b (BatchNormalizati	(None, 28, 28, 128)	512	res3c_branch2b[0][0]

activation_18 (Activation)	(None, 28, 28, 128)	0	bn3c_branch2b[0][0]
res3c_branch2c (Conv2D)	(None, 28, 28, 512)	66048	activation_18[0][0]
bn3c_branch2c (BatchNormalizati	(None, 28, 28, 512)	2048	res3c_branch2c[0][0]
add_6 (Add)	(None, 28, 28, 512)	0	bn3c_branch2c[0][0] activation_16[0][0]
activation_19 (Activation)	(None, 28, 28, 512)	0	add_6[0][0]
res3d_branch2a (Conv2D)	(None, 28, 28, 128)	65664	activation_19[0][0]
bn3d_branch2a (BatchNormalizati	(None, 28, 28, 128)	512	res3d_branch2a[0][0]
activation_20 (Activation)	(None, 28, 28, 128)	0	bn3d_branch2a[0][0]
res3d_branch2b (Conv2D)	(None, 28, 28, 128)	147584	activation_20[0][0]
bn3d_branch2b (BatchNormalizati	(None, 28, 28, 128)	512	res3d_branch2b[0][0]
activation_21 (Activation)	(None, 28, 28, 128)	0	bn3d_branch2b[0][0]
res3d_branch2c (Conv2D)	(None, 28, 28, 512)	66048	activation_21[0][0]
bn3d_branch2c (BatchNormalizati	(None, 28, 28, 512)	2048	res3d_branch2c[0][0]
add_7 (Add)	(None, 28, 28, 512)	0	bn3d_branch2c[0][0] activation_19[0][0]
activation_22 (Activation)	(None, 28, 28, 512)	0	add_7[0][0]
res4a_branch2a (Conv2D)	(None, 14, 14, 256)	131328	activation_22[0][0]
bn4a_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4a_branch2a[0][0]
activation_23 (Activation)	(None, 14, 14, 256)	0	bn4a_branch2a[0][0]
res4a_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_23[0][0]
bn4a_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4a_branch2b[0][0]

activation_24 (Activation)	(None, 14, 14, 256)	0	bn4a_branch2b[0][0]
res4a_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_24[0][0]
res4a_branch1 (Conv2D)	(None, 14, 14, 1024)	525312	activation_22[0][0]
bn4a_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4a_branch2c[0][0]
bn4a_branch1 (BatchNormalizatio	(None, 14, 14, 1024)	4096	res4a_branch1[0][0]
add_8 (Add)	(None, 14, 14, 1024)	0	bn4a_branch2c[0][0] bn4a_branch1[0][0]
activation_25 (Activation)	(None, 14, 14, 1024)	0	add_8[0][0]
res4b_branch2a (Conv2D)	(None, 14, 14, 256)	262400	activation_25[0][0]
bn4b_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4b_branch2a[0][0]
activation_26 (Activation)	(None, 14, 14, 256)	0	bn4b_branch2a[0][0]
res4b_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_26[0][0]
bn4b_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4b_branch2b[0][0]
activation_27 (Activation)	(None, 14, 14, 256)	0	bn4b_branch2b[0][0]
res4b_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_27[0][0]
bn4b_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4b_branch2c[0][0]
add_9 (Add)	(None, 14, 14, 1024)	0	bn4b_branch2c[0][0] activation_25[0][0]
activation_28 (Activation)	(None, 14, 14, 1024)	0	add_9[0][0]
res4c_branch2a (Conv2D)	(None, 14, 14, 256)	262400	activation_28[0][0]
bn4c_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4c_branch2a[0][0]
activation_29 (Activation)	(None, 14, 14, 256)	0	bn4c_branch2a[0][0]

res4c_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_29[0][0]
bn4c_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4c_branch2b[0][0]
activation_30 (Activation)	(None, 14, 14, 256)	0	bn4c_branch2b[0][0]
res4c_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_30[0][0]
bn4c_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4c_branch2c[0][0]
add_10 (Add)	(None, 14, 14, 1024)	0	bn4c_branch2c[0][0] activation_28[0][0]
activation_31 (Activation)	(None, 14, 14, 1024)	0	add_10[0][0]
res4d_branch2a (Conv2D)	(None, 14, 14, 256)	262400	activation_31[0][0]
bn4d_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4d_branch2a[0][0]
activation_32 (Activation)	(None, 14, 14, 256)	0	bn4d_branch2a[0][0]
res4d_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_32[0][0]
bn4d_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4d_branch2b[0][0]
activation_33 (Activation)	(None, 14, 14, 256)	0	bn4d_branch2b[0][0]
res4d_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_33[0][0]
bn4d_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4d_branch2c[0][0]
add_11 (Add)	(None, 14, 14, 1024)	0	bn4d_branch2c[0][0] activation_31[0][0]
activation_34 (Activation)	(None, 14, 14, 1024)	0	add_11[0][0]
res4e_branch2a (Conv2D)	(None, 14, 14, 256)	262400	activation_34[0][0]
bn4e_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4e_branch2a[0][0]
activation_35 (Activation)	(None, 14, 14, 256)	0	bn4e_branch2a[0][0]

res4e_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_35[0][0]
bn4e_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4e_branch2b[0][0]
activation_36 (Activation)	(None, 14, 14, 256)	0	bn4e_branch2b[0][0]
res4e_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_36[0][0]
bn4e_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4e_branch2c[0][0]
add_12 (Add)	(None, 14, 14, 1024)	0	bn4e_branch2c[0][0] activation_34[0][0]
activation_37 (Activation)	(None, 14, 14, 1024)	0	add_12[0][0]
res4f_branch2a (Conv2D)	(None, 14, 14, 256)	262400	activation_37[0][0]
bn4f_branch2a (BatchNormalizati	(None, 14, 14, 256)	1024	res4f_branch2a[0][0]
activation_38 (Activation)	(None, 14, 14, 256)	0	bn4f_branch2a[0][0]
res4f_branch2b (Conv2D)	(None, 14, 14, 256)	590080	activation_38[0][0]
bn4f_branch2b (BatchNormalizati	(None, 14, 14, 256)	1024	res4f_branch2b[0][0]
activation_39 (Activation)	(None, 14, 14, 256)	0	bn4f_branch2b[0][0]
res4f_branch2c (Conv2D)	(None, 14, 14, 1024)	263168	activation_39[0][0]
bn4f_branch2c (BatchNormalizati	(None, 14, 14, 1024)	4096	res4f_branch2c[0][0]
add_13 (Add)	(None, 14, 14, 1024)	0	bn4f_branch2c[0][0] activation_37[0][0]
activation_40 (Activation)	(None, 14, 14, 1024)	0	add_13[0][0]
res5a_branch2a (Conv2D)	(None, 7, 7, 512)	524800	activation_40[0][0]
bn5a_branch2a (BatchNormalizati	(None, 7, 7, 512)	2048	res5a_branch2a[0][0]
activation_41 (Activation)	(None, 7, 7, 512)	0	bn5a_branch2a[0][0]

res5a_branch2b (Conv2D)	(None, 7, 7, 512)	2359808	activation_41[0][0]
bn5a_branch2b (BatchNormalizati	(None, 7, 7, 512)	2048	res5a_branch2b[0][0]
activation_42 (Activation)	(None, 7, 7, 512)	0	bn5a_branch2b[0][0]
res5a_branch2c (Conv2D)	(None, 7, 7, 2048)	1050624	activation_42[0][0]
res5a_branch1 (Conv2D)	(None, 7, 7, 2048)	2099200	activation_40[0][0]
bn5a_branch2c (BatchNormalizati	(None, 7, 7, 2048)	8192	res5a_branch2c[0][0]
bn5a_branch1 (BatchNormalizatio	(None, 7, 7, 2048)	8192	res5a_branch1[0][0]
add_14 (Add)	(None, 7, 7, 2048)	0	bn5a_branch2c[0][0] bn5a_branch1[0][0]
activation_43 (Activation)	(None, 7, 7, 2048)	0	add_14[0][0]
res5b_branch2a (Conv2D)	(None, 7, 7, 512)	1049088	activation_43[0][0]
bn5b_branch2a (BatchNormalizati	(None, 7, 7, 512)	2048	res5b_branch2a[0][0]
activation_44 (Activation)	(None, 7, 7, 512)	0	bn5b_branch2a[0][0]
res5b_branch2b (Conv2D)	(None, 7, 7, 512)	2359808	activation_44[0][0]
bn5b_branch2b (BatchNormalizati	(None, 7, 7, 512)	2048	res5b_branch2b[0][0]
activation_45 (Activation)	(None, 7, 7, 512)	0	bn5b_branch2b[0][0]
res5b_branch2c (Conv2D)	(None, 7, 7, 2048)	1050624	activation_45[0][0]
bn5b_branch2c (BatchNormalizati	(None, 7, 7, 2048)	8192	res5b_branch2c[0][0]
add_15 (Add)	(None, 7, 7, 2048)	0	bn5b_branch2c[0][0] activation_43[0][0]
activation_46 (Activation)	(None, 7, 7, 2048)	0	add_15[0][0]
res5c_branch2a (Conv2D)	(None, 7, 7, 512)	1049088	activation_46[0][0]

bn5c_branch2a (BatchNormalizati	(None, 7, 7, 512)	2048	res5c_branch2a[0][0]
activation_47 (Activation)	(None, 7, 7, 512)	0	bn5c_branch2a[0][0]
res5c_branch2b (Conv2D)	(None, 7, 7, 512)	2359808	activation_47[0][0]
bn5c_branch2b (BatchNormalizati	(None, 7, 7, 512)	2048	res5c_branch2b[0][0]
activation_48 (Activation)	(None, 7, 7, 512)	0	bn5c_branch2b[0][0]
res5c_branch2c (Conv2D)	(None, 7, 7, 2048)	1050624	activation_48[0][0]
bn5c_branch2c (BatchNormalizati	(None, 7, 7, 2048)	8192	res5c_branch2c[0][0]
add_16 (Add)	(None, 7, 7, 2048)	0	bn5c_branch2c[0][0] activation_46[0][0]
activation_49 (Activation)	(None, 7, 7, 2048)	0	add_16[0][0]
global_average_pooling2d_1 (Glo	(None, 2048)	0	activation_49[0][0]
dense_1 (Dense)	(None, 512)	1049088	global_average_pooling2d_1[0][0]
dropout_1 (Dropout)	(None, 512)	0	dense_1[0][0]
dense_2 (Dense)	(None, 512)	262656	dropout_1[0][0]
dropout_2 (Dropout)	(None, 512)	0	dense_2[0][0]
custom_output (Dense)	(None, 7)	3591	dropout_2[0][0]

Total params: 24,903,047
Trainable params: 1,315,335
Non-trainable params: 23,587,712

In [4]:
```
datagen = ImageDataGenerator(preprocessing_function=preprocess_input)
traingen = datagen.flow_from_directory(TRAIN_PATH, target_size=(224,224), batch_size=1, class_mode='categorical')
validgen = datagen.flow_from_directory(VALID_PATH, target_size=(224,224), batch_size=1, class_mode='categorical', shuf
fle=False)
```

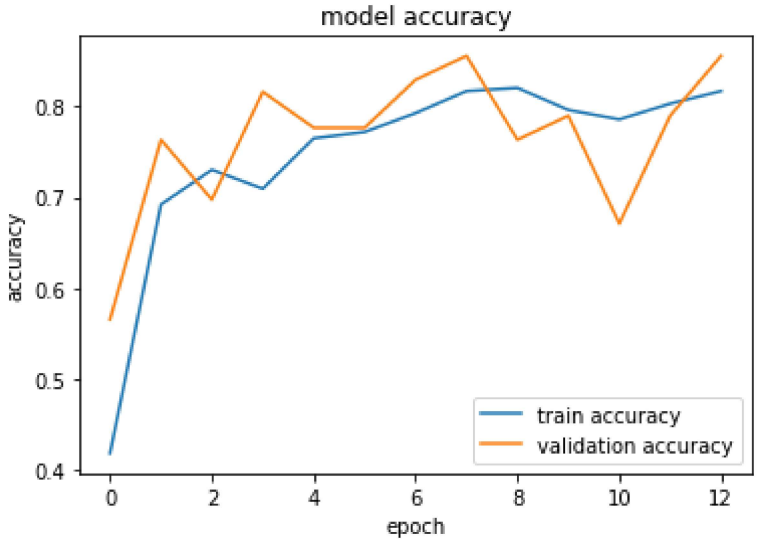
```
Found 289 images belonging to 7 classes.
Found 76 images belonging to 7 classes.
```

In [5]:
```
es_callback = EarlyStopping(monitor='val_acc', patience=PATIENCE, mode='max')
mc_callback = ModelCheckpoint(filepath=MODEL_CHECK_WEIGHT_NAME, monitor='val_acc', save_best_only=True, mode='max')
train_history = custom_resnet.fit_generator(traingen, steps_per_epoch=len(traingen), epochs= EPOCHS, validation_data=traingen, validation_steps=len(validgen), verbose=2, callbacks=[es_callback, mc_callback])
```

```
WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\tensorflow\python\ops\math_grad.py:1250: add_dispatch_support.<locals>.wrapper (from tensorflow.python.ops.array_ops) is deprecated and will be removed in a future version.
Instructions for updating:
Use tf.where in 2.0, which has the same broadcast rule as np.where
Epoch 1/15
 - 120s - loss: 4.6279 - acc: 0.4187 - val_loss: 1.5185 - val_acc: 0.5658
Epoch 2/15
 - 114s - loss: 0.9591 - acc: 0.6920 - val_loss: 0.7707 - val_acc: 0.7632
Epoch 3/15
 - 113s - loss: 0.9414 - acc: 0.7301 - val_loss: 0.7187 - val_acc: 0.6974
Epoch 4/15
 - 114s - loss: 0.8620 - acc: 0.7093 - val_loss: 0.5596 - val_acc: 0.8158
Epoch 5/15
 - 117s - loss: 0.7460 - acc: 0.7647 - val_loss: 0.4453 - val_acc: 0.7763
Epoch 6/15
 - 118s - loss: 0.7680 - acc: 0.7716 - val_loss: 0.7239 - val_acc: 0.7763
Epoch 7/15
 - 115s - loss: 0.6730 - acc: 0.7924 - val_loss: 0.6597 - val_acc: 0.8289
Epoch 8/15
 - 116s - loss: 0.6731 - acc: 0.8166 - val_loss: 0.6240 - val_acc: 0.8553
Epoch 9/15
 - 114s - loss: 0.6171 - acc: 0.8201 - val_loss: 0.7160 - val_acc: 0.7632
Epoch 10/15
 - 115s - loss: 0.6592 - acc: 0.7958 - val_loss: 0.5166 - val_acc: 0.7895
Epoch 11/15
 - 114s - loss: 0.6689 - acc: 0.7855 - val_loss: 0.8689 - val_acc: 0.6711
Epoch 12/15
 - 111s - loss: 0.6672 - acc: 0.8028 - val_loss: 0.6177 - val_acc: 0.7895
Epoch 13/15
 - 115s - loss: 0.5646 - acc: 0.8166 - val_loss: 0.4999 - val_acc: 0.8553
```

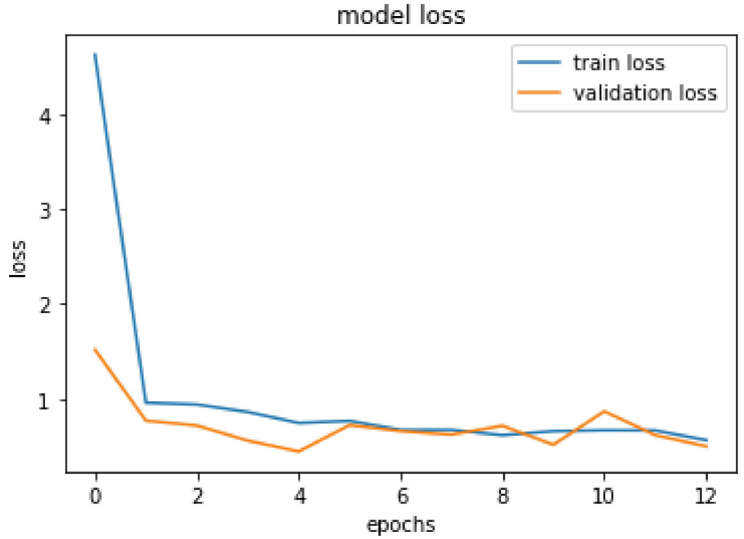
In [6]:
```
#accuracy
plt.plot(train_history.history['acc'])
plt.plot(train_history.history['val_acc'])
plt.title('model accuracy')
plt.ylabel('accuracy')
plt.xlabel('epoch')
plt.legend(['train accuracy','validation accuracy'])
```

Out[6]: <matplotlib.legend.Legend at 0x26a01b85fc8>



In [7]:
```
#loss
plt.plot(train_history.history['loss'])
plt.plot(train_history.history['val_loss'])
plt.title('model loss')
plt.ylabel('loss')
plt.xlabel('epochs')
plt.legend(['train loss', 'validation loss'])
```

Out[7]: <matplotlib.legend.Legend at 0x26a03df5788>



In [8]:
```
custom_resnet.load_weights(MODEL_CHECK_WEIGHT_NAME)
```

In [9]:
```
predict = custom_resnet.predict_generator(validgen, steps=len(validgen), verbose=1)
test_labels = validgen.classes
confusion_matrix(test_labels, predict.argmax(axis=1))
```

```
76/76 [==============================] - 24s 319ms/step
```

Out[9]:
```
array([[ 0,  0,  1,  0,  0,  0,  0],
       [ 0, 21,  0,  1,  0,  0,  2],
       [ 0,  0, 12,  0,  0,  0,  0],
       [ 0,  6, 11,  7,  0,  0,  0],
       [ 0,  0,  1,  0,  0,  0,  0],
       [ 0,  0,  1,  0,  0,  0,  0],
       [ 0, 12,  0,  0,  0,  0,  1]], dtype=int64)
```

In [10]:
```
cr_labels = list(validgen.class_indices.keys())
classification_report(test_labels, predict.argmax(axis=1), target_names=cr_labels)
```

```
C:\Users\shash\anaconda3\lib\site-packages\sklearn\metrics\_classification.py:1272: UndefinedMetricWarning: Precision
and F-score are ill-defined and being set to 0.0 in labels with no predicted samples. Use `zero_division` parameter t
o control this behavior.
  _warn_prf(average, modifier, msg_start, len(result))
```

Out[10]:
```
'              precision    recall  f1-score   support\n\n         ARDS       0.00      0.00      0.00         1\n
Bacteria       0.54      0.88      0.67        24\n        COVID       0.46      1.00      0.63        12\n       Nor
mal       0.88      0.29      0.44        24\n         SARS       0.00      0.00      0.00         1\nStreptococcus
0.00      0.00      0.00         1\n        Virus       0.33      0.08      0.12        13\n\n     accuracy
0.54        76\n    macro avg       0.32      0.32      0.27        76\n weighted avg       0.58      0.54      0.47
76\n'
```

In [11]:
```
accuracy_score(test_labels,predict.argmax(axis=1))
```

Out[11]:
```
0.5394736842105263
```

In [12]:
```
import tensorflow as tf
from keras.models import load_model
```

In [13]:
```
custom_resnet.save('covidchest_resnet.h5')
```

Done!