

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

import warnings
warnings.filterwarnings('ignore')

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 (type, (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 (type, (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 (type, (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 (type, (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 (type, (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 (type, (1,)) / '(1,)type'.
    np_resource = np.dtype([("resource", np.ubyte, 1)])
```

```
In [2]: from keras.models import load_model

IMAGE_SIZE = [224, 224]

train_path = r'S:\VIT AP\SummerInternship1\COVID 19\Coronahack-Chest-XRay-Dataset\train'
valid_path = r'S:\VIT AP\SummerInternship1\COVID 19\Coronahack-Chest-XRay-Dataset\test'
```

```
In [3]: # add preprocessing layer
resnet = ResNet50(input_shape=IMAGE_SIZE + [3], weights='imagenet', include_top=False)

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

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\backend\tensorflow\_backend.py:74: 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.

```
In [4]: # Layers
x = Flatten()(resnet.output)
# x = Dense(1000, activation='relu')(x)
prediction = Dense(4, activation='softmax')(x)
```

```
In [5]: # create a model object
model = Model(inputs=resnet.input, outputs=prediction)
```

```
In [6]: # view the structure of the model  
model.summary()
```

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]
flatten_1 (Flatten)	(None, 100352)	0	activation_49[0][0]
dense_1 (Dense)	(None, 4)	401412	flatten_1[0][0]
<hr/>			
Total params: 23,989,124			
Trainable params: 401,412			
Non-trainable params: 23,587,712			

```
In [7]: # telling the model what cost and optimization method to use  
model.compile(  
    loss='categorical_crossentropy',  
    optimizer='adam',  
    metrics=['accuracy'])
```

WARNING:tensorflow:From C:\Users\shash\anaconda3\lib\site-packages\keras\optimizers.py:790: The name tf.train.Optimizer is deprecated. Please use tf.compat.v1.train.Optimizer instead.

```
In [8]: #resizing the images  
train_datagen = ImageDataGenerator(rescale = 1./255,  
                                    shear_range = 0.2,  
                                    zoom_range = 0.2,  
                                    horizontal_flip = True)  
  
test_datagen = ImageDataGenerator(rescale = 1./255)
```

```
In [9]: training_set = train_datagen.flow_from_directory(r'S:\VIT AP\SummerInternship1\COVID 19\Coronahack-Chest-XRay-Dataset\train',  
                                                    target_size = (224, 224),  
                                                    batch_size = 8,  
                                                    class_mode = 'categorical')
```

Found 279 images belonging to 4 classes.

```
In [10]: test_set = test_datagen.flow_from_directory(r'S:\VIT AP\SummerInternship1\COVID 19\Coronahack-Chest-XRay-Dataset\test',  
                                                    target_size = (224, 224),  
                                                    batch_size = 8,  
                                                    class_mode = 'categorical')
```

Found 73 images belonging to 4 classes.

```
In [11]: # fit the model
r = model.fit_generator(
    training_set,
    validation_data=test_set,
    epochs=100,
    steps_per_epoch=len(training_set),
    validation_steps=len(test_set)
)
```

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 1/100  
35/35 [=====] - 94s 3s/step - loss: 3.7044 - acc: 0.6449 - val\_loss: 7.8453 - val\_acc: 0.1781  
Epoch 2/100  
35/35 [=====] - 96s 3s/step - loss: 2.5209 - acc: 0.8026 - val\_loss: 7.4570 - val\_acc: 0.1644  
Epoch 3/100  
35/35 [=====] - 93s 3s/step - loss: 2.1300 - acc: 0.8428 - val\_loss: 7.9175 - val\_acc: 0.1781  
Epoch 4/100  
35/35 [=====] - 92s 3s/step - loss: 1.9397 - acc: 0.8571 - val\_loss: 11.7295 - val\_acc: 0.1644  
Epoch 5/100  
35/35 [=====] - 92s 3s/step - loss: 2.7880 - acc: 0.7995 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 6/100  
35/35 [=====] - 92s 3s/step - loss: 2.2761 - acc: 0.8051 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 7/100  
35/35 [=====] - 92s 3s/step - loss: 1.4919 - acc: 0.8709 - val\_loss: 11.7558 - val\_acc: 0.1644  
Epoch 8/100  
35/35 [=====] - 93s 3s/step - loss: 2.2650 - acc: 0.8347 - val\_loss: 11.1366 - val\_acc: 0.1233  
Epoch 9/100  
35/35 [=====] - 93s 3s/step - loss: 1.8397 - acc: 0.8709 - val\_loss: 12.2448 - val\_acc: 0.1644  
Epoch 10/100  
35/35 [=====] - 92s 3s/step - loss: 1.9210 - acc: 0.8607 - val\_loss: 12.4651 - val\_acc: 0.1644  
Epoch 11/100  
35/35 [=====] - 92s 3s/step - loss: 1.2699 - acc: 0.9102 - val\_loss: 12.9367 - val\_acc: 0.1644  
Epoch 12/100  
35/35 [=====] - 92s 3s/step - loss: 1.2185 - acc: 0.9138 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 13/100  
35/35 [=====] - 94s 3s/step - loss: 1.1926 - acc: 0.9061 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 14/100  
35/35 [=====] - 94s 3s/step - loss: 1.4076 - acc: 0.9061 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 15/100  
35/35 [=====] - 92s 3s/step - loss: 1.7073 - acc: 0.8771 - val\_loss: 13.2979 - val\_acc: 0.1644  
Epoch 16/100  
35/35 [=====] - 94s 3s/step - loss: 1.2164 - acc: 0.9133 - val\_loss: 11.9838 - val\_acc: 0.1644  
Epoch 17/100  
35/35 [=====] - 91s 3s/step - loss: 0.8454 - acc: 0.9393 - val\_loss: 13.4686 - val\_acc: 0.1644  
Epoch 18/100  
35/35 [=====] - 92s 3s/step - loss: 0.9712 - acc: 0.9316 - val\_loss: 12.7910 - val\_acc: 0.1644  
Epoch 19/100  
35/35 [=====] - 92s 3s/step - loss: 0.7402 - acc: 0.9459 - val\_loss: 12.1929 - val\_acc: 0.1644  
Epoch 20/100  
35/35 [=====] - 91s 3s/step - loss: 1.6704 - acc: 0.8928 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 21/100  
35/35 [=====] - 95s 3s/step - loss: 0.9579 - acc: 0.9204 - val\_loss: 12.7588 - val\_acc: 0.1644  
Epoch 22/100  
35/35 [=====] - 90s 3s/step - loss: 1.0577 - acc: 0.9250 - val\_loss: 12.9964 - val\_acc: 0.1644  
Epoch 23/100  
35/35 [=====] - 91s 3s/step - loss: 0.9498 - acc: 0.9286 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 24/100  
35/35 [=====] - 91s 3s/step - loss: 1.5492 - acc: 0.8914 - val\_loss: 9.7043 - val\_acc: 0.1233  
Epoch 25/100  
35/35 [=====] - 92s 3s/step - loss: 1.3527 - acc: 0.9071 - val\_loss: 9.5898 - val\_acc: 0.1370  
Epoch 26/100  
35/35 [=====] - 93s 3s/step - loss: 0.6009 - acc: 0.9607 - val\_loss: 11.5405 - val\_acc: 0.1370  
Epoch 27/100  
35/35 [=====] - 90s 3s/step - loss: 0.7617 - acc: 0.9495 - val\_loss: 11.8344 - val\_acc: 0.1644  
Epoch 28/100  
35/35 [=====] - 91s 3s/step - loss: 0.8045 - acc: 0.9459 - val\_loss: 12.5081 - val\_acc: 0.1644  
Epoch 29/100  
35/35 [=====] - 91s 3s/step - loss: 1.2251 - acc: 0.9209 - val\_loss: 10.5051 - val\_acc: 0.1233  
Epoch 30/100

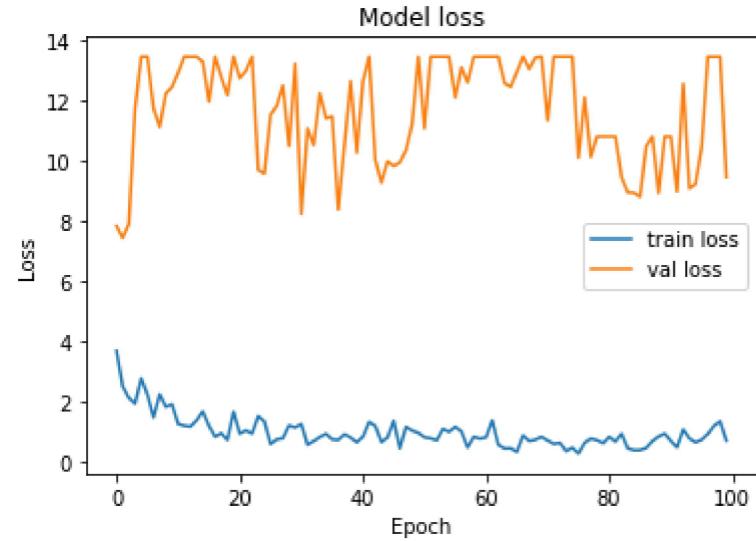
35/35 [=====] - 90s 3s/step - loss: 1.1516 - acc: 0.9143 - val\_loss: 13.2370 - val\_acc: 0.1781  
Epoch 31/100  
35/35 [=====] - 91s 3s/step - loss: 1.2683 - acc: 0.9107 - val\_loss: 8.2525 - val\_acc: 0.2877  
Epoch 32/100  
35/35 [=====] - 90s 3s/step - loss: 0.5802 - acc: 0.9500 - val\_loss: 11.0876 - val\_acc: 0.1781  
Epoch 33/100  
35/35 [=====] - 91s 3s/step - loss: 0.7021 - acc: 0.9429 - val\_loss: 10.5406 - val\_acc: 0.1233  
Epoch 34/100  
35/35 [=====] - 92s 3s/step - loss: 0.8347 - acc: 0.9464 - val\_loss: 12.2549 - val\_acc: 0.1644  
Epoch 35/100  
35/35 [=====] - 91s 3s/step - loss: 0.9526 - acc: 0.9388 - val\_loss: 11.4263 - val\_acc: 0.1507  
Epoch 36/100  
35/35 [=====] - 90s 3s/step - loss: 0.7797 - acc: 0.9414 - val\_loss: 11.4832 - val\_acc: 0.1644  
Epoch 37/100  
35/35 [=====] - 100s 3s/step - loss: 0.7679 - acc: 0.9521 - val\_loss: 8.3927 - val\_acc: 0.3288  
Epoch 38/100  
35/35 [=====] - 136s 4s/step - loss: 0.9346 - acc: 0.9316 - val\_loss: 10.5448 - val\_acc: 0.1233  
Epoch 39/100  
35/35 [=====] - 127s 4s/step - loss: 0.8343 - acc: 0.9454 - val\_loss: 12.6634 - val\_acc: 0.1644  
Epoch 40/100  
35/35 [=====] - 127s 4s/step - loss: 0.6685 - acc: 0.9531 - val\_loss: 10.2809 - val\_acc: 0.1233  
Epoch 41/100  
35/35 [=====] - 126s 4s/step - loss: 0.8490 - acc: 0.9321 - val\_loss: 12.6532 - val\_acc: 0.1644  
Epoch 42/100  
35/35 [=====] - 125s 4s/step - loss: 1.3319 - acc: 0.9107 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 43/100  
35/35 [=====] - 127s 4s/step - loss: 1.2056 - acc: 0.9250 - val\_loss: 10.0461 - val\_acc: 0.3288  
Epoch 44/100  
35/35 [=====] - 125s 4s/step - loss: 0.6675 - acc: 0.9536 - val\_loss: 9.2882 - val\_acc: 0.3288  
Epoch 45/100  
35/35 [=====] - 125s 4s/step - loss: 0.8222 - acc: 0.9429 - val\_loss: 9.9916 - val\_acc: 0.3288  
Epoch 46/100  
35/35 [=====] - 125s 4s/step - loss: 1.3737 - acc: 0.9000 - val\_loss: 9.8429 - val\_acc: 0.3288  
Epoch 47/100  
35/35 [=====] - 123s 4s/step - loss: 0.4606 - acc: 0.9714 - val\_loss: 9.9546 - val\_acc: 0.3288  
Epoch 48/100  
35/35 [=====] - 125s 4s/step - loss: 1.1854 - acc: 0.9240 - val\_loss: 10.3622 - val\_acc: 0.3288  
Epoch 49/100  
35/35 [=====] - 125s 4s/step - loss: 1.0574 - acc: 0.9316 - val\_loss: 11.2370 - val\_acc: 0.1370  
Epoch 50/100  
35/35 [=====] - 125s 4s/step - loss: 0.9750 - acc: 0.9286 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 51/100  
35/35 [=====] - 125s 4s/step - loss: 0.8282 - acc: 0.9357 - val\_loss: 11.0872 - val\_acc: 0.1644  
Epoch 52/100  
35/35 [=====] - 125s 4s/step - loss: 0.7937 - acc: 0.9464 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 53/100  
35/35 [=====] - 125s 4s/step - loss: 0.7310 - acc: 0.9500 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 54/100  
35/35 [=====] - 125s 4s/step - loss: 1.1120 - acc: 0.9281 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 55/100  
35/35 [=====] - 125s 4s/step - loss: 1.0195 - acc: 0.9347 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 56/100  
35/35 [=====] - 125s 4s/step - loss: 1.1767 - acc: 0.9250 - val\_loss: 12.1086 - val\_acc: 0.1644  
Epoch 57/100  
35/35 [=====] - 123s 4s/step - loss: 1.0191 - acc: 0.9321 - val\_loss: 13.1089 - val\_acc: 0.1644  
Epoch 58/100  
35/35 [=====] - 126s 4s/step - loss: 0.4951 - acc: 0.9679 - val\_loss: 12.6182 - val\_acc: 0.1644  
Epoch 59/100  
35/35 [=====] - 125s 4s/step - loss: 0.8512 - acc: 0.9352 - val\_loss: 13.4609 - val\_acc: 0.1644  
Epoch 60/100  
35/35 [=====] - 134s 4s/step - loss: 0.7905 - acc: 0.9495 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 61/100  
35/35 [=====] - 129s 4s/step - loss: 0.8350 - acc: 0.9424 - val\_loss: 13.4685 - val\_acc: 0.1644

Epoch 62/100  
35/35 [=====] - 126s 4s/step - loss: 1.3847 - acc: 0.9107 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 63/100  
35/35 [=====] - 125s 4s/step - loss: 0.5765 - acc: 0.9643 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 64/100  
35/35 [=====] - 125s 4s/step - loss: 0.4576 - acc: 0.9714 - val\_loss: 12.5912 - val\_acc: 0.1507  
Epoch 65/100  
35/35 [=====] - 125s 4s/step - loss: 0.4649 - acc: 0.9679 - val\_loss: 12.4671 - val\_acc: 0.1507  
Epoch 66/100  
35/35 [=====] - 125s 4s/step - loss: 0.3463 - acc: 0.9786 - val\_loss: 12.9650 - val\_acc: 0.1644  
Epoch 67/100  
35/35 [=====] - 135s 4s/step - loss: 0.8851 - acc: 0.9429 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 68/100  
35/35 [=====] - 127s 4s/step - loss: 0.7129 - acc: 0.9531 - val\_loss: 13.0615 - val\_acc: 0.1644  
Epoch 69/100  
35/35 [=====] - 120s 3s/step - loss: 0.7481 - acc: 0.9500 - val\_loss: 13.4419 - val\_acc: 0.1644  
Epoch 70/100  
35/35 [=====] - 125s 4s/step - loss: 0.8503 - acc: 0.9388 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 71/100  
35/35 [=====] - 125s 4s/step - loss: 0.7263 - acc: 0.9459 - val\_loss: 11.3551 - val\_acc: 0.1370  
Epoch 72/100  
35/35 [=====] - 126s 4s/step - loss: 0.6086 - acc: 0.9571 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 73/100  
35/35 [=====] - 125s 4s/step - loss: 0.6518 - acc: 0.9495 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 74/100  
35/35 [=====] - 126s 4s/step - loss: 0.3701 - acc: 0.9714 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 75/100  
35/35 [=====] - 126s 4s/step - loss: 0.4825 - acc: 0.9679 - val\_loss: 13.4685 - val\_acc: 0.1644  
Epoch 76/100  
35/35 [=====] - 125s 4s/step - loss: 0.2915 - acc: 0.9786 - val\_loss: 10.1142 - val\_acc: 0.1233  
Epoch 77/100  
35/35 [=====] - 125s 4s/step - loss: 0.6526 - acc: 0.9531 - val\_loss: 12.1175 - val\_acc: 0.1644  
Epoch 78/100  
35/35 [=====] - 125s 4s/step - loss: 0.7867 - acc: 0.9464 - val\_loss: 10.1378 - val\_acc: 0.3288  
Epoch 79/100  
35/35 [=====] - 125s 4s/step - loss: 0.7333 - acc: 0.9464 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 80/100  
35/35 [=====] - 125s 4s/step - loss: 0.6333 - acc: 0.9607 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 81/100  
35/35 [=====] - 125s 4s/step - loss: 0.8432 - acc: 0.9429 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 82/100  
35/35 [=====] - 126s 4s/step - loss: 0.6862 - acc: 0.9536 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 83/100  
35/35 [=====] - 122s 3s/step - loss: 0.9530 - acc: 0.9388 - val\_loss: 9.4606 - val\_acc: 0.3288  
Epoch 84/100  
35/35 [=====] - 125s 4s/step - loss: 0.4606 - acc: 0.9714 - val\_loss: 8.9634 - val\_acc: 0.3425  
Epoch 85/100  
35/35 [=====] - 125s 4s/step - loss: 0.4030 - acc: 0.9750 - val\_loss: 8.9525 - val\_acc: 0.3425  
Epoch 86/100  
35/35 [=====] - 123s 4s/step - loss: 0.4043 - acc: 0.9750 - val\_loss: 8.8153 - val\_acc: 0.1507  
Epoch 87/100  
35/35 [=====] - 123s 4s/step - loss: 0.4762 - acc: 0.9679 - val\_loss: 10.5048 - val\_acc: 0.3288  
Epoch 88/100  
35/35 [=====] - 125s 4s/step - loss: 0.7022 - acc: 0.9500 - val\_loss: 10.8135 - val\_acc: 0.3288  
Epoch 89/100  
35/35 [=====] - 125s 4s/step - loss: 0.8526 - acc: 0.9464 - val\_loss: 8.9438 - val\_acc: 0.1096  
Epoch 90/100  
35/35 [=====] - 126s 4s/step - loss: 0.9498 - acc: 0.9393 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 91/100  
35/35 [=====] - 126s 4s/step - loss: 0.7040 - acc: 0.9536 - val\_loss: 10.8190 - val\_acc: 0.3288  
Epoch 92/100  
35/35 [=====] - 125s 4s/step - loss: 0.4973 - acc: 0.9643 - val\_loss: 8.9956 - val\_acc: 0.1233  
Epoch 93/100

```
35/35 [=====] - 125s 4s/step - loss: 1.0841 - acc: 0.9321 - val_loss: 12.5660 - val_acc: 0.1644
Epoch 94/100
35/35 [=====] - 125s 4s/step - loss: 0.8087 - acc: 0.9454 - val_loss: 9.0931 - val_acc: 0.3425
Epoch 95/100
35/35 [=====] - 128s 4s/step - loss: 0.6596 - acc: 0.9500 - val_loss: 9.2423 - val_acc: 0.1233
Epoch 96/100
35/35 [=====] - 132s 4s/step - loss: 0.7492 - acc: 0.9536 - val_loss: 10.4780 - val_acc: 0.1370
Epoch 97/100
35/35 [=====] - 127s 4s/step - loss: 0.9389 - acc: 0.9393 - val_loss: 13.4685 - val_acc: 0.1644
Epoch 98/100
35/35 [=====] - 125s 4s/step - loss: 1.2037 - acc: 0.9178 - val_loss: 13.4685 - val_acc: 0.1644
Epoch 99/100
35/35 [=====] - 125s 4s/step - loss: 1.3575 - acc: 0.9107 - val_loss: 13.4685 - val_acc: 0.1644
Epoch 100/100
35/35 [=====] - 125s 4s/step - loss: 0.7185 - acc: 0.9464 - val_loss: 9.4689 - val_acc: 0.1233
```

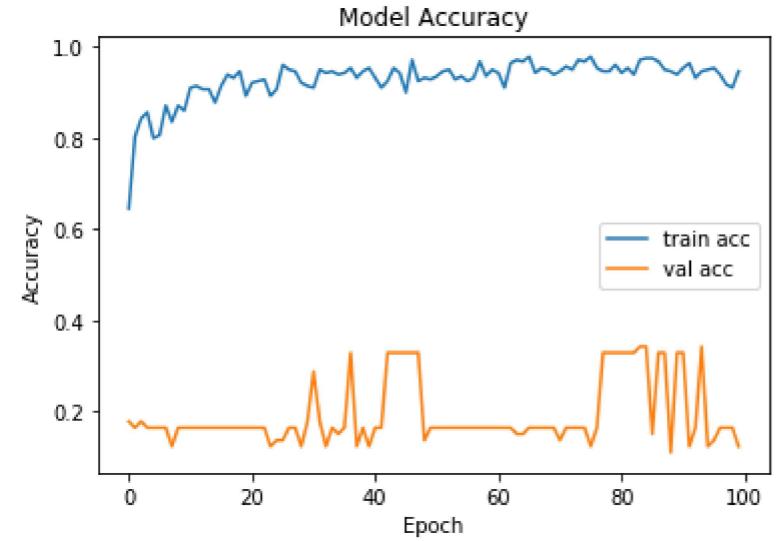
In [12]:

```
# Loss
plt.plot(r.history['loss'], label='train loss')
plt.plot(r.history['val_loss'], label='val loss')
plt.legend()
plt.title('Model loss')
plt.xlabel('Epoch')
plt.ylabel('Loss')
plt.show()
plt.savefig('LossVal_loss')
```



<Figure size 432x288 with 0 Axes>

```
In [13]: # accuracies  
plt.plot(r.history['acc'], label='train acc')  
plt.plot(r.history['val_acc'], label='val acc')  
plt.legend()  
plt.title('Model Accuracy')  
plt.xlabel('Epoch')  
plt.ylabel('Accuracy')  
plt.show()  
plt.savefig('AccVal_acc')
```



<Figure size 432x288 with 0 Axes>

```
In [14]: import tensorflow as tf  
from keras.models import load_model
```

```
In [15]: model.save('CovidChest1.h5')
```

```
In [ ]:
```