**CODE BACKUP**

import tensorflow as tf

import os

from tensorflow.keras.preprocessing.image import ImageDataGenerator

from tensorflow.keras import layers, models

import matplotlib.pyplot as plt

import numpy as np

from sklearn.model\_selection import train\_test\_split

from tensorflow import keras

from tensorflow.keras.utils import to\_categorical

from tensorflow.keras.models import Sequential

from tensorflow.keras import layers

from matplotlib import pyplot

from sklearn.model\_selection import train\_test\_split

# pip list

train\_dir= 'C:/Users/Admin/Downloads/4 final/lung cancer/lung/Train' # change the path

test\_dir= 'C:/Users/Admin/Downloads/4 final/lung cancer/lung/Test'

batch\_size = 1

epochs = 10

img\_height = 224

img\_width = 224

from tensorflow.keras.preprocessing.image import ImageDataGenerator

train\_image\_generator = ImageDataGenerator(rescale=1./255)

train\_data\_gen = train\_image\_generator.flow\_from\_directory(batch\_size=batch\_size,directory=train\_dir,shuffle=True,target\_size=(img\_height, img\_width),class\_mode='categorical')

Found 11250 images belonging to 3 classes.

val\_image\_generator = ImageDataGenerator(rescale=1./255)

val\_data\_gen = val\_image\_generator .flow\_from\_directory(batch\_size=batch\_size,directory=test\_dir,shuffle=True,target\_size=(img\_height, img\_width),class\_mode='categorical')

Found 1875 images belonging to 3 classes.

import warnings

import os

import glob

import matplotlib.pyplot as plt

# Import Keras

import keras

from keras.models import Sequential

from keras.layers import Dense,Dropout,Flatten

from keras.layers import Conv2D,MaxPooling2D,Activation,AveragePooling2D,BatchNormalization

from keras.preprocessing.image import ImageDataGenerator

from tensorflow.keras.applications.mobilenet import MobileNet

from tensorflow.keras.applications.vgg16 import VGG16

from tensorflow.keras.applications import EfficientNetB0

from tensorflow.keras import Sequential

from tensorflow.keras.applications import DenseNet121,MobileNet,ResNet50

from tensorflow.keras.applications import ResNet50V2

from tensorflow.keras.applications import ResNet152V2

from tensorflow.keras.applications import InceptionV3

from tensorflow.keras.applications import Xception

from tensorflow.keras.applications import MobileNetV2

base\_models = InceptionV3(weights = 'imagenet', include\_top=False, input\_shape=(224, 224, 3))

base\_models.trainable = False

base\_models.summary()

Model: "inception\_v3"

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Layer (type) Output Shape Param # Connected to

==================================================================================================

input\_1 (InputLayer) [(None, 224, 224, 3 0 []

)]

conv2d (Conv2D) (None, 111, 111, 32 864 ['input\_1[0][0]']

)

batch\_normalization (BatchNorm (None, 111, 111, 32 96 ['conv2d[0][0]']

alization) )

activation (Activation) (None, 111, 111, 32 0 ['batch\_normalization[0][0]']

)

conv2d\_1 (Conv2D) (None, 109, 109, 32 9216 ['activation[0][0]']

)

batch\_normalization\_1 (BatchNo (None, 109, 109, 32 96 ['conv2d\_1[0][0]']

rmalization) )

activation\_1 (Activation) (None, 109, 109, 32 0 ['batch\_normalization\_1[0][0]']

)

conv2d\_2 (Conv2D) (None, 109, 109, 64 18432 ['activation\_1[0][0]']

)

batch\_normalization\_2 (BatchNo (None, 109, 109, 64 192 ['conv2d\_2[0][0]']

rmalization) )

activation\_2 (Activation) (None, 109, 109, 64 0 ['batch\_normalization\_2[0][0]']

)

max\_pooling2d (MaxPooling2D) (None, 54, 54, 64) 0 ['activation\_2[0][0]']

conv2d\_3 (Conv2D) (None, 54, 54, 80) 5120 ['max\_pooling2d[0][0]']

batch\_normalization\_3 (BatchNo (None, 54, 54, 80) 240 ['conv2d\_3[0][0]']

rmalization)

activation\_3 (Activation) (None, 54, 54, 80) 0 ['batch\_normalization\_3[0][0]']

conv2d\_4 (Conv2D) (None, 52, 52, 192) 138240 ['activation\_3[0][0]']

batch\_normalization\_4 (BatchNo (None, 52, 52, 192) 576 ['conv2d\_4[0][0]']

rmalization)

activation\_4 (Activation) (None, 52, 52, 192) 0 ['batch\_normalization\_4[0][0]']

max\_pooling2d\_1 (MaxPooling2D) (None, 25, 25, 192) 0 ['activation\_4[0][0]']

conv2d\_8 (Conv2D) (None, 25, 25, 64) 12288 ['max\_pooling2d\_1[0][0]']

batch\_normalization\_8 (BatchNo (None, 25, 25, 64) 192 ['conv2d\_8[0][0]']

rmalization)

activation\_8 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_8[0][0]']

conv2d\_6 (Conv2D) (None, 25, 25, 48) 9216 ['max\_pooling2d\_1[0][0]']

conv2d\_9 (Conv2D) (None, 25, 25, 96) 55296 ['activation\_8[0][0]']

batch\_normalization\_6 (BatchNo (None, 25, 25, 48) 144 ['conv2d\_6[0][0]']

rmalization)

batch\_normalization\_9 (BatchNo (None, 25, 25, 96) 288 ['conv2d\_9[0][0]']

rmalization)

activation\_6 (Activation) (None, 25, 25, 48) 0 ['batch\_normalization\_6[0][0]']

activation\_9 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_9[0][0]']

average\_pooling2d (AveragePool (None, 25, 25, 192) 0 ['max\_pooling2d\_1[0][0]']

ing2D)

conv2d\_5 (Conv2D) (None, 25, 25, 64) 12288 ['max\_pooling2d\_1[0][0]']

conv2d\_7 (Conv2D) (None, 25, 25, 64) 76800 ['activation\_6[0][0]']

conv2d\_10 (Conv2D) (None, 25, 25, 96) 82944 ['activation\_9[0][0]']

conv2d\_11 (Conv2D) (None, 25, 25, 32) 6144 ['average\_pooling2d[0][0]']

batch\_normalization\_5 (BatchNo (None, 25, 25, 64) 192 ['conv2d\_5[0][0]']

rmalization)

batch\_normalization\_7 (BatchNo (None, 25, 25, 64) 192 ['conv2d\_7[0][0]']

rmalization)

batch\_normalization\_10 (BatchN (None, 25, 25, 96) 288 ['conv2d\_10[0][0]']

ormalization)

batch\_normalization\_11 (BatchN (None, 25, 25, 32) 96 ['conv2d\_11[0][0]']

ormalization)

activation\_5 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_5[0][0]']

activation\_7 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_7[0][0]']

activation\_10 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_10[0][0]']

activation\_11 (Activation) (None, 25, 25, 32) 0 ['batch\_normalization\_11[0][0]']

mixed0 (Concatenate) (None, 25, 25, 256) 0 ['activation\_5[0][0]',

'activation\_7[0][0]',

'activation\_10[0][0]',

'activation\_11[0][0]']

conv2d\_15 (Conv2D) (None, 25, 25, 64) 16384 ['mixed0[0][0]']

batch\_normalization\_15 (BatchN (None, 25, 25, 64) 192 ['conv2d\_15[0][0]']

ormalization)

activation\_15 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_15[0][0]']

conv2d\_13 (Conv2D) (None, 25, 25, 48) 12288 ['mixed0[0][0]']

conv2d\_16 (Conv2D) (None, 25, 25, 96) 55296 ['activation\_15[0][0]']

batch\_normalization\_13 (BatchN (None, 25, 25, 48) 144 ['conv2d\_13[0][0]']

ormalization)

batch\_normalization\_16 (BatchN (None, 25, 25, 96) 288 ['conv2d\_16[0][0]']

ormalization)

activation\_13 (Activation) (None, 25, 25, 48) 0 ['batch\_normalization\_13[0][0]']

activation\_16 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_16[0][0]']

average\_pooling2d\_1 (AveragePo (None, 25, 25, 256) 0 ['mixed0[0][0]']

oling2D)

conv2d\_12 (Conv2D) (None, 25, 25, 64) 16384 ['mixed0[0][0]']

conv2d\_14 (Conv2D) (None, 25, 25, 64) 76800 ['activation\_13[0][0]']

conv2d\_17 (Conv2D) (None, 25, 25, 96) 82944 ['activation\_16[0][0]']

conv2d\_18 (Conv2D) (None, 25, 25, 64) 16384 ['average\_pooling2d\_1[0][0]']

batch\_normalization\_12 (BatchN (None, 25, 25, 64) 192 ['conv2d\_12[0][0]']

ormalization)

batch\_normalization\_14 (BatchN (None, 25, 25, 64) 192 ['conv2d\_14[0][0]']

ormalization)

batch\_normalization\_17 (BatchN (None, 25, 25, 96) 288 ['conv2d\_17[0][0]']

ormalization)

batch\_normalization\_18 (BatchN (None, 25, 25, 64) 192 ['conv2d\_18[0][0]']

ormalization)

activation\_12 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_12[0][0]']

activation\_14 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_14[0][0]']

activation\_17 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_17[0][0]']

activation\_18 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_18[0][0]']

mixed1 (Concatenate) (None, 25, 25, 288) 0 ['activation\_12[0][0]',

'activation\_14[0][0]',

'activation\_17[0][0]',

'activation\_18[0][0]']

conv2d\_22 (Conv2D) (None, 25, 25, 64) 18432 ['mixed1[0][0]']

batch\_normalization\_22 (BatchN (None, 25, 25, 64) 192 ['conv2d\_22[0][0]']

ormalization)

activation\_22 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_22[0][0]']

conv2d\_20 (Conv2D) (None, 25, 25, 48) 13824 ['mixed1[0][0]']

conv2d\_23 (Conv2D) (None, 25, 25, 96) 55296 ['activation\_22[0][0]']

batch\_normalization\_20 (BatchN (None, 25, 25, 48) 144 ['conv2d\_20[0][0]']

ormalization)

batch\_normalization\_23 (BatchN (None, 25, 25, 96) 288 ['conv2d\_23[0][0]']

ormalization)

activation\_20 (Activation) (None, 25, 25, 48) 0 ['batch\_normalization\_20[0][0]']

activation\_23 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_23[0][0]']

average\_pooling2d\_2 (AveragePo (None, 25, 25, 288) 0 ['mixed1[0][0]']

oling2D)

conv2d\_19 (Conv2D) (None, 25, 25, 64) 18432 ['mixed1[0][0]']

conv2d\_21 (Conv2D) (None, 25, 25, 64) 76800 ['activation\_20[0][0]']

conv2d\_24 (Conv2D) (None, 25, 25, 96) 82944 ['activation\_23[0][0]']

conv2d\_25 (Conv2D) (None, 25, 25, 64) 18432 ['average\_pooling2d\_2[0][0]']

batch\_normalization\_19 (BatchN (None, 25, 25, 64) 192 ['conv2d\_19[0][0]']

ormalization)

batch\_normalization\_21 (BatchN (None, 25, 25, 64) 192 ['conv2d\_21[0][0]']

ormalization)

batch\_normalization\_24 (BatchN (None, 25, 25, 96) 288 ['conv2d\_24[0][0]']

ormalization)

batch\_normalization\_25 (BatchN (None, 25, 25, 64) 192 ['conv2d\_25[0][0]']

ormalization)

activation\_19 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_19[0][0]']

activation\_21 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_21[0][0]']

activation\_24 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_24[0][0]']

activation\_25 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_25[0][0]']

mixed2 (Concatenate) (None, 25, 25, 288) 0 ['activation\_19[0][0]',

'activation\_21[0][0]',

'activation\_24[0][0]',

'activation\_25[0][0]']

conv2d\_27 (Conv2D) (None, 25, 25, 64) 18432 ['mixed2[0][0]']

batch\_normalization\_27 (BatchN (None, 25, 25, 64) 192 ['conv2d\_27[0][0]']

ormalization)

activation\_27 (Activation) (None, 25, 25, 64) 0 ['batch\_normalization\_27[0][0]']

conv2d\_28 (Conv2D) (None, 25, 25, 96) 55296 ['activation\_27[0][0]']

batch\_normalization\_28 (BatchN (None, 25, 25, 96) 288 ['conv2d\_28[0][0]']

ormalization)

activation\_28 (Activation) (None, 25, 25, 96) 0 ['batch\_normalization\_28[0][0]']

conv2d\_26 (Conv2D) (None, 12, 12, 384) 995328 ['mixed2[0][0]']

conv2d\_29 (Conv2D) (None, 12, 12, 96) 82944 ['activation\_28[0][0]']

batch\_normalization\_26 (BatchN (None, 12, 12, 384) 1152 ['conv2d\_26[0][0]']

ormalization)

batch\_normalization\_29 (BatchN (None, 12, 12, 96) 288 ['conv2d\_29[0][0]']

ormalization)

activation\_26 (Activation) (None, 12, 12, 384) 0 ['batch\_normalization\_26[0][0]']

activation\_29 (Activation) (None, 12, 12, 96) 0 ['batch\_normalization\_29[0][0]']

max\_pooling2d\_2 (MaxPooling2D) (None, 12, 12, 288) 0 ['mixed2[0][0]']

mixed3 (Concatenate) (None, 12, 12, 768) 0 ['activation\_26[0][0]',

'activation\_29[0][0]',

'max\_pooling2d\_2[0][0]']

conv2d\_34 (Conv2D) (None, 12, 12, 128) 98304 ['mixed3[0][0]']

batch\_normalization\_34 (BatchN (None, 12, 12, 128) 384 ['conv2d\_34[0][0]']

ormalization)

activation\_34 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_34[0][0]']

conv2d\_35 (Conv2D) (None, 12, 12, 128) 114688 ['activation\_34[0][0]']

batch\_normalization\_35 (BatchN (None, 12, 12, 128) 384 ['conv2d\_35[0][0]']

ormalization)

activation\_35 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_35[0][0]']

conv2d\_31 (Conv2D) (None, 12, 12, 128) 98304 ['mixed3[0][0]']

conv2d\_36 (Conv2D) (None, 12, 12, 128) 114688 ['activation\_35[0][0]']

batch\_normalization\_31 (BatchN (None, 12, 12, 128) 384 ['conv2d\_31[0][0]']

ormalization)

batch\_normalization\_36 (BatchN (None, 12, 12, 128) 384 ['conv2d\_36[0][0]']

ormalization)

activation\_31 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_31[0][0]']

activation\_36 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_36[0][0]']

conv2d\_32 (Conv2D) (None, 12, 12, 128) 114688 ['activation\_31[0][0]']

conv2d\_37 (Conv2D) (None, 12, 12, 128) 114688 ['activation\_36[0][0]']

batch\_normalization\_32 (BatchN (None, 12, 12, 128) 384 ['conv2d\_32[0][0]']

ormalization)

batch\_normalization\_37 (BatchN (None, 12, 12, 128) 384 ['conv2d\_37[0][0]']

ormalization)

activation\_32 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_32[0][0]']

activation\_37 (Activation) (None, 12, 12, 128) 0 ['batch\_normalization\_37[0][0]']

average\_pooling2d\_3 (AveragePo (None, 12, 12, 768) 0 ['mixed3[0][0]']

oling2D)

conv2d\_30 (Conv2D) (None, 12, 12, 192) 147456 ['mixed3[0][0]']

conv2d\_33 (Conv2D) (None, 12, 12, 192) 172032 ['activation\_32[0][0]']

conv2d\_38 (Conv2D) (None, 12, 12, 192) 172032 ['activation\_37[0][0]']

conv2d\_39 (Conv2D) (None, 12, 12, 192) 147456 ['average\_pooling2d\_3[0][0]']

batch\_normalization\_30 (BatchN (None, 12, 12, 192) 576 ['conv2d\_30[0][0]']

ormalization)

batch\_normalization\_33 (BatchN (None, 12, 12, 192) 576 ['conv2d\_33[0][0]']

ormalization)

batch\_normalization\_38 (BatchN (None, 12, 12, 192) 576 ['conv2d\_38[0][0]']

ormalization)

batch\_normalization\_39 (BatchN (None, 12, 12, 192) 576 ['conv2d\_39[0][0]']

ormalization)

activation\_30 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_30[0][0]']

activation\_33 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_33[0][0]']

activation\_38 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_38[0][0]']

activation\_39 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_39[0][0]']

mixed4 (Concatenate) (None, 12, 12, 768) 0 ['activation\_30[0][0]',

'activation\_33[0][0]',

'activation\_38[0][0]',

'activation\_39[0][0]']

conv2d\_44 (Conv2D) (None, 12, 12, 160) 122880 ['mixed4[0][0]']

batch\_normalization\_44 (BatchN (None, 12, 12, 160) 480 ['conv2d\_44[0][0]']

ormalization)

activation\_44 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_44[0][0]']

conv2d\_45 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_44[0][0]']

batch\_normalization\_45 (BatchN (None, 12, 12, 160) 480 ['conv2d\_45[0][0]']

ormalization)

activation\_45 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_45[0][0]']

conv2d\_41 (Conv2D) (None, 12, 12, 160) 122880 ['mixed4[0][0]']

conv2d\_46 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_45[0][0]']

batch\_normalization\_41 (BatchN (None, 12, 12, 160) 480 ['conv2d\_41[0][0]']

ormalization)

batch\_normalization\_46 (BatchN (None, 12, 12, 160) 480 ['conv2d\_46[0][0]']

ormalization)

activation\_41 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_41[0][0]']

activation\_46 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_46[0][0]']

conv2d\_42 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_41[0][0]']

conv2d\_47 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_46[0][0]']

batch\_normalization\_42 (BatchN (None, 12, 12, 160) 480 ['conv2d\_42[0][0]']

ormalization)

batch\_normalization\_47 (BatchN (None, 12, 12, 160) 480 ['conv2d\_47[0][0]']

ormalization)

activation\_42 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_42[0][0]']

activation\_47 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_47[0][0]']

average\_pooling2d\_4 (AveragePo (None, 12, 12, 768) 0 ['mixed4[0][0]']

oling2D)

conv2d\_40 (Conv2D) (None, 12, 12, 192) 147456 ['mixed4[0][0]']

conv2d\_43 (Conv2D) (None, 12, 12, 192) 215040 ['activation\_42[0][0]']

conv2d\_48 (Conv2D) (None, 12, 12, 192) 215040 ['activation\_47[0][0]']

conv2d\_49 (Conv2D) (None, 12, 12, 192) 147456 ['average\_pooling2d\_4[0][0]']

batch\_normalization\_40 (BatchN (None, 12, 12, 192) 576 ['conv2d\_40[0][0]']

ormalization)

batch\_normalization\_43 (BatchN (None, 12, 12, 192) 576 ['conv2d\_43[0][0]']

ormalization)

batch\_normalization\_48 (BatchN (None, 12, 12, 192) 576 ['conv2d\_48[0][0]']

ormalization)

batch\_normalization\_49 (BatchN (None, 12, 12, 192) 576 ['conv2d\_49[0][0]']

ormalization)

activation\_40 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_40[0][0]']

activation\_43 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_43[0][0]']

activation\_48 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_48[0][0]']

activation\_49 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_49[0][0]']

mixed5 (Concatenate) (None, 12, 12, 768) 0 ['activation\_40[0][0]',

'activation\_43[0][0]',

'activation\_48[0][0]',

'activation\_49[0][0]']

conv2d\_54 (Conv2D) (None, 12, 12, 160) 122880 ['mixed5[0][0]']

batch\_normalization\_54 (BatchN (None, 12, 12, 160) 480 ['conv2d\_54[0][0]']

ormalization)

activation\_54 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_54[0][0]']

conv2d\_55 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_54[0][0]']

batch\_normalization\_55 (BatchN (None, 12, 12, 160) 480 ['conv2d\_55[0][0]']

ormalization)

activation\_55 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_55[0][0]']

conv2d\_51 (Conv2D) (None, 12, 12, 160) 122880 ['mixed5[0][0]']

conv2d\_56 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_55[0][0]']

batch\_normalization\_51 (BatchN (None, 12, 12, 160) 480 ['conv2d\_51[0][0]']

ormalization)

batch\_normalization\_56 (BatchN (None, 12, 12, 160) 480 ['conv2d\_56[0][0]']

ormalization)

activation\_51 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_51[0][0]']

activation\_56 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_56[0][0]']

conv2d\_52 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_51[0][0]']

conv2d\_57 (Conv2D) (None, 12, 12, 160) 179200 ['activation\_56[0][0]']

batch\_normalization\_52 (BatchN (None, 12, 12, 160) 480 ['conv2d\_52[0][0]']

ormalization)

batch\_normalization\_57 (BatchN (None, 12, 12, 160) 480 ['conv2d\_57[0][0]']

ormalization)

activation\_52 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_52[0][0]']

activation\_57 (Activation) (None, 12, 12, 160) 0 ['batch\_normalization\_57[0][0]']

average\_pooling2d\_5 (AveragePo (None, 12, 12, 768) 0 ['mixed5[0][0]']

oling2D)

conv2d\_50 (Conv2D) (None, 12, 12, 192) 147456 ['mixed5[0][0]']

conv2d\_53 (Conv2D) (None, 12, 12, 192) 215040 ['activation\_52[0][0]']

conv2d\_58 (Conv2D) (None, 12, 12, 192) 215040 ['activation\_57[0][0]']

conv2d\_59 (Conv2D) (None, 12, 12, 192) 147456 ['average\_pooling2d\_5[0][0]']

batch\_normalization\_50 (BatchN (None, 12, 12, 192) 576 ['conv2d\_50[0][0]']

ormalization)

batch\_normalization\_53 (BatchN (None, 12, 12, 192) 576 ['conv2d\_53[0][0]']

ormalization)

batch\_normalization\_58 (BatchN (None, 12, 12, 192) 576 ['conv2d\_58[0][0]']

ormalization)

batch\_normalization\_59 (BatchN (None, 12, 12, 192) 576 ['conv2d\_59[0][0]']

ormalization)

activation\_50 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_50[0][0]']

activation\_53 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_53[0][0]']

activation\_58 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_58[0][0]']

activation\_59 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_59[0][0]']

mixed6 (Concatenate) (None, 12, 12, 768) 0 ['activation\_50[0][0]',

'activation\_53[0][0]',

'activation\_58[0][0]',

'activation\_59[0][0]']

conv2d\_64 (Conv2D) (None, 12, 12, 192) 147456 ['mixed6[0][0]']

batch\_normalization\_64 (BatchN (None, 12, 12, 192) 576 ['conv2d\_64[0][0]']

ormalization)

activation\_64 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_64[0][0]']

conv2d\_65 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_64[0][0]']

batch\_normalization\_65 (BatchN (None, 12, 12, 192) 576 ['conv2d\_65[0][0]']

ormalization)

activation\_65 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_65[0][0]']

conv2d\_61 (Conv2D) (None, 12, 12, 192) 147456 ['mixed6[0][0]']

conv2d\_66 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_65[0][0]']

batch\_normalization\_61 (BatchN (None, 12, 12, 192) 576 ['conv2d\_61[0][0]']

ormalization)

batch\_normalization\_66 (BatchN (None, 12, 12, 192) 576 ['conv2d\_66[0][0]']

ormalization)

activation\_61 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_61[0][0]']

activation\_66 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_66[0][0]']

conv2d\_62 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_61[0][0]']

conv2d\_67 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_66[0][0]']

batch\_normalization\_62 (BatchN (None, 12, 12, 192) 576 ['conv2d\_62[0][0]']

ormalization)

batch\_normalization\_67 (BatchN (None, 12, 12, 192) 576 ['conv2d\_67[0][0]']

ormalization)

activation\_62 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_62[0][0]']

activation\_67 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_67[0][0]']

average\_pooling2d\_6 (AveragePo (None, 12, 12, 768) 0 ['mixed6[0][0]']

oling2D)

conv2d\_60 (Conv2D) (None, 12, 12, 192) 147456 ['mixed6[0][0]']

conv2d\_63 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_62[0][0]']

conv2d\_68 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_67[0][0]']

conv2d\_69 (Conv2D) (None, 12, 12, 192) 147456 ['average\_pooling2d\_6[0][0]']

batch\_normalization\_60 (BatchN (None, 12, 12, 192) 576 ['conv2d\_60[0][0]']

ormalization)

batch\_normalization\_63 (BatchN (None, 12, 12, 192) 576 ['conv2d\_63[0][0]']

ormalization)

batch\_normalization\_68 (BatchN (None, 12, 12, 192) 576 ['conv2d\_68[0][0]']

ormalization)

batch\_normalization\_69 (BatchN (None, 12, 12, 192) 576 ['conv2d\_69[0][0]']

ormalization)

activation\_60 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_60[0][0]']

activation\_63 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_63[0][0]']

activation\_68 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_68[0][0]']

activation\_69 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_69[0][0]']

mixed7 (Concatenate) (None, 12, 12, 768) 0 ['activation\_60[0][0]',

'activation\_63[0][0]',

'activation\_68[0][0]',

'activation\_69[0][0]']

conv2d\_72 (Conv2D) (None, 12, 12, 192) 147456 ['mixed7[0][0]']

batch\_normalization\_72 (BatchN (None, 12, 12, 192) 576 ['conv2d\_72[0][0]']

ormalization)

activation\_72 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_72[0][0]']

conv2d\_73 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_72[0][0]']

batch\_normalization\_73 (BatchN (None, 12, 12, 192) 576 ['conv2d\_73[0][0]']

ormalization)

activation\_73 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_73[0][0]']

conv2d\_70 (Conv2D) (None, 12, 12, 192) 147456 ['mixed7[0][0]']

conv2d\_74 (Conv2D) (None, 12, 12, 192) 258048 ['activation\_73[0][0]']

batch\_normalization\_70 (BatchN (None, 12, 12, 192) 576 ['conv2d\_70[0][0]']

ormalization)

batch\_normalization\_74 (BatchN (None, 12, 12, 192) 576 ['conv2d\_74[0][0]']

ormalization)

activation\_70 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_70[0][0]']

activation\_74 (Activation) (None, 12, 12, 192) 0 ['batch\_normalization\_74[0][0]']

conv2d\_71 (Conv2D) (None, 5, 5, 320) 552960 ['activation\_70[0][0]']

conv2d\_75 (Conv2D) (None, 5, 5, 192) 331776 ['activation\_74[0][0]']

batch\_normalization\_71 (BatchN (None, 5, 5, 320) 960 ['conv2d\_71[0][0]']

ormalization)

batch\_normalization\_75 (BatchN (None, 5, 5, 192) 576 ['conv2d\_75[0][0]']

ormalization)

activation\_71 (Activation) (None, 5, 5, 320) 0 ['batch\_normalization\_71[0][0]']

activation\_75 (Activation) (None, 5, 5, 192) 0 ['batch\_normalization\_75[0][0]']

max\_pooling2d\_3 (MaxPooling2D) (None, 5, 5, 768) 0 ['mixed7[0][0]']

mixed8 (Concatenate) (None, 5, 5, 1280) 0 ['activation\_71[0][0]',

'activation\_75[0][0]',

'max\_pooling2d\_3[0][0]']

conv2d\_80 (Conv2D) (None, 5, 5, 448) 573440 ['mixed8[0][0]']

batch\_normalization\_80 (BatchN (None, 5, 5, 448) 1344 ['conv2d\_80[0][0]']

ormalization)

activation\_80 (Activation) (None, 5, 5, 448) 0 ['batch\_normalization\_80[0][0]']

conv2d\_77 (Conv2D) (None, 5, 5, 384) 491520 ['mixed8[0][0]']

conv2d\_81 (Conv2D) (None, 5, 5, 384) 1548288 ['activation\_80[0][0]']

batch\_normalization\_77 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_77[0][0]']

ormalization)

batch\_normalization\_81 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_81[0][0]']

ormalization)

activation\_77 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_77[0][0]']

activation\_81 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_81[0][0]']

conv2d\_78 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_77[0][0]']

conv2d\_79 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_77[0][0]']

conv2d\_82 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_81[0][0]']

conv2d\_83 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_81[0][0]']

average\_pooling2d\_7 (AveragePo (None, 5, 5, 1280) 0 ['mixed8[0][0]']

oling2D)

conv2d\_76 (Conv2D) (None, 5, 5, 320) 409600 ['mixed8[0][0]']

batch\_normalization\_78 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_78[0][0]']

ormalization)

batch\_normalization\_79 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_79[0][0]']

ormalization)

batch\_normalization\_82 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_82[0][0]']

ormalization)

batch\_normalization\_83 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_83[0][0]']

ormalization)

conv2d\_84 (Conv2D) (None, 5, 5, 192) 245760 ['average\_pooling2d\_7[0][0]']

batch\_normalization\_76 (BatchN (None, 5, 5, 320) 960 ['conv2d\_76[0][0]']

ormalization)

activation\_78 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_78[0][0]']

activation\_79 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_79[0][0]']

activation\_82 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_82[0][0]']

activation\_83 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_83[0][0]']

batch\_normalization\_84 (BatchN (None, 5, 5, 192) 576 ['conv2d\_84[0][0]']

ormalization)

activation\_76 (Activation) (None, 5, 5, 320) 0 ['batch\_normalization\_76[0][0]']

mixed9\_0 (Concatenate) (None, 5, 5, 768) 0 ['activation\_78[0][0]',

'activation\_79[0][0]']

concatenate (Concatenate) (None, 5, 5, 768) 0 ['activation\_82[0][0]',

'activation\_83[0][0]']

activation\_84 (Activation) (None, 5, 5, 192) 0 ['batch\_normalization\_84[0][0]']

mixed9 (Concatenate) (None, 5, 5, 2048) 0 ['activation\_76[0][0]',

'mixed9\_0[0][0]',

'concatenate[0][0]',

'activation\_84[0][0]']

conv2d\_89 (Conv2D) (None, 5, 5, 448) 917504 ['mixed9[0][0]']

batch\_normalization\_89 (BatchN (None, 5, 5, 448) 1344 ['conv2d\_89[0][0]']

ormalization)

activation\_89 (Activation) (None, 5, 5, 448) 0 ['batch\_normalization\_89[0][0]']

conv2d\_86 (Conv2D) (None, 5, 5, 384) 786432 ['mixed9[0][0]']

conv2d\_90 (Conv2D) (None, 5, 5, 384) 1548288 ['activation\_89[0][0]']

batch\_normalization\_86 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_86[0][0]']

ormalization)

batch\_normalization\_90 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_90[0][0]']

ormalization)

activation\_86 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_86[0][0]']

activation\_90 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_90[0][0]']

conv2d\_87 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_86[0][0]']

conv2d\_88 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_86[0][0]']

conv2d\_91 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_90[0][0]']

conv2d\_92 (Conv2D) (None, 5, 5, 384) 442368 ['activation\_90[0][0]']

average\_pooling2d\_8 (AveragePo (None, 5, 5, 2048) 0 ['mixed9[0][0]']

oling2D)

conv2d\_85 (Conv2D) (None, 5, 5, 320) 655360 ['mixed9[0][0]']

batch\_normalization\_87 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_87[0][0]']

ormalization)

batch\_normalization\_88 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_88[0][0]']

ormalization)

batch\_normalization\_91 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_91[0][0]']

ormalization)

batch\_normalization\_92 (BatchN (None, 5, 5, 384) 1152 ['conv2d\_92[0][0]']

ormalization)

conv2d\_93 (Conv2D) (None, 5, 5, 192) 393216 ['average\_pooling2d\_8[0][0]']

batch\_normalization\_85 (BatchN (None, 5, 5, 320) 960 ['conv2d\_85[0][0]']

ormalization)

activation\_87 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_87[0][0]']

activation\_88 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_88[0][0]']

activation\_91 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_91[0][0]']

activation\_92 (Activation) (None, 5, 5, 384) 0 ['batch\_normalization\_92[0][0]']

batch\_normalization\_93 (BatchN (None, 5, 5, 192) 576 ['conv2d\_93[0][0]']

ormalization)

activation\_85 (Activation) (None, 5, 5, 320) 0 ['batch\_normalization\_85[0][0]']

mixed9\_1 (Concatenate) (None, 5, 5, 768) 0 ['activation\_87[0][0]',

'activation\_88[0][0]']

concatenate\_1 (Concatenate) (None, 5, 5, 768) 0 ['activation\_91[0][0]',

'activation\_92[0][0]']

activation\_93 (Activation) (None, 5, 5, 192) 0 ['batch\_normalization\_93[0][0]']

mixed10 (Concatenate) (None, 5, 5, 2048) 0 ['activation\_85[0][0]',

'mixed9\_1[0][0]',

'concatenate\_1[0][0]',

'activation\_93[0][0]']

==================================================================================================

Total params: 21,802,784

Trainable params: 0

Non-trainable params: 21,802,784

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from tensorflow.keras.layers import Dense, Conv2D, MaxPooling2D, GlobalAveragePooling2D

base\_model = tf.keras.models.Sequential()

base\_model.add(base\_models)

base\_model.add(GlobalAveragePooling2D())

base\_model.add(Dense(3, activation = 'softmax'))

base\_model.summary()

Model: "sequential"

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Layer (type) Output Shape Param #

=================================================================

inception\_v3 (Functional) (None, 5, 5, 2048) 21802784

global\_average\_pooling2d (G (None, 2048) 0

lobalAveragePooling2D)

dense (Dense) (None, 3) 6147

=================================================================

Total params: 21,808,931

Trainable params: 6,147

Non-trainable params: 21,802,784

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base\_model.compile(optimizer= 'adam' , loss= 'categorical\_crossentropy', metrics=['accuracy'])

history = base\_model.fit(train\_data\_gen, epochs=2,

validation\_data= val\_data\_gen,)

Epoch 1/2

11250/11250 [==============================] - 629s 56ms/step - loss: 0.2446 - accuracy: 0.9183 - val\_loss: 0.2834 - val\_accuracy: 0.9152

Epoch 2/2

11250/11250 [==============================] - 623s 55ms/step - loss: 0.1789 - accuracy: 0.9446 - val\_loss: 0.2470 - val\_accuracy: 0.9387

base\_model.save('lung.h5')

history\_dict = history.history

loss\_values = history\_dict['loss']

val\_loss\_values = history\_dict['val\_loss']

epochs = range(1, len(loss\_values) + 1)

line1 = plt.plot(epochs, val\_loss\_values, label='Validation/Test Loss')

line2 = plt.plot(epochs, loss\_values, label='Training Loss')

plt.setp(line1, linewidth=2.0, marker = '+', markersize=10.0)

plt.setp(line2, linewidth=2.0, marker = '4', markersize=10.0)

plt.xlabel('Epochs')

plt.ylabel('Loss')

plt.grid(True)

plt.legend()

plt.show()

history\_dict = history.history

acc\_values = history\_dict['accuracy']

val\_acc\_values = history\_dict['val\_accuracy']

epochs = range(1, len(loss\_values) + 1)

line1 = plt.plot(epochs, val\_acc\_values, label='Validation/Test Accuracy')

line2 = plt.plot(epochs, acc\_values, label='Training Accuracy')

plt.setp(line1, linewidth=2.0, marker = '+', markersize=10.0)

plt.setp(line2, linewidth=2.0, marker = '4', markersize=10.0)

plt.xlabel('Epochs')

plt.ylabel('Accuracy')

plt.grid(True)

plt.legend()

plt.show()

import numpy as np

y=np.concatenate([val\_data\_gen.next()[1] for i in range(val\_data\_gen.\_\_len\_\_())])

true\_labels=np.argmax(y, axis=-1)

prediction= base\_model.predict(val\_data\_gen, verbose=2)

prediction=np.argmax(prediction, axis=-1)

1875/1875 - 84s - 84s/epoch - 45ms/step

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.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')

from sklearn.metrics import confusion\_matrix

import itertools

import matplotlib.pyplot as plt

cm = confusion\_matrix(y\_true=true\_labels, y\_pred=prediction)

cm\_plot\_labels = ['adenocarcinoma','benign','squamous\_carcinoma']

plot\_confusion\_matrix(cm=cm, classes=cm\_plot\_labels, title='Confusion Matrix')

from sklearn.metrics import accuracy\_score

acc=accuracy\_score(true\_labels,prediction)

print('Accuracy: %.3f' % acc)

from sklearn.metrics import precision\_score

precision = precision\_score(true\_labels,prediction,labels=[1,2], average='micro')

print('Precision: %.3f' % precision)

from sklearn.metrics import recall\_score

recall = recall\_score(true\_labels,prediction, average='micro')

print('Recall: %.3f' % recall)

from sklearn.metrics import f1\_score

score = f1\_score(true\_labels,prediction, average='micro')

print('F-Measure: %.3f' % score)

Confusion matrix, without normalization

[[609 5 11]

[ 2 623 0]

[ 97 0 528]]

Accuracy: 0.939

Precision: 0.986

Recall: 0.939

F-Measure: 0.939