In [265]:

In [4]:

```
!pip install tensorflow==2.2
```

```
Collecting tensorflow==2.2
  Downloading tensorflow-2.2.0-cp38-cp38-win_amd64.whl (459.2 MB)
Requirement already satisfied: numpy<2.0,>=1.16.0 in c:\users\rana\anaconda3\lib\site-packages (from tensor
flow==2.2) (1.23.5)
Requirement already satisfied: opt-einsum>=2.3.2 in c:\users\rana\anaconda3\lib\site-packages (from tensorf
low==2.2) (3.3.0)
Requirement already satisfied: wrapt>=1.11.1 in c:\users\rana\anaconda3\lib\site-packages (from tensorflow=
=2.2) (1.12.1)
Requirement already satisfied: wheel>=0.26 in c:\users\rana\anaconda3\lib\site-packages (from tensorflow==
2.2) (0.36.2)
Requirement already satisfied: absl-py>=0.7.0 in c:\users\rana\anaconda3\lib\site-packages (from tensorflow
==2.2) (1.4.0)
Collecting gast==0.3.3
  Downloading gast-0.3.3-py2.py3-none-any.whl (9.7 kB)
Collecting keras-preprocessing>=1.1.0
  Downloading Keras_Preprocessing-1.1.2-py2.py3-none-any.whl (42 kB)
Requirement already satisfied: protobuf>=3.8.0 in c:\users\rana\anaconda3\lib\site-packages (from tensorflo
w==2.2) (4.22.4)
Collecting scipy==1.4.1
  Downloading scipy-1.4.1-cp38-cp38-win_amd64.whl (31.0 MB)
Requirement already satisfied: termcolor>=1.1.0 in c:\users\rana\anaconda3\lib\site-packages (from tensorfl
ow==2.2) (2.3.0)
Requirement already satisfied: h5py<2.11.0,>=2.10.0 in c:\users\rana\anaconda3\lib\site-packages (from tens
orflow==2.2) (2.10.0)
Requirement already satisfied: six>=1.12.0 in c:\users\rana\anaconda3\lib\site-packages (from tensorflow==
2.2) (1.15.0)
Requirement already satisfied: grpcio>=1.8.6 in c:\users\rana\anaconda3\lib\site-packages (from tensorflow=
=2.2) (1.54.0)
Collecting  tensorflow-estimator<2.3.0,>=2.2.0
  Downloading tensorflow_estimator-2.2.0-py2.py3-none-any.whl (454 kB)
Requirement already satisfied: astunparse==1.6.3 in c:\users\rana\anaconda3\lib\site-packages (from tensorf
low==2.2) (1.6.3)
Requirement already satisfied: google-pasta>=0.1.8 in c:\users\rana\anaconda3\lib\site-packages (from tenso
rflow==2.2) (0.2.0)
Collecting tensorboard<2.3.0,>=2.2.0
  Downloading tensorboard-2.2.2-py3-none-any.whl (3.0 MB)
Requirement already satisfied: requests<3,>=2.21.0 in c:\users\rana\anaconda3\lib\site-packages (from tenso
rboard<2.3.0,>=2.2.0->tensorflow==2.2) (2.25.1)
Collecting  google-auth-oauthlib<0.5,>=0.4.1
  Downloading google_auth_oauthlib-0.4.6-py2.py3-none-any.whl (18 kB)
Requirement already satisfied: markdown>=2.6.8 in c:\users\rana\anaconda3\lib\site-packages (from tensorboa
rd<2.3.0,>=2.2.0->tensorflow==2.2) (3.4.3)
Collecting google-auth<2,>=1.6.3
  Downloading google_auth-1.35.0-py2.py3-none-any.whl (152 kB)
Requirement already satisfied: setuptools>=41.0.0 in c:\users\rana\anaconda3\lib\site-packages (from tensor
board<2.3.0,>=2.2.0->tensorflow==2.2) (52.0.0.post20210125)
Collecting  tensorboard-plugin-wit>=1.6.0
  Downloading tensorboard_plugin_wit-1.8.1-py3-none-any.whl (781 kB)
Requirement already satisfied: werkzeug>=0.11.15 in c:\users\rana\anaconda3\lib\site-packages (from tensorb
oard<2.3.0,>=2.2.0->tensorflow==2.2) (1.0.1)
Requirement already satisfied: pyasn1-modules>=0.2.1 in c:\users\rana\anaconda3\lib\site-packages (from goo
gle-auth<2,>=1.6.3->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (0.3.0)
Collecting cachetools<5.0,>=2.0.0
  Downloading cachetools-4.2.4-py3-none-any.whl (10 kB)
Requirement already satisfied: rsa<5,>=3.1.4 in c:\users\rana\anaconda3\lib\site-packages (from google-auth
<2,>=1.6.3->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2)  (4.9)
Requirement already satisfied: requests-oauthlib>=0.7.0 in c:\users\rana\anaconda3\lib\site-packages (from
google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (1.3.1)
Requirement already satisfied: importlib-metadata>=4.4 in c:\users\rana\anaconda3\lib\site-packages (from m
arkdown>=2.6.8->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (6.6.0)
Requirement already satisfied: zipp>=0.5 in c:\users\rana\anaconda3\lib\site-packages (from importlib-metad
ata>=4.4->markdown>=2.6.8->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (3.4.1)
Requirement already satisfied: pyasn1<0.6.0,>=0.4.6 in c:\users\rana\anaconda3\lib\site-packages (from pyas
n1-modules>=0.2.1->google-auth<2,>=1.6.3->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (0.5.0)
Requirement already satisfied: idna<3,>=2.5 in c:\users\rana\anaconda3\lib\site-packages (from requests<3,>
=2.21.0->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2)  (2.10)
Requirement already satisfied: certifi>=2017.4.17 in c:\users\rana\anaconda3\lib\site-packages (from reques
ts<3,>=2.21.0->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (2020.12.5)
Requirement already satisfied: urllib3<1.27,>=1.21.1 in c:\users\rana\anaconda3\lib\site-packages (from req
uests<3,>=2.21.0->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (1.26.4)
Requirement already satisfied: chardet<5,>=3.0.2 in c:\users\rana\anaconda3\lib\site-packages (from request
s<3,>=2.21.0->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (4.0.0)
Requirement already satisfied: oauthlib>=3.0.0 in c:\users\rana\anaconda3\lib\site-packages (from requests-
oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard<2.3.0,>=2.2.0->tensorflow==2.2) (3.2.2)
Installing collected packages: cachetools, google-auth, tensorboard-plugin-wit, google-auth-oauthlib, tenso
rflow-estimator, tensorboard, scipy, keras-preprocessing, gast, tensorflow
```

In [265]:

```
  Attempting uninstall: cachetools
    Found existing installation: cachetools 5.3.0
    Uninstalling cachetools-5.3.0:
      Successfully uninstalled cachetools-5.3.0
  Attempting uninstall: google-auth
      Found existing installation: google-auth
  2.17.3Uninstalling google-auth-2.17.3:
      Successfully uninstalled google-auth-2.17.3
  Attempting uninstall: google-auth-oauthlib
    Found existing installation: google-auth-oauthlib 1.0.0
    Uninstalling google-auth-oauthlib-1.0.0:
      Successfully uninstalled google-auth-oauthlib-1.0.0
  Attempting uninstall: tensorflow-estimator
    Found existing installation: tensorflow-estimator 2.12.0
    Uninstalling tensorflow-estimator-2.12.0:
      Successfully uninstalled tensorflow-estimator-2.12.0
  Attempting uninstall: tensorboard
    Found existing installation: tensorboard 2.12.3
    Uninstalling tensorboard-2.12.3:
      Successfully uninstalled tensorboard-2.12.3
  Attempting uninstall: scipy
    Found existing installation: scipy 1.10.1
    Uninstalling scipy-1.10.1:
      Successfully uninstalled scipy-1.10.1
ERROR: Could not install packages due to an OSError: [WinError 5] Access is denied: 'C:\\Users\\Rana\\anaco
nda3\\Lib\\site-packages\\~cipy.libs\\libopenblas-802f9ed1179cb9c9b03d67ff79f48187.dll'
Consider using the `--user` option or check the permissions.
```

In [12]:

```
import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
```

resizing and rescaling

In [33]:

```
training_datagenerator=ImageDataGenerator(rescale=1./255,horizontal_flip=True,
    vertical_flip=True,shear_range=0.2,
    zoom_range=0.2,width_shift_range=0.2,
    height_shift_range=0.2,validation_split=0.1)
```

In [34]:

```
batch_size=16
train=training_datagenerator.flow_from_directory(r'D:\UEM\2ndyrsem4\innovative  project\forest_fire\Training  and  Validatio
                                                 ,target_size=(256,  256),color_mode='rgb',
                                                 class_mode='binary',batch_size=batch_size,subset='training')
validation=training_datagenerator.flow_from_directory(r'D:\UEM\2ndyrsem4\innovative  project\forest_fire\Training  and  Vali
                                                 ,target_size=(256,  256),color_mode='rgb',
                                                 class_mode='binary',batch_size=batch_size,subset='validation')
```

```
Found 1650 images belonging to 2 classes.
Found 182 images belonging to 2 classes.
```

CNN model

In [35]:

```
cnn=tf.keras.Sequential()
#layer1
cnn.add(tf.keras.layers.Conv2D(filters=32,kernel_size=3,padding='same',
                               activation='relu',input_shape=[256,256,3]))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2))
#layer2
cnn.add(tf.keras.layers.Conv2D(filters=64,kernel_size=3,padding='same',activation='relu'))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2))
#layer3
cnn.add(tf.keras.layers.Conv2D(filters=124,kernel_size=3,padding='same',activation='relu'))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2))
#layer4
cnn.add(tf.keras.layers.Conv2D(filters=256,kernel_size=3,padding='same',activation='relu'))
cnn.add(tf.keras.layers.MaxPool2D(pool_size=2))
#flatten
cnn.add(tf.keras.layers.Flatten())
#fully connected layer
cnn.add(tf.keras.layers.Dense(units=128,activation='relu'))
#outputlayer
cnn.add(tf.keras.layers.Dense(units=1,activation='sigmoid'))
```

In [265]:

In [36]:

```
cnn.summary()
```

```
Model: "sequential_5"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 conv2d_13 (Conv2D)          (None, 256, 256, 32)      896

 max_pooling2d_13 (MaxPoolin  (None, 128, 128, 32)     0
 g2D)

 conv2d_14 (Conv2D)          (None, 128, 128, 64)      18496

 max_pooling2d_14 (MaxPoolin  (None, 64, 64, 64)       0
 g2D)

 conv2d_15 (Conv2D)          (None, 64, 64, 124)       71548

 max_pooling2d_15 (MaxPoolin  (None, 32, 32, 124)      0
 g2D)

 conv2d_16 (Conv2D)          (None, 32, 32, 256)       285952

 max_pooling2d_16 (MaxPoolin  (None, 16, 16, 256)      0
 g2D)

 flatten_2 (Flatten)         (None, 65536)             0

 dense_4 (Dense)             (None, 128)               8388736

 dense_5 (Dense)             (None, 1)                 129

=================================================================
Total params: 8,765,757
Trainable params: 8,765,757
Non-trainable params: 0
_________________________________________________________________
```

train CNN model

In [41]:

```
checkpoint=tf.keras.callbacks.ModelCheckpoint(r'D:\UEM\2ndyrsem4\innovative project\model\dpmodel.h5',monitor='val_loss',
callbacks=[checkpoint]
```

```
cnn.compile(optimizer='Adam',loss='binary_crossentropy',metrics=['accuracy'])

cnn.fit_generator(train,validation_data=validation,epochs=1,steps_per_epoch=train.samples//batch_size,
                  validation_steps=validation.samples//batch_size,
                  callbacks=callbacks)
```

```
<ipython-input-42-accd0c4b17d9>:3: UserWarning: `Model.fit_generator` is deprecated and will be removed in
a future version. Please use `Model.fit`, which supports generators.
  cnn.fit_generator(train,validation_data=validation,epochs=1,steps_per_epoch=train.samples//batch_size,

103/103 [==============================] - 137s 1s/step - loss: 0.1826 - accuracy: 0.9468 - val_loss: 0.280
9 - val_accuracy: 0.9091
```

Out[42]:

```
<keras.callbacks.History at 0x284c413d040>
```

testing

In [264]:

```
from tensorflow.keras.preprocessing import image
import numpy as np
test_image=image.load_img(r'D:\UEM\2ndyrsem4\innovative project\forest_fire\Testing\fire\abc182.jpg',target_size=(256,256
test_image
```

Out[264]:

In [265]:

```
test_image=image.img_to_array(test_image)
test_image
```

Out[265]:

```
array([[[ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        ...,
        [ 37.,  19.,   7.],
        [ 36.,  18.,   6.],
        [ 36.,  18.,   6.]],

       [[ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        ...,
        [ 37.,  19.,   7.],
        [ 37.,  19.,   7.],
        [ 37.,  19.,   7.]],

       [[ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        [ 35.,  18.,   8.],
        ...,
        [ 37.,  19.,   7.],
        [ 37.,  19.,   7.],
        [ 37.,  19.,   7.]],

       ...,

       [[137.,  63.,   0.],
        [204., 130.,  43.],
        [149.,  74.,   0.],
        ...,
        [  8.,   6.,   9.],
        [  7.,   5.,   8.],
        [  7.,   5.,   8.]],

       [[202., 128.,  19.],
        [255., 188.,  81.],
        [224., 149.,  48.],
        ...,
        [  5.,   3.,   6.],
        [  6.,   4.,   7.],
        [  6.,   4.,   7.]],

       [[216., 141.,  14.],
        [234., 159.,  34.],
        [176.,  99.,   0.],
        ...,
        [  5.,   3.,   6.],
        [  6.,   4.,   7.],
        [  6.,   4.,   7.]]], dtype=float32)
```

In [272]:
```
test_image
```

Out[266]:

```
array([[[0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        ...,
        [0.14509805, 0.07450981, 0.02745098],
        [0.14117648, 0.07058824, 0.02352941],
        [0.14117648, 0.07058824, 0.02352941]],

       [[0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        ...,
        [0.14509805, 0.07450981, 0.02745098],
        [0.14509805, 0.07450981, 0.02745098],
        [0.14509805, 0.07450981, 0.02745098]],

       [[0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        [0.13725491, 0.07058824, 0.03137255],
        ...,
        [0.14509805, 0.07450981, 0.02745098],
        [0.14509805, 0.07450981, 0.02745098],
        [0.14509805, 0.07450981, 0.02745098]],

       ...,

       [[0.5372549 , 0.24705882, 0.        ],
        [0.8       , 0.50980395, 0.16862746],
        [0.58431375, 0.2901961 , 0.        ],
        ...,
        [0.03137255, 0.02352941, 0.03529412],
        [0.02745098, 0.01960784, 0.03137255],
        [0.02745098, 0.01960784, 0.03137255]],

       [[0.7921569 , 0.5019608 , 0.07450981],
        [1.        , 0.7372549 , 0.31764707],
        [0.8784314 , 0.58431375, 0.1882353 ],
        ...,
        [0.01960784, 0.01176471, 0.02352941],
        [0.02352941, 0.01568628, 0.02745098],
        [0.02352941, 0.01568628, 0.02745098]],

       [[0.84705883, 0.5529412 , 0.05490196],
        [0.91764706, 0.62352943, 0.13333334],
        [0.6901961 , 0.3882353 , 0.        ],
        ...,
        [0.01960784, 0.01176471, 0.02352941],
        [0.02352941, 0.01568628, 0.02745098],
        [0.02352941, 0.01568628, 0.02745098]]] dtype=float32)
```

```
test_image=np.expand_dims(test_image,axis=0)
test_image
```

Out[267]:

```
array([[[[0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         ...,
         [0.14509805, 0.07450981, 0.02745098],
         [0.14117648, 0.07058824, 0.02352941],
         [0.14117648, 0.07058824, 0.02352941]],

        [[0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         ...,
         [0.14509805, 0.07450981, 0.02745098],
         [0.14509805, 0.07450981, 0.02745098],
         [0.14509805, 0.07450981, 0.02745098]],

        [[0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         [0.13725491, 0.07058824, 0.03137255],
         ...,
         [0.14509805, 0.07450981, 0.02745098],
         [0.14509805, 0.07450981, 0.02745098],
         [0.14509805, 0.07450981, 0.02745098]],
```

In [272]:

```
        ...,

        [[0.5372549 , 0.24705882, 0.        ],
         [0.8       , 0.50980395, 0.16862746],
         [0.58431375, 0.2901961 , 0.        ],
         ...,
         [0.03137255, 0.02352941, 0.03529412],
         [0.02745098, 0.01960784, 0.03137255],
         [0.02745098, 0.01960784, 0.03137255]],

        [[0.7921569 , 0.5019608 , 0.07450981],
         [1.        , 0.7372549 , 0.31764707],
         [0.8784314 , 0.58431375, 0.1882353 ],
         ...,
         [0.01960784, 0.01176471, 0.02352941],
         [0.02352941, 0.01568628, 0.02745098],
         [0.02352941, 0.01568628, 0.02745098]],

        [[0.84705883, 0.5529412 , 0.05490196],
         [0.91764706, 0.62352943, 0.13333334],
         [0.6901961 , 0.3882353 , 0.        ],
         ...,
         [0.01960784, 0.01176471, 0.02352941],
         [0.02352941, 0.01568628, 0.02745098],
         [0.02352941, 0.01568628, 0.02745098]]]], dtype=float32)
```

In [268]:

```
#result=cnn.predict(test_image)
#result
```

In [269]:

```
#result=np.argmax(cnn.predict(test_image),   axis=-1)
```

In [270]:

```
result=(cnn.predict(test_image) > 0.5).astype("int32")
```

```
1/1 [==============================] - 0s 33ms/step
```

In [271]:

```
result[0]
```

Out[271]:

```
array([0])
```

```
if result[0]==0:
    print("fire")
else:
    print("no fire")
```

```
fire
```

In [ ]: