

In [47]:

```
pip install tensorflow-gpu
```

```
Requirement already satisfied: tensorflow-gpu in d:\anaconda\lib\site-packages (2.7.0)
te: you may need to restart the kernel to use updated packages.
Requirement already satisfied: typing-extensions>=3.6.6 in d:\anaconda\lib\site-packages
(from tensorflow-gpu) (3.7.4.3)
Requirement already satisfied: wheel<1.0,>=0.32.0 in d:\anaconda\lib\site-packages (from
tensorflow-gpu) (0.36.2)
Requirement already satisfied: wrapt>=1.11.0 in d:\anaconda\lib\site-packages (from tens
orflow-gpu) (1.12.1)
Requirement already satisfied: protobuf>=3.9.2 in d:\anaconda\lib\site-packages (from te
nsorflow-gpu) (3.19.1)
Requirement already satisfied: tensorboard~=2.6 in d:\anaconda\lib\site-packages (from t
ensorflow-gpu) (2.7.0)

Requirement already satisfied: six>=1.12.0 in d:\anaconda\lib\site-packages (from tensor
flow-gpu) (1.15.0)
Requirement already satisfied: grpcio<2.0,>=1.24.3 in d:\anaconda\lib\site-packages (fro
m tensorflow-gpu) (1.41.1)
Requirement already satisfied: tensorflow-estimator<2.8,~=2.7.0rc0 in d:\anaconda\lib\si
te-packages (from tensorflow-gpu) (2.7.0)
Requirement already satisfied: termcolor>=1.1.0 in d:\anaconda\lib\site-packages (from t
ensorflow-gpu) (1.1.0)
Requirement already satisfied: h5py>=2.9.0 in d:\anaconda\lib\site-packages (from tensor
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Requirement already satisfied: numpy>=1.14.5 in d:\anaconda\lib\site-packages (from tens
orflow-gpu) (1.20.1)
Requirement already satisfied: absl-py>=0.4.0 in d:\anaconda\lib\site-packages (from ten
sorflow-gpu) (1.0.0)
Requirement already satisfied: gast<0.5.0,>=0.2.1 in d:\anaconda\lib\site-packages (from
tensorflow-gpu) (0.4.0)
Requirement already satisfied: libclang>=9.0.1 in d:\anaconda\lib\site-packages (from te
nsorflow-gpu) (12.0.0)
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.21.0 in d:\anaconda\lib\s
ite-packages (from tensorflow-gpu) (0.22.0)
Requirement already satisfied: opt-einsum>=2.3.2 in d:\anaconda\lib\site-packages (from
tensorflow-gpu) (3.3.0)
Requirement already satisfied: flatbuffers<3.0,>=1.12 in d:\anaconda\lib\site-packages
(from tensorflow-gpu) (2.0)
Requirement already satisfied: keras<2.8,>=2.7.0rc0 in d:\anaconda\lib\site-packages (fr
om tensorflow-gpu) (2.7.0)
Requirement already satisfied: google-pasta>=0.1.1 in d:\anaconda\lib\site-packages (fro
m tensorflow-gpu) (0.2.0)
Requirement already satisfied: keras-preprocessing>=1.1.1 in d:\anaconda\lib\site-packag
es (from tensorflow-gpu) (1.1.2)
Requirement already satisfied: astunparse>=1.6.0 in d:\anaconda\lib\site-packages (from
tensorflow-gpu) (1.6.3)
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in d:\anaconda\lib
\site-packages (from tensorboard~=2.6->tensorflow-gpu) (0.6.1)
Requirement already satisfied: setuptools>=41.0.0 in d:\anaconda\lib\site-packages (from
tensorboard~=2.6->tensorflow-gpu) (52.0.0.post20210125)
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in d:\anaconda\lib\site-
packages (from tensorboard~=2.6->tensorflow-gpu) (0.4.6)
Requirement already satisfied: werkzeug>=0.11.15 in d:\anaconda\lib\site-packages (from
tensorboard~=2.6->tensorflow-gpu) (1.0.1)
Requirement already satisfied: markdown>=2.6.8 in d:\anaconda\lib\site-packages (from te
nsorboard~=2.6->tensorflow-gpu) (3.3.4)
Requirement already satisfied: google-auth<3,>=1.6.3 in d:\anaconda\lib\site-packages (f
rom tensorboard~=2.6->tensorflow-gpu) (2.3.3)
Requirement already satisfied: requests<3,>=2.21.0 in d:\anaconda\lib\site-packages (fro
m tensorboard~=2.6->tensorflow-gpu) (2.25.1)
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in d:\anaconda\lib\site-pac
kages (from tensorboard~=2.6->tensorflow-gpu) (1.8.0)
```

Requirement already satisfied: rsa<5,>=3.1.4 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow-gpu) (4.7.2)  
 Requirement already satisfied: cachetools<5.0,>=2.0.0 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow-gpu) (4.2.4)  
 Requirement already satisfied: pyasn1-modules>=0.2.1 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow-gpu) (0.2.8)  
 Requirement already satisfied: requests-oauthlib>=0.7.0 in d:\anaconda\lib\site-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.6->tensorflow-gpu) (1.3.0)  
 Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in d:\anaconda\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow-gpu) (0.4.8)  
 Requirement already satisfied: chardet<5,>=3.0.2 in d:\anaconda\lib\site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow-gpu) (4.0.0)  
 Requirement already satisfied: idna<3,>=2.5 in d:\anaconda\lib\site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow-gpu) (2.10)  
 Requirement already satisfied: certifi>=2017.4.17 in d:\anaconda\lib\site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow-gpu) (2021.10.8)  
 Requirement already satisfied: urllib3<1.27,>=1.21.1 in d:\anaconda\lib\site-packages (from requests<3,>=2.21.0->tensorboard~=2.6->tensorflow-gpu) (1.26.4)  
 Requirement already satisfied: oauthlib>=3.0.0 in d:\anaconda\lib\site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.6->tensorflow-gpu) (3.1.1)

In [48]: `pip install opencv-python`

Requirement already satisfied: opencv-python in d:\anaconda\lib\site-packages (4.5.4.6)  
 Requirement already satisfied: numpy>=1.17.3 in d:\anaconda\lib\site-packages (from opencv-python) (1.20.1)  
 Note: you may need to restart the kernel to use updated packages.

In [1]: `import tensorflow as tf  
import cv2  
import os  
import matplotlib.pyplot as plt  
import numpy as np`

In [2]: `img_array = cv2.imread("D:/Project/final/trainn/0/WIN_20220128_16_01_14_Pro.jpg")`

In [3]: `img_array.shape # rgb image becoz this has 3 chnnels`

Out[3]: (720, 1280, 3)

In [4]: `print(img_array)`

```
[[[172 181 195]
  [169 178 192]
  [169 177 190]
  ...
  [190 190 202]
  [194 194 206]
  [197 197 209]]

 [[172 179 194]
  [170 178 191]
  [174 180 193]
  ...
  [193 193 205]]
```

```

[194 194 206]
[193 193 205]]

[[183 189 202]
 [181 187 200]
 [183 186 200]
 ...
 [196 196 210]
 [193 194 208]
 [189 190 204]]

...

[[122 115 118]
 [128 122 123]
 [127 122 124]
 ...
 [ 47  42  43]
 [ 45  40  41]
 [ 42  37  38]]

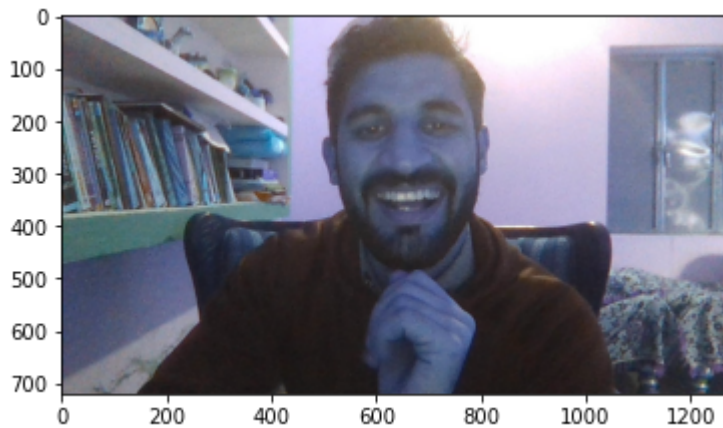
[[125 119 120]
 [126 121 120]
 [126 121 122]
 ...
 [ 49  44  45]
 [ 50  46  45]
 [ 48  44  43]]

[[126 121 120]
 [123 118 117]
 [128 124 123]
 ...
 [ 51  46  47]
 [ 55  51  50]
 [ 55  51  50]]]

```

```
In [5]: plt.imshow(img_array) #BGR
```

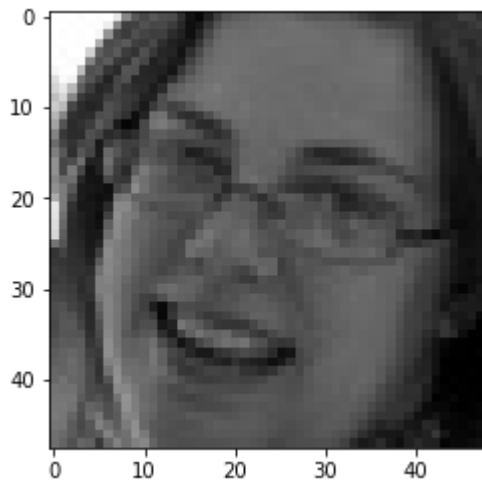
```
Out[5]: <matplotlib.image.AxesImage at 0x1b9ae3e65e0>
```



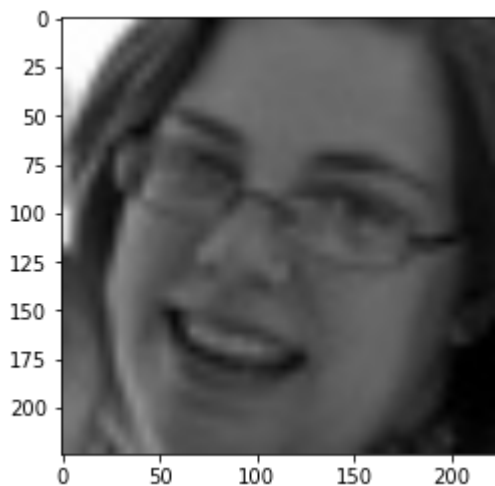
```
In [6]: DataDirectory = "D:/Project/final/train/" #Training DataSet
```

```
In [7]: classes = ['0','1'] #List of classes ==> this must be exact name of your folders under t
```

```
In [8]: for category in classes:
        path = os.path.join(DataDirectory, category) #//
        for img in os.listdir(path):
            img_array = cv2.imread(os.path.join(path , img))
            #backtorgb = (cv2.cvtColor(img_array, cv2.COLOR_BGR2RGB))
            plt.imshow(cv2.cvtColor(img_array , cv2.COLOR_BGR2RGB))
            plt.show()
            break
        break
```



```
In [9]: img_size = 224 #==>224 * 224
        new_array = cv2.resize(img_array , (img_size , img_size))
        plt.imshow(cv2.cvtColor(new_array , cv2.COLOR_BGR2RGB))
        plt.show()
```



```
In [10]: new_array.shape
```

```
Out[10]: (224, 224, 3)
```

```
In [11]: training_data = [] #data array
```

```
def create_training_data():
    for category in classes:
        path = os.path.join(DataDirectory , category)
        class_num = classes.index(category)
        for img in os.listdir(path):
            try:
                img_array = cv2.imread(os.path.join(path , img))
                new_array = cv2.resize(img_array , (img_size , img_size))
                training_data.append([new_array , class_num])
            except Exception as e:
                pass
```

In [12]: `create_training_data()`

In [13]: `print(len(training_data))`

2000

In [14]: `import random`  
`random.shuffle(training_data)`

In [15]: `x = [] #data / feature`  
`y = [] #Label`  
  
`for features,label in training_data:`  
 `x.append(features)`  
 `y.append(label)`  
  
`x = np.array(x).reshape(-1, img_size, img_size, 3) #converting it into 4 dimensions`

In [16]: `x.shape`

Out[16]: (2000, 224, 224, 3)

In [ ]:

In [17]: `#Normalize the data`  
`x = x/255.0; #we are normlizing it`

In [18]: `type(y)`

Out[18]: list

In [19]: `y[0] ## 000000000 000000010 00000100 ONE HOT ENCODING`

Out[19]: 0

```
In [20]: y = np.array(y)
```

```
In [21]: y.shape
```

```
Out[21]: (2000,)
```

```
In [22]: import tensorflow as tf
from tensorflow import keras
from tensorflow.keras import layers
```

```
In [23]: model = tf.keras.applications.MobileNetV2()
```

```
In [24]: model.summary()
```

Model: "mobilenetv2\_1.00\_224"

| Layer (type)                                    | Output Shape          | Param # | Connected to                         |
|---|-----------------------|---------|--------------------------------------|
| =====   |                       |         |                                      |
| input_1 (InputLayer)                            | [(None, 224, 224, 3)] | 0       | []                                   |
| Conv1 (Conv2D)                                  | (None, 112, 112, 32)  | 864     | ['input_1[0][0]']                    |
| bn_Conv1 (BatchNormalization)                   | (None, 112, 112, 32)  | 128     | ['Conv1[0][0]']                      |
| Conv1_relu (ReLU)                               | (None, 112, 112, 32)  | 0       | ['bn_Conv1[0][0]']                   |
| expanded_conv_depthwise (DepthwiseConv2D)       | (None, 112, 112, 32)  | 288     | ['Conv1_relu[0][0]']                 |
| expanded_conv_depthwise_BN (BatchNormalization) | (None, 112, 112, 32)  | 128     | ['expanded_conv_depthwise[0][0]']    |
| expanded_conv_depthwise_relu (ReLU)             | (None, 112, 112, 32)  | 0       | ['expanded_conv_depthwise_BN[0][0]'] |
| expanded_conv_project (Conv2D)                  | (None, 112, 112, 16)  | 512     | ['expanded_conv_depthwise_relu[0]']  |
| expanded_conv_project_BN (BatchNormalization)   | (None, 112, 112, 16)  | 64      | ['expanded_conv_project[0][0]']      |
| block_1_expand (Conv2D)                         | (None, 112, 112, 96)  | 1536    | ['expanded_conv_project_BN[0][0]']   |
| block_1_expand_BN (BatchNormalization)          | (None, 112, 112, 96)  | 384     | ['block_1_expand[0]']                |

|   |                            |   |
|---|----------------------------|---|
| [0]']<br>ization)                             | )                          |   |
| block_1_expand_relu (ReLU)<br>[0]']           | (None, 112, 112, 96 0<br>) | ['block_1_expand_BN[0]                                |
| block_1_pad (ZeroPadding2D)<br>[0][0]']       | (None, 113, 113, 96 0<br>) | ['block_1_expand_relu                                 |
| block_1_depthwise (DepthwiseCo<br>nv2D)       | (None, 56, 56, 96) 864     | ['block_1_pad[0][0]']                                 |
| block_1_depthwise_BN (BatchNor<br>malization) | (None, 56, 56, 96) 384     | ['block_1_depthwise[0]                                |
| block_1_depthwise_relu (ReLU)<br>[0][0]']     | (None, 56, 56, 96) 0       | ['block_1_depthwise_BN                                |
| block_1_project (Conv2D)<br>u[0][0]']         | (None, 56, 56, 24) 2304    | ['block_1_depthwise_relu                              |
| block_1_project_BN (BatchNorma<br>lization)   | (None, 56, 56, 24) 96      | ['block_1_project[0]                                  |
| block_2_expand (Conv2D)<br>[0]']              | (None, 56, 56, 144) 3456   | ['block_1_project_BN[0]                               |
| block_2_expand_BN (BatchNormal<br>ization)    | (None, 56, 56, 144) 576    | ['block_2_expand[0]                                   |
| block_2_expand_relu (ReLU)<br>[0]']           | (None, 56, 56, 144) 0      | ['block_2_expand_BN[0]                                |
| block_2_depthwise (DepthwiseCo<br>nv2D)       | (None, 56, 56, 144) 1296   | ['block_2_expand_relu                                 |
| block_2_depthwise_BN (BatchNor<br>malization) | (None, 56, 56, 144) 576    | ['block_2_depthwise[0]                                |
| block_2_depthwise_relu (ReLU)<br>[0][0]']     | (None, 56, 56, 144) 0      | ['block_2_depthwise_BN                                |
| block_2_project (Conv2D)<br>u[0][0]']         | (None, 56, 56, 24) 3456    | ['block_2_depthwise_relu                              |
| block_2_project_BN (BatchNorma<br>lization)   | (None, 56, 56, 24) 96      | ['block_2_project[0]                                  |
| block_2_add (Add)<br>[0]',<br>[0]']           | (None, 56, 56, 24) 0       | ['block_1_project_BN[0]<br><br>'block_2_project_BN[0] |
| block_3_expand (Conv2D)                       | (None, 56, 56, 144) 3456   | ['block_2_add[0][0]']                                 |
| block_3_expand_BN (BatchNormal<br>[0]']       | (None, 56, 56, 144) 576    | ['block_3_expand[0]                                   |

```

ization)

block_3_expand_relu (ReLU)      (None, 56, 56, 144)  0      ['block_3_expand_BN[0]
[0]']

block_3_pad (ZeroPadding2D)     (None, 57, 57, 144)  0      ['block_3_expand_relu
[0][0]']

block_3_depthwise (DepthwiseCo (None, 28, 28, 144) 1296    ['block_3_pad[0][0]']
nv2D)

block_3_depthwise_BN (BatchNor (None, 28, 28, 144) 576      ['block_3_depthwise[0]
[0]']
malization)

block_3_depthwise_relu (ReLU)   (None, 28, 28, 144)  0      ['block_3_depthwise_BN
[0][0]']

block_3_project (Conv2D)        (None, 28, 28, 32)   4608    ['block_3_depthwise_rel
u[0][0]']

block_3_project_BN (BatchNorma (None, 28, 28, 32) 128      ['block_3_project[0]
[0]']
lization)

block_4_expand (Conv2D)         (None, 28, 28, 192) 6144    ['block_3_project_BN[0]
[0]']

block_4_expand_BN (BatchNormal (None, 28, 28, 192) 768      ['block_4_expand[0]
[0]']
ization)

block_4_expand_relu (ReLU)      (None, 28, 28, 192)  0      ['block_4_expand_BN[0]
[0]']

block_4_depthwise (DepthwiseCo (None, 28, 28, 192) 1728    ['block_4_expand_relu
[0][0]']
nv2D)

block_4_depthwise_BN (BatchNor (None, 28, 28, 192) 768      ['block_4_depthwise[0]
[0]']
malization)

block_4_depthwise_relu (ReLU)   (None, 28, 28, 192)  0      ['block_4_depthwise_BN
[0][0]']

block_4_project (Conv2D)        (None, 28, 28, 32)   6144    ['block_4_depthwise_rel
u[0][0]']

block_4_project_BN (BatchNorma (None, 28, 28, 32) 128      ['block_4_project[0]
[0]']
lization)

block_4_add (Add)               (None, 28, 28, 32)   0      ['block_3_project_BN[0]
[0]',
'block_4_project_BN[0]
[0]']

block_5_expand (Conv2D)         (None, 28, 28, 192) 6144    ['block_4_add[0][0]']

block_5_expand_BN (BatchNormal (None, 28, 28, 192) 768      ['block_5_expand[0]
[0]']
ization)

block_5_expand_relu (ReLU)      (None, 28, 28, 192)  0      ['block_5_expand_BN[0]

```



|                                |                     |       |  |                          |  |
|--------------------------------|---------------------|-------|--|--------------------------|--|
| [0]']                          |                     |       |  |                          |  |
| block_5_depthwise (DepthwiseCo | (None, 28, 28, 192) | 1728  |  | ['block_5_expand_relu    |  |
| [0][0]']                       |                     |       |  |                          |  |
| nv2D)                          |                     |       |  |                          |  |
| block_5_depthwise_BN (BatchNor | (None, 28, 28, 192) | 768   |  | ['block_5_depthwise[0]   |  |
| [0]']                          |                     |       |  |                          |  |
| malization)                    |                     |       |  |                          |  |
| block_5_depthwise_relu (ReLU)  | (None, 28, 28, 192) | 0     |  | ['block_5_depthwise_BN   |  |
| [0][0]']                       |                     |       |  |                          |  |
| block_5_project (Conv2D)       | (None, 28, 28, 32)  | 6144  |  | ['block_5_depthwise_relu |  |
| u[0][0]']                      |                     |       |  |                          |  |
| block_5_project_BN (BatchNorma | (None, 28, 28, 32)  | 128   |  | ['block_5_project[0]     |  |
| [0]']                          |                     |       |  |                          |  |
| lization)                      |                     |       |  |                          |  |
| block_5_add (Add)              | (None, 28, 28, 32)  | 0     |  | ['block_4_add[0][0]',    |  |
|                                |                     |       |  | 'block_5_project_BN[0]   |  |
| [0]']                          |                     |       |  |                          |  |
| block_6_expand (Conv2D)        | (None, 28, 28, 192) | 6144  |  | ['block_5_add[0][0]']    |  |
|                                |                     |       |  |                          |  |
| block_6_expand_BN (BatchNormal | (None, 28, 28, 192) | 768   |  | ['block_6_expand[0]      |  |
| [0]']                          |                     |       |  |                          |  |
| ization)                       |                     |       |  |                          |  |
| block_6_expand_relu (ReLU)     | (None, 28, 28, 192) | 0     |  | ['block_6_expand_BN[0]   |  |
| [0]']                          |                     |       |  |                          |  |
| block_6_pad (ZeroPadding2D)    | (None, 29, 29, 192) | 0     |  | ['block_6_expand_relu    |  |
| [0][0]']                       |                     |       |  |                          |  |
| block_6_depthwise (DepthwiseCo | (None, 14, 14, 192) | 1728  |  | ['block_6_pad[0][0]']    |  |
| nv2D)                          |                     |       |  |                          |  |
| block_6_depthwise_BN (BatchNor | (None, 14, 14, 192) | 768   |  | ['block_6_depthwise[0]   |  |
| [0]']                          |                     |       |  |                          |  |
| malization)                    |                     |       |  |                          |  |
| block_6_depthwise_relu (ReLU)  | (None, 14, 14, 192) | 0     |  | ['block_6_depthwise_BN   |  |
| [0][0]']                       |                     |       |  |                          |  |
| block_6_project (Conv2D)       | (None, 14, 14, 64)  | 12288 |  | ['block_6_depthwise_relu |  |
| u[0][0]']                      |                     |       |  |                          |  |
| block_6_project_BN (BatchNorma | (None, 14, 14, 64)  | 256   |  | ['block_6_project[0]     |  |
| [0]']                          |                     |       |  |                          |  |
| lization)                      |                     |       |  |                          |  |
| block_7_expand (Conv2D)        | (None, 14, 14, 384) | 24576 |  | ['block_6_project_BN[0]  |  |
| [0]']                          |                     |       |  |                          |  |
| block_7_expand_BN (BatchNormal | (None, 14, 14, 384) | 1536  |  | ['block_7_expand[0]      |  |
| [0]']                          |                     |       |  |                          |  |
| ization)                       |                     |       |  |                          |  |
| block_7_expand_relu (ReLU)     | (None, 14, 14, 384) | 0     |  | ['block_7_expand_BN[0]   |  |
| [0]']                          |                     |       |  |                          |  |
| block_7_depthwise (DepthwiseCo | (None, 14, 14, 384) | 3456  |  | ['block_7_expand_relu    |  |
| [0][0]']                       |                     |       |  |                          |  |

|   |                     |       |  |
|---|---------------------|-------|--|
| nv2D)                                     |                     |       |  |
| block_7_depthwise_BN (BatchNormalization) | (None, 14, 14, 384) | 1536  | ['block_7_depthwise[0][0]']                              |
| block_7_depthwise_relu (ReLU)             | (None, 14, 14, 384) | 0     | ['block_7_depthwise_BN[0][0]']                           |
| block_7_project (Conv2D)                  | (None, 14, 14, 64)  | 24576 | ['block_7_depthwise_relu[0][0]']                         |
| block_7_project_BN (BatchNormalization)   | (None, 14, 14, 64)  | 256   | ['block_7_project[0][0]']                                |
| block_7_add (Add)                         | (None, 14, 14, 64)  | 0     | ['block_6_project_BN[0][0]', 'block_7_project_BN[0][0]'] |
| block_8_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_7_add[0][0]']                                    |
| block_8_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_8_expand[0][0]']                                 |
| block_8_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_8_expand_BN[0][0]']                              |
| block_8_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_8_expand_relu[0][0]']                            |
| block_8_depthwise_BN (BatchNormalization) | (None, 14, 14, 384) | 1536  | ['block_8_depthwise[0][0]']                              |
| block_8_depthwise_relu (ReLU)             | (None, 14, 14, 384) | 0     | ['block_8_depthwise_BN[0][0]']                           |
| block_8_project (Conv2D)                  | (None, 14, 14, 64)  | 24576 | ['block_8_depthwise_relu[0][0]']                         |
| block_8_project_BN (BatchNormalization)   | (None, 14, 14, 64)  | 256   | ['block_8_project[0][0]']                                |
| block_8_add (Add)                         | (None, 14, 14, 64)  | 0     | ['block_7_add[0][0]', 'block_8_project_BN[0][0]']        |
| block_9_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_8_add[0][0]']                                    |
| block_9_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_9_expand[0][0]']                                 |
| block_9_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_9_expand_BN[0][0]']                              |
| block_9_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_9_expand_relu[0][0]']                            |

|  |                     |       |   |
|--|---------------------|-------|---|
| block_9_depthwise_BN (BatchNormalization)  | (None, 14, 14, 384) | 1536  | ['block_9_depthwise[0][0]']                       |
| block_9_depthwise_relu (ReLU)              | (None, 14, 14, 384) | 0     | ['block_9_depthwise_BN[0][0]']                    |
| block_9_project (Conv2D)                   | (None, 14, 14, 64)  | 24576 | ['block_9_depthwise_relu[0][0]']                  |
| block_9_project_BN (BatchNormalization)    | (None, 14, 14, 64)  | 256   | ['block_9_project[0][0]']                         |
| block_9_add (Add)                          | (None, 14, 14, 64)  | 0     | ['block_8_add[0][0]', 'block_9_project_BN[0][0]'] |
| block_10_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_9_add[0][0]']                             |
| block_10_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_10_expand[0][0]']                         |
| block_10_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_10_expand_BN[0][0]']                      |
| block_10_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_10_expand_relu[0][0]']                    |
| block_10_depthwise_BN (BatchNormalization) | (None, 14, 14, 384) | 1536  | ['block_10_depthwise[0][0]']                      |
| block_10_depthwise_relu (ReLU)             | (None, 14, 14, 384) | 0     | ['block_10_depthwise_BN[0][0]']                   |
| block_10_project (Conv2D)                  | (None, 14, 14, 96)  | 36864 | ['block_10_depthwise_relu[0][0]']                 |
| block_10_project_BN (BatchNormalization)   | (None, 14, 14, 96)  | 384   | ['block_10_project[0][0]']                        |
| block_11_expand (Conv2D)                   | (None, 14, 14, 576) | 55296 | ['block_10_project_BN[0][0]']                     |
| block_11_expand_BN (BatchNormalization)    | (None, 14, 14, 576) | 2304  | ['block_11_expand[0][0]']                         |
| block_11_expand_relu (ReLU)                | (None, 14, 14, 576) | 0     | ['block_11_expand_BN[0][0]']                      |
| block_11_depthwise (DepthwiseConv2D)       | (None, 14, 14, 576) | 5184  | ['block_11_expand_relu[0][0]']                    |
| block_11_depthwise_BN (BatchNormalization) | (None, 14, 14, 576) | 2304  | ['block_11_depthwise[0][0]']                      |
| block_11_depthwise_relu (ReLU)             | (None, 14, 14, 576) | 0     | ['block_11_depthwise_BN[0][0]']                   |

|  |                     |       |  |
|--|---------------------|-------|--|
| block_11_project (Conv2D)                  | (None, 14, 14, 96)  | 55296 | ['block_11_depthwise_relu[0][0]']                          |
| block_11_project_BN (BatchNormalization)   | (None, 14, 14, 96)  | 384   | ['block_11_project[0][0]']                                 |
| block_11_add (Add)                         | (None, 14, 14, 96)  | 0     | ['block_10_project_BN[0][0]', 'block_11_project_BN[0][0]'] |
| block_12_expand (Conv2D)                   | (None, 14, 14, 576) | 55296 | ['block_11_add[0][0]']                                     |
| block_12_expand_BN (BatchNormalization)    | (None, 14, 14, 576) | 2304  | ['block_12_expand[0][0]']                                  |
| block_12_expand_relu (ReLU)                | (None, 14, 14, 576) | 0     | ['block_12_expand_BN[0][0]']                               |
| block_12_depthwise (DepthwiseConv2D)       | (None, 14, 14, 576) | 5184  | ['block_12_expand_relu[0][0]']                             |
| block_12_depthwise_BN (BatchNormalization) | (None, 14, 14, 576) | 2304  | ['block_12_depthwise[0][0]']                               |
| block_12_depthwise_relu (ReLU)             | (None, 14, 14, 576) | 0     | ['block_12_depthwise_BN[0][0]']                            |
| block_12_project (Conv2D)                  | (None, 14, 14, 96)  | 55296 | ['block_12_depthwise_relu[0][0]']                          |
| block_12_project_BN (BatchNormalization)   | (None, 14, 14, 96)  | 384   | ['block_12_project[0][0]']                                 |
| block_12_add (Add)                         | (None, 14, 14, 96)  | 0     | ['block_11_add[0][0]', 'block_12_project_BN[0][0]']        |
| block_13_expand (Conv2D)                   | (None, 14, 14, 576) | 55296 | ['block_12_add[0][0]']                                     |
| block_13_expand_BN (BatchNormalization)    | (None, 14, 14, 576) | 2304  | ['block_13_expand[0][0]']                                  |
| block_13_expand_relu (ReLU)                | (None, 14, 14, 576) | 0     | ['block_13_expand_BN[0][0]']                               |
| block_13_pad (ZeroPadding2D)               | (None, 15, 15, 576) | 0     | ['block_13_expand_relu[0][0]']                             |
| block_13_depthwise (DepthwiseConv2D)       | (None, 7, 7, 576)   | 5184  | ['block_13_pad[0][0]']                                     |
| block_13_depthwise_BN (BatchNormalization) | (None, 7, 7, 576)   | 2304  | ['block_13_depthwise[0][0]']                               |
| block_13_depthwise_relu (ReLU)             | (None, 7, 7, 576)   | 0     | ['block_13_depthwise_BN[0][0]']                            |

|  |                   |        |  |
|--|-------------------|--------|--|
| block_13_project (Conv2D)                  | (None, 7, 7, 160) | 92160  | ['block_13_depthwise_relu[0][0]']                          |
| block_13_project_BN (BatchNormalization)   | (None, 7, 7, 160) | 640    | ['block_13_project[0][0]']                                 |
| block_14_expand (Conv2D)                   | (None, 7, 7, 960) | 153600 | ['block_13_project_BN[0][0]']                              |
| block_14_expand_BN (BatchNormalization)    | (None, 7, 7, 960) | 3840   | ['block_14_expand[0][0]']                                  |
| block_14_expand_relu (ReLU)                | (None, 7, 7, 960) | 0      | ['block_14_expand_BN[0][0]']                               |
| block_14_depthwise (DepthwiseConv2D)       | (None, 7, 7, 960) | 8640   | ['block_14_expand_relu[0][0]']                             |
| block_14_depthwise_BN (BatchNormalization) | (None, 7, 7, 960) | 3840   | ['block_14_depthwise[0][0]']                               |
| block_14_depthwise_relu (ReLU)             | (None, 7, 7, 960) | 0      | ['block_14_depthwise_BN[0][0]']                            |
| block_14_project (Conv2D)                  | (None, 7, 7, 160) | 153600 | ['block_14_depthwise_relu[0][0]']                          |
| block_14_project_BN (BatchNormalization)   | (None, 7, 7, 160) | 640    | ['block_14_project[0][0]']                                 |
| block_14_add (Add)                         | (None, 7, 7, 160) | 0      | ['block_13_project_BN[0][0]', 'block_14_project_BN[0][0]'] |
| block_15_expand (Conv2D)                   | (None, 7, 7, 960) | 153600 | ['block_14_add[0][0]']                                     |
| block_15_expand_BN (BatchNormalization)    | (None, 7, 7, 960) | 3840   | ['block_15_expand[0][0]']                                  |
| block_15_expand_relu (ReLU)                | (None, 7, 7, 960) | 0      | ['block_15_expand_BN[0][0]']                               |
| block_15_depthwise (DepthwiseConv2D)       | (None, 7, 7, 960) | 8640   | ['block_15_expand_relu[0][0]']                             |
| block_15_depthwise_BN (BatchNormalization) | (None, 7, 7, 960) | 3840   | ['block_15_depthwise[0][0]']                               |
| block_15_depthwise_relu (ReLU)             | (None, 7, 7, 960) | 0      | ['block_15_depthwise_BN[0][0]']                            |
| block_15_project (Conv2D)                  | (None, 7, 7, 160) | 153600 | ['block_15_depthwise_relu[0][0]']                          |
| block_15_project_BN (BatchNormalization)   | (None, 7, 7, 160) | 640    | ['block_15_project[0][0]']                                 |

```

[0]']
alization)

block_15_add (Add)          (None, 7, 7, 160)    0      ['block_14_add[0][0]',
                                         'block_15_project_BN
[0][0]']

block_16_expand (Conv2D)    (None, 7, 7, 960)    153600  ['block_15_add[0][0]']

block_16_expand_BN (BatchNorma (None, 7, 7, 960)    3840    ['block_16_expand[0]
[0]']
alization)

block_16_expand_relu (ReLU)  (None, 7, 7, 960)    0      ['block_16_expand_BN[0]
[0]']

block_16_depthwise (DepthwiseC (None, 7, 7, 960)    8640    ['block_16_expand_relu
[0][0]']
onv2D)

block_16_depthwise_BN (BatchNo (None, 7, 7, 960)    3840    ['block_16_depthwise[0]
[0]']
rmalization)

block_16_depthwise_relu (ReLU) (None, 7, 7, 960)    0      ['block_16_depthwise_BN
[0][0]']

block_16_project (Conv2D)    (None, 7, 7, 320)    307200  ['block_16_depthwise_re
lu[0][0]']

block_16_project_BN (BatchNorm (None, 7, 7, 320)    1280    ['block_16_project[0]
[0]']
alization)

Conv_1 (Conv2D)              (None, 7, 7, 1280)    409600  ['block_16_project_BN
[0][0]']

Conv_1_bn (BatchNormalization) (None, 7, 7, 1280)    5120    ['Conv_1[0][0]']

out_relu (ReLU)              (None, 7, 7, 1280)    0      ['Conv_1_bn[0][0]']

global_average_pooling2d (Glob (None, 1280)          0      ['out_relu[0][0]']
alAveragePooling2D)

predictions (Dense)          (None, 1000)          1281000 ['global_average_poolin
g2d[0][0]']

```

```

=====
Total params: 3,538,984
Trainable params: 3,504,872
Non-trainable params: 34,112

```



```
In [25]: base_input = model.layers[0].input
```

```
In [26]: base_output = model.layers[-2].output
```

```
In [27]: base_output
```

```
Out[27]: <KerasTensor: shape=(None, 1280) dtype=float32 (created by layer 'global_average_pool: 2d')>
```

```
In [28]: final_output = layers.Dense(128)(base_output)##adding new layer after the output of  
final_output = layers.Activation('relu')(final_output)##Activation Function  
final_output = layers.Dense(64)(final_output)  
final_output = layers.Activation('relu')(final_output)  
final_output = layers.Dense(2 , activation = 'softmax')(final_output)## my classes are
```

```
In [29]: final_output ##output
```

```
Out[29]: <KerasTensor: shape=(None, 2) dtype=float32 (created by layer 'dense_2')>
```

```
In [30]: new_model = keras.Model(inputs = base_input , outputs = final_output)
```

```
In [31]: new_model.summary()
```

Model: "model"

| Layer (type)  | Output Shape                       | Param # | Connected to            |
|---|------------------------------------|---------|-------------------------|
| =====   |                                    |         |                         |
| input_1 (InputLayer)  | [(None, 224, 224, 3<br>)]          | 0       | []                      |
| Conv1 (Conv2D)  | (None, 112, 112, 32<br>)           | 864     | ['input_1[0][0]']       |
| bn_Conv1 (BatchNormalization)   | (None, 112, 112, 32<br>)           | 128     | ['Conv1[0][0]']         |
| Conv1_relu (ReLU)   | (None, 112, 112, 32<br>)           | 0       | ['bn_Conv1[0][0]']      |
| expanded_conv_depthwise (Depth<br>wiseConv2D)                             | (None, 112, 112, 32<br>)           | 288     | ['Conv1_relu[0][0]']    |
| expanded_conv_depthwise_BN (Ba<br>se[0][0]']<br>tchNormalization)         | (None, 112, 112, 32<br>)           | 128     | ['expanded_conv_depthwi |
| expanded_conv_depthwise_relu ( (None, 112, 112, 32<br>se_BN[0][0<br>ReLU) | )                                  | 0       | ['expanded_conv_depthwi |
| expanded_conv_project (Conv2D)  | (None, 112, 112, 16<br>)           | 512     | ['expanded_conv_depthwi |
| expanded_conv_project_BN (Batk<br>[0][0]']<br>hNormalization)             | (None, 112, 112, 16<br>)           | 64      | ['expanded_conv_project |
| block_1_expand (Conv2D)   | (None, 112, 112, 96<br>_BN[0][0]'] | 1536    | ['expanded_conv_project |

|   |  |
|---|--|
| )   | ]  |
| block_1_expand_BN (BatchNormalization)    | (None, 112, 112, 96 384 ['block_1_expand[0]      |
| )   |  |
| block_1_expand_relu (ReLU)                | (None, 112, 112, 96 0 ['block_1_expand_BN[0]     |
| )   |  |
| block_1_pad (ZeroPadding2D)               | (None, 113, 113, 96 0 ['block_1_expand_relu      |
| [0][0]')                                  |  |
| )   |  |
| block_1_depthwise (DepthwiseConv2D)       | (None, 56, 56, 96) 864 ['block_1_pad[0][0]')     |
| block_1_depthwise_BN (BatchNormalization) | (None, 56, 56, 96) 384 ['block_1_depthwise[0]    |
| block_1_depthwise_relu (ReLU)             | (None, 56, 56, 96) 0 ['block_1_depthwise_BN      |
| [0][0]')                                  |  |
| block_1_project (Conv2D)                  | (None, 56, 56, 24) 2304 ['block_1_depthwise_relu |
| [0][0]')                                  |  |
| block_1_project_BN (BatchNormalization)   | (None, 56, 56, 24) 96 ['block_1_project[0]       |
| block_2_expand (Conv2D)                   | (None, 56, 56, 144) 3456 ['block_1_project_BN[0] |
| [0]')                                     |  |
| block_2_expand_BN (BatchNormalization)    | (None, 56, 56, 144) 576 ['block_2_expand[0]      |
| block_2_expand_relu (ReLU)                | (None, 56, 56, 144) 0 ['block_2_expand_BN[0]     |
| [0]')                                     |  |
| block_2_depthwise (DepthwiseConv2D)       | (None, 56, 56, 144) 1296 ['block_2_expand_relu   |
| [0][0]')                                  |  |
| block_2_depthwise_BN (BatchNormalization) | (None, 56, 56, 144) 576 ['block_2_depthwise[0]   |
| block_2_depthwise_relu (ReLU)             | (None, 56, 56, 144) 0 ['block_2_depthwise_BN     |
| [0][0]')                                  |  |
| block_2_project (Conv2D)                  | (None, 56, 56, 24) 3456 ['block_2_depthwise_relu |
| [0][0]')                                  |  |
| block_2_project_BN (BatchNormalization)   | (None, 56, 56, 24) 96 ['block_2_project[0]       |
| block_2_add (Add)                         | (None, 56, 56, 24) 0 ['block_1_project_BN[0]     |
| [0]',                                     |  |
| [0]')                                     | 'block_2_project_BN[0]                           |
| block_3_expand (Conv2D)                   | (None, 56, 56, 144) 3456 ['block_2_add[0][0]')   |



|  |                     |      |   |
|--|---------------------|------|---|
| block_3_expand_BN (BatchNormal<br>[0]']<br>ization)    | (None, 56, 56, 144) | 576  | ['block_3_expand[0]                                   |
| block_3_expand_relu (ReLU)<br>[0]']                    | (None, 56, 56, 144) | 0    | ['block_3_expand_BN[0]                                |
| block_3_pad (ZeroPadding2D)<br>[0][0]']                | (None, 57, 57, 144) | 0    | ['block_3_expand_relu                                 |
| block_3_depthwise (DepthwiseCo<br>nv2D)                | (None, 28, 28, 144) | 1296 | ['block_3_pad[0][0]']                                 |
| block_3_depthwise_BN (BatchNor<br>[0]']<br>malization) | (None, 28, 28, 144) | 576  | ['block_3_depthwise[0]                                |
| block_3_depthwise_relu (ReLU)<br>[0][0]']              | (None, 28, 28, 144) | 0    | ['block_3_depthwise_BN                                |
| block_3_project (Conv2D)<br>u[0][0]']                  | (None, 28, 28, 32)  | 4608 | ['block_3_depthwise_rel                               |
| block_3_project_BN (BatchNorma<br>[0]']<br>lization)   | (None, 28, 28, 32)  | 128  | ['block_3_project[0]                                  |
| block_4_expand (Conv2D)<br>[0]']                       | (None, 28, 28, 192) | 6144 | ['block_3_project_BN[0]                               |
| block_4_expand_BN (BatchNormal<br>[0]']<br>ization)    | (None, 28, 28, 192) | 768  | ['block_4_expand[0]                                   |
| block_4_expand_relu (ReLU)<br>[0]']                    | (None, 28, 28, 192) | 0    | ['block_4_expand_BN[0]                                |
| block_4_depthwise (DepthwiseCo<br>[0][0]']<br>nv2D)    | (None, 28, 28, 192) | 1728 | ['block_4_expand_relu                                 |
| block_4_depthwise_BN (BatchNor<br>[0]']<br>malization) | (None, 28, 28, 192) | 768  | ['block_4_depthwise[0]                                |
| block_4_depthwise_relu (ReLU)<br>[0][0]']              | (None, 28, 28, 192) | 0    | ['block_4_depthwise_BN                                |
| block_4_project (Conv2D)<br>u[0][0]']                  | (None, 28, 28, 32)  | 6144 | ['block_4_depthwise_rel                               |
| block_4_project_BN (BatchNorma<br>[0]']<br>lization)   | (None, 28, 28, 32)  | 128  | ['block_4_project[0]                                  |
| block_4_add (Add)<br>[0]',<br>[0]']                    | (None, 28, 28, 32)  | 0    | ['block_3_project_BN[0]<br><br>'block_4_project_BN[0] |
| block_5_expand (Conv2D)                                | (None, 28, 28, 192) | 6144 | ['block_4_add[0][0]']                                 |
| block_5_expand_BN (BatchNormal<br>[0]']                | (None, 28, 28, 192) | 768  | ['block_5_expand[0]                                   |

|   |                     |       |   |
|---|---------------------|-------|---|
| ization)                                  |                     |       |   |
| block_5_expand_relu (ReLU)                | (None, 28, 28, 192) | 0     | ['block_5_expand_BN[0][0]']                       |
| block_5_depthwise (DepthwiseConv2D)       | (None, 28, 28, 192) | 1728  | ['block_5_expand_relu[0][0]']                     |
| block_5_depthwise_BN (BatchNormalization) | (None, 28, 28, 192) | 768   | ['block_5_depthwise[0][0]']                       |
| block_5_depthwise_relu (ReLU)             | (None, 28, 28, 192) | 0     | ['block_5_depthwise_BN[0][0]']                    |
| block_5_project (Conv2D)                  | (None, 28, 28, 32)  | 6144  | ['block_5_depthwise_relu[0][0]']                  |
| block_5_project_BN (BatchNormalization)   | (None, 28, 28, 32)  | 128   | ['block_5_project[0][0]']                         |
| block_5_add (Add)                         | (None, 28, 28, 32)  | 0     | ['block_4_add[0][0]', 'block_5_project_BN[0][0]'] |
| block_6_expand (Conv2D)                   | (None, 28, 28, 192) | 6144  | ['block_5_add[0][0]']                             |
| block_6_expand_BN (BatchNormalization)    | (None, 28, 28, 192) | 768   | ['block_6_expand[0][0]']                          |
| block_6_expand_relu (ReLU)                | (None, 28, 28, 192) | 0     | ['block_6_expand_BN[0][0]']                       |
| block_6_pad (ZeroPadding2D)               | (None, 29, 29, 192) | 0     | ['block_6_expand_relu[0][0]']                     |
| block_6_depthwise (DepthwiseConv2D)       | (None, 14, 14, 192) | 1728  | ['block_6_pad[0][0]']                             |
| block_6_depthwise_BN (BatchNormalization) | (None, 14, 14, 192) | 768   | ['block_6_depthwise[0][0]']                       |
| block_6_depthwise_relu (ReLU)             | (None, 14, 14, 192) | 0     | ['block_6_depthwise_BN[0][0]']                    |
| block_6_project (Conv2D)                  | (None, 14, 14, 64)  | 12288 | ['block_6_depthwise_relu[0][0]']                  |
| block_6_project_BN (BatchNormalization)   | (None, 14, 14, 64)  | 256   | ['block_6_project[0][0]']                         |
| block_7_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_6_project_BN[0][0]']                      |
| block_7_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_7_expand[0][0]']                          |
| block_7_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_7_expand_BN[0][0]']                       |

|   |                     |       |   |
|---|---------------------|-------|---|
| block_7_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_7_expand_relu[0][0]']                               |
| block_7_depthwise_BN (BatchNormalization) | (None, 14, 14, 384) | 1536  | ['block_7_depthwise[0][0]']                                 |
| block_7_depthwise_relu (ReLU)             | (None, 14, 14, 384) | 0     | ['block_7_depthwise_BN[0][0]']                              |
| block_7_project (Conv2D)                  | (None, 14, 14, 64)  | 24576 | ['block_7_depthwise_relu[0][0]']                            |
| block_7_project_BN (BatchNormalization)   | (None, 14, 14, 64)  | 256   | ['block_7_project[0][0]']                                   |
| block_7_add (Add)                         | (None, 14, 14, 64)  | 0     | ['block_6_project_BN[0][0]',<br>'block_7_project_BN[0][0]'] |
| block_8_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_7_add[0][0]']                                       |
| block_8_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_8_expand[0][0]']                                    |
| block_8_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_8_expand_BN[0][0]']                                 |
| block_8_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_8_expand_relu[0][0]']                               |
| block_8_depthwise_BN (BatchNormalization) | (None, 14, 14, 384) | 1536  | ['block_8_depthwise[0][0]']                                 |
| block_8_depthwise_relu (ReLU)             | (None, 14, 14, 384) | 0     | ['block_8_depthwise_BN[0][0]']                              |
| block_8_project (Conv2D)                  | (None, 14, 14, 64)  | 24576 | ['block_8_depthwise_relu[0][0]']                            |
| block_8_project_BN (BatchNormalization)   | (None, 14, 14, 64)  | 256   | ['block_8_project[0][0]']                                   |
| block_8_add (Add)                         | (None, 14, 14, 64)  | 0     | ['block_7_add[0][0]',<br>'block_8_project_BN[0][0]']        |
| block_9_expand (Conv2D)                   | (None, 14, 14, 384) | 24576 | ['block_8_add[0][0]']                                       |
| block_9_expand_BN (BatchNormalization)    | (None, 14, 14, 384) | 1536  | ['block_9_expand[0][0]']                                    |
| block_9_expand_relu (ReLU)                | (None, 14, 14, 384) | 0     | ['block_9_expand_BN[0][0]']                                 |
| block_9_depthwise (DepthwiseConv2D)       | (None, 14, 14, 384) | 3456  | ['block_9_expand_relu[0][0]']                               |

|                                |                     |       |  |                                  |  |
|--------------------------------|---------------------|-------|--|----------------------------------|--|
| [0][0]'                        |                     |       |  |                                  |  |
| nv2D)                          |                     |       |  |                                  |  |
| block_9_depthwise_BN (BatchNor | (None, 14, 14, 384) | 1536  |  | ['block_9_depthwise[0]           |  |
| [0]']                          |                     |       |  |                                  |  |
| malization)                    |                     |       |  |                                  |  |
| block_9_depthwise_relu (ReLU)  | (None, 14, 14, 384) | 0     |  | ['block_9_depthwise_BN           |  |
| [0][0]']                       |                     |       |  |                                  |  |
| block_9_project (Conv2D)       | (None, 14, 14, 64)  | 24576 |  | ['block_9_depthwise_relu[0][0]'] |  |
| u[0][0]']                      |                     |       |  |                                  |  |
| block_9_project_BN (BatchNorma | (None, 14, 14, 64)  | 256   |  | ['block_9_project[0]             |  |
| [0]']                          |                     |       |  |                                  |  |
| lization)                      |                     |       |  |                                  |  |
| block_9_add (Add)              | (None, 14, 14, 64)  | 0     |  | ['block_8_add[0][0]',            |  |
| [0]']                          |                     |       |  | 'block_9_project_BN[0]           |  |
|                                |                     |       |  |                                  |  |
| block_10_expand (Conv2D)       | (None, 14, 14, 384) | 24576 |  | ['block_9_add[0][0]']            |  |
|                                |                     |       |  |                                  |  |
| block_10_expand_BN (BatchNorma | (None, 14, 14, 384) | 1536  |  | ['block_10_expand[0]             |  |
| [0]']                          |                     |       |  |                                  |  |
| lization)                      |                     |       |  |                                  |  |
| block_10_expand_relu (ReLU)    | (None, 14, 14, 384) | 0     |  | ['block_10_expand_BN[0]          |  |
| [0]']                          |                     |       |  |                                  |  |
| block_10_depthwise (DepthwiseC | (None, 14, 14, 384) | 3456  |  | ['block_10_expand_relu           |  |
| [0][0]']                       |                     |       |  |                                  |  |
| onv2D)                         |                     |       |  |                                  |  |
| block_10_depthwise_BN (BatchNo | (None, 14, 14, 384) | 1536  |  | ['block_10_depthwise[0]          |  |
| [0]']                          |                     |       |  |                                  |  |
| rmalization)                   |                     |       |  |                                  |  |
| block_10_depthwise_relu (ReLU) | (None, 14, 14, 384) | 0     |  | ['block_10_depthwise_BN          |  |
| [0][0]']                       |                     |       |  |                                  |  |
| block_10_project (Conv2D)      | (None, 14, 14, 96)  | 36864 |  | ['block_10_depthwise_re          |  |
| lu[0][0]']                     |                     |       |  |                                  |  |
| block_10_project_BN (BatchNorm | (None, 14, 14, 96)  | 384   |  | ['block_10_project[0]            |  |
| [0]']                          |                     |       |  |                                  |  |
| alization)                     |                     |       |  |                                  |  |
| block_11_expand (Conv2D)       | (None, 14, 14, 576) | 55296 |  | ['block_10_project_BN            |  |
| [0][0]']                       |                     |       |  |                                  |  |
| block_11_expand_BN (BatchNorma | (None, 14, 14, 576) | 2304  |  | ['block_11_expand[0]             |  |
| [0]']                          |                     |       |  |                                  |  |
| lization)                      |                     |       |  |                                  |  |
| block_11_expand_relu (ReLU)    | (None, 14, 14, 576) | 0     |  | ['block_11_expand_BN[0]          |  |
| [0]']                          |                     |       |  |                                  |  |
| block_11_depthwise (DepthwiseC | (None, 14, 14, 576) | 5184  |  | ['block_11_expand_relu           |  |
| [0][0]']                       |                     |       |  |                                  |  |
| onv2D)                         |                     |       |  |                                  |  |
| block_11_depthwise_BN (BatchNo | (None, 14, 14, 576) | 2304  |  | ['block_11_depthwise[0]          |  |
| [0]']                          |                     |       |  |                                  |  |
| rmalization)                   |                     |       |  |                                  |  |

|  |                     |       |  |
|--|---------------------|-------|--|
| block_11_depthwise_relu (ReLU)             | (None, 14, 14, 576) | 0     | ['block_11_depthwise_BN[0][0]']                            |
| block_11_project (Conv2D)                  | (None, 14, 14, 96)  | 55296 | ['block_11_depthwise_relu[0][0]']                          |
| block_11_project_BN (BatchNormalization)   | (None, 14, 14, 96)  | 384   | ['block_11_project[0][0]']                                 |
| block_11_add (Add)                         | (None, 14, 14, 96)  | 0     | ['block_10_project_BN[0][0]', 'block_11_project_BN[0][0]'] |
| block_12_expand (Conv2D)                   | (None, 14, 14, 576) | 55296 | ['block_11_add[0][0]']                                     |
| block_12_expand_BN (BatchNormalization)    | (None, 14, 14, 576) | 2304  | ['block_12_expand[0][0]']                                  |
| block_12_expand_relu (ReLU)                | (None, 14, 14, 576) | 0     | ['block_12_expand_BN[0][0]']                               |
| block_12_depthwise (DepthwiseConv2D)       | (None, 14, 14, 576) | 5184  | ['block_12_expand_relu[0][0]']                             |
| block_12_depthwise_BN (BatchNormalization) | (None, 14, 14, 576) | 2304  | ['block_12_depthwise[0][0]']                               |
| block_12_depthwise_relu (ReLU)             | (None, 14, 14, 576) | 0     | ['block_12_depthwise_BN[0][0]']                            |
| block_12_project (Conv2D)                  | (None, 14, 14, 96)  | 55296 | ['block_12_depthwise_relu[0][0]']                          |
| block_12_project_BN (BatchNormalization)   | (None, 14, 14, 96)  | 384   | ['block_12_project[0][0]']                                 |
| block_12_add (Add)                         | (None, 14, 14, 96)  | 0     | ['block_11_add[0][0]', 'block_12_project_BN[0][0]']        |
| block_13_expand (Conv2D)                   | (None, 14, 14, 576) | 55296 | ['block_12_add[0][0]']                                     |
| block_13_expand_BN (BatchNormalization)    | (None, 14, 14, 576) | 2304  | ['block_13_expand[0][0]']                                  |
| block_13_expand_relu (ReLU)                | (None, 14, 14, 576) | 0     | ['block_13_expand_BN[0][0]']                               |
| block_13_pad (ZeroPadding2D)               | (None, 15, 15, 576) | 0     | ['block_13_expand_relu[0][0]']                             |
| block_13_depthwise (DepthwiseConv2D)       | (None, 7, 7, 576)   | 5184  | ['block_13_pad[0][0]']                                     |
| block_13_depthwise_BN (BatchNormalization) | (None, 7, 7, 576)   | 2304  | ['block_13_depthwise[0][0]']                               |

|  |                   |        |  |
|--|-------------------|--------|--|
| block_13_depthwise_relu (ReLU)             | (None, 7, 7, 576) | 0      | ['block_13_depthwise_BN[0][0]']                            |
| block_13_project (Conv2D)                  | (None, 7, 7, 160) | 92160  | ['block_13_depthwise_relu[0][0]']                          |
| block_13_project_BN (BatchNormalization)   | (None, 7, 7, 160) | 640    | ['block_13_project[0][0]']                                 |
| block_14_expand (Conv2D)                   | (None, 7, 7, 960) | 153600 | ['block_13_project_BN[0][0]']                              |
| block_14_expand_BN (BatchNormalization)    | (None, 7, 7, 960) | 3840   | ['block_14_expand[0][0]']                                  |
| block_14_expand_relu (ReLU)                | (None, 7, 7, 960) | 0      | ['block_14_expand_BN[0][0]']                               |
| block_14_depthwise (DepthwiseConv2D)       | (None, 7, 7, 960) | 8640   | ['block_14_expand_relu[0][0]']                             |
| block_14_depthwise_BN (BatchNormalization) | (None, 7, 7, 960) | 3840   | ['block_14_depthwise[0][0]']                               |
| block_14_depthwise_relu (ReLU)             | (None, 7, 7, 960) | 0      | ['block_14_depthwise_BN[0][0]']                            |
| block_14_project (Conv2D)                  | (None, 7, 7, 160) | 153600 | ['block_14_depthwise_relu[0][0]']                          |
| block_14_project_BN (BatchNormalization)   | (None, 7, 7, 160) | 640    | ['block_14_project[0][0]']                                 |
| block_14_add (Add)                         | (None, 7, 7, 160) | 0      | ['block_13_project_BN[0][0]', 'block_14_project_BN[0][0]'] |
| block_15_expand (Conv2D)                   | (None, 7, 7, 960) | 153600 | ['block_14_add[0][0]']                                     |
| block_15_expand_BN (BatchNormalization)    | (None, 7, 7, 960) | 3840   | ['block_15_expand[0][0]']                                  |
| block_15_expand_relu (ReLU)                | (None, 7, 7, 960) | 0      | ['block_15_expand_BN[0][0]']                               |
| block_15_depthwise (DepthwiseConv2D)       | (None, 7, 7, 960) | 8640   | ['block_15_expand_relu[0][0]']                             |
| block_15_depthwise_BN (BatchNormalization) | (None, 7, 7, 960) | 3840   | ['block_15_depthwise[0][0]']                               |
| block_15_depthwise_relu (ReLU)             | (None, 7, 7, 960) | 0      | ['block_15_depthwise_BN[0][0]']                            |
| block_15_project (Conv2D)                  | (None, 7, 7, 160) | 153600 | ['block_15_depthwise_relu[0][0]']                          |

|   |                    |        |  |
|---|--------------------|--------|--|
| lu[0][0]'   |                    |        |  |
| block_15_project_BN (BatchNorm<br>[0]')<br>alization)   | (None, 7, 7, 160)  | 640    | ['block_15_project[0]                          |
| block_15_add (Add)                                      | (None, 7, 7, 160)  | 0      | ['block_14_add[0][0]',<br>'block_15_project_BN |
| [0][0]'   |                    |        |  |
| block_16_expand (Conv2D)                                | (None, 7, 7, 960)  | 153600 | ['block_15_add[0][0]']                         |
| block_16_expand_BN (BatchNorma<br>[0]')<br>alization)   | (None, 7, 7, 960)  | 3840   | ['block_16_expand[0]                           |
| block_16_expand_relu (ReLU)                             | (None, 7, 7, 960)  | 0      | ['block_16_expand_BN[0]                        |
| [0]')   |                    |        |  |
| block_16_depthwise (DepthwiseC<br>[0][0]')<br>onv2D)    | (None, 7, 7, 960)  | 8640   | ['block_16_expand_relu                         |
| block_16_depthwise_BN (BatchNo<br>[0]')<br>rmalization) | (None, 7, 7, 960)  | 3840   | ['block_16_depthwise[0]                        |
| block_16_depthwise_relu (ReLU)                          | (None, 7, 7, 960)  | 0      | ['block_16_depthwise_BN                        |
| [0][0]')  |                    |        |  |
| block_16_project (Conv2D)                               | (None, 7, 7, 320)  | 307200 | ['block_16_depthwise_re                        |
| lu[0][0]')  |                    |        |  |
| block_16_project_BN (BatchNorm<br>[0]')<br>alization)   | (None, 7, 7, 320)  | 1280   | ['block_16_project[0]                          |
| Conv_1 (Conv2D)   | (None, 7, 7, 1280) | 409600 | ['block_16_project_BN                          |
| [0][0]')  |                    |        |  |
| Conv_1_bn (BatchNormalization)                          | (None, 7, 7, 1280) | 5120   | ['Conv_1[0][0]']                               |
| out_relu (ReLU)   | (None, 7, 7, 1280) | 0      | ['Conv_1_bn[0][0]']                            |
| global_average_pooling2d (Glob<br>alAveragePooling2D)   | (None, 1280)       | 0      | ['out_relu[0][0]']                             |
| dense (Dense)   | (None, 128)        | 163968 | ['global_average_poolin                        |
| g2d[0][0]'  |                    |        | ]  |
| activation (Activation)                                 | (None, 128)        | 0      | ['dense[0][0]']                                |
| dense_1 (Dense)   | (None, 64)         | 8256   | ['activation[0][0]']                           |
| activation_1 (Activation)                               | (None, 64)         | 0      | ['dense_1[0][0]']                              |
| dense_2 (Dense)   | (None, 2)          | 130    | ['activation_1[0][0]']                         |

=====

=====

Total params: 2,430,338

Trainable params: 2,396,226

Non-trainable params: 34,112

```
In [32]: new_model.compile(loss="sparse_categorical_crossentropy", optimizer = "adam", metric =
```

```
In [33]: y[1900]
```

```
Out[33]: 0
```

```
In [34]: new_model.fit(x,y, epochs = 5)
```

```
Epoch 1/5
63/63 [=====] - 434s 7s/step - loss: 0.4410 - accuracy: 0.8030
Epoch 2/5
63/63 [=====] - 376s 6s/step - loss: 0.2716 - accuracy: 0.8995
Epoch 3/5
63/63 [=====] - 343s 5s/step - loss: 0.2308 - accuracy: 0.9105
Epoch 4/5
63/63 [=====] - 341s 5s/step - loss: 0.2044 - accuracy: 0.9225
Epoch 5/5
63/63 [=====] - 345s 5s/step - loss: 0.1444 - accuracy: 0.9445
```

```
Out[34]: <keras.callbacks.History at 0x1b9ae869d90>
```

```
In [35]: new_model.save('Fiinaal_model')
```

```
INFO:tensorflow:Assets written to: Fiinaal_model\assets
D:\Anaconda\lib\site-packages\keras\engine\functional.py:1410: CustomMaskWarning: Custom mask layers require a config and must override get_config. When loading, the custom mask layer must be passed to the custom_objects argument.
  layer_config = serialize_layer_fn(layer)
D:\Anaconda\lib\site-packages\keras\saving\saved_model\layer_serialization.py:112: CustomMaskWarning: Custom mask layers require a config and must override get_config. When loading, the custom mask layer must be passed to the custom_objects argument.
  return generic_utils.serialize_keras_object(obj)
```

```
In [36]: frame = cv2.imread("R.jfif")
```

```
In [37]: frame.shape
```

```
Out[37]: (240, 320, 3)
```

```
In [38]: plt.imshow(cv2.cvtColor(frame, cv2.COLOR_BGR2RGB))
```

```
Out[38]: <matplotlib.image.AxesImage at 0x1b9844d6a90>
```





```
In [39]: faceCascade = cv2.CascadeClassifier(cv2.data.harcascades + 'haarcascade_frontalface')
```

```
In [40]: gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
```

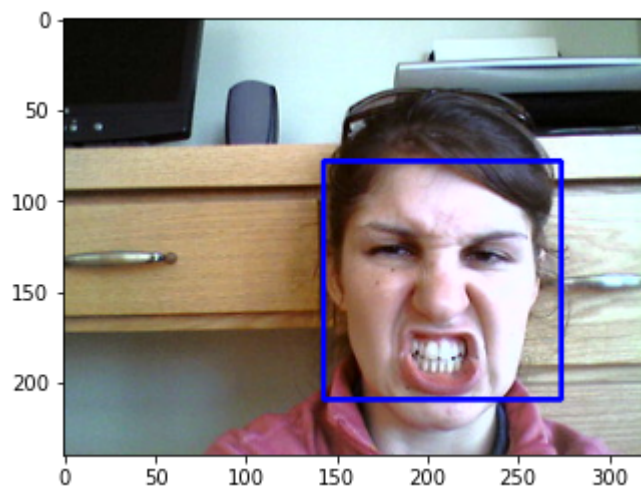
```
In [41]: gray.shape
```

```
Out[41]: (240, 320)
```

```
In [42]: faces = faceCascade.detectMultiScale(gray,1.1,4)
for x,y,w,h in faces:
    roi_gray = gray[y:y+h , x:x+w]
    roi_color = frame[y:y+h , x:x+w]
    cv2.rectangle(frame, (x , y) , (x + w , y + h) , (255 , 0 , 0) , 2)
    faces = faceCascade.detectMultiScale(roi_gray)
    if len(faces) == 0:
        print("Face not detected")
    else:
        for (ex , ey , ew , eh) in faces:
            face_roi = roi_color[ey: ey+eh, ex:ex+ew]
```

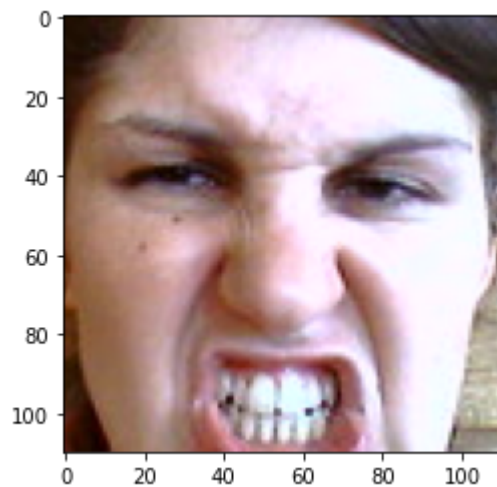
```
In [43]: plt.imshow(cv2.cvtColor(frame , cv2.COLOR_BGR2RGB))
```

```
Out[43]: <matplotlib.image.AxesImage at 0x1b981dab220>
```



```
In [44]: plt.imshow(cv2.cvtColor(face_roi , cv2.COLOR_BGR2RGB))
```

```
Out[44]: <matplotlib.image.AxesImage at 0x1b9834123a0>
```



```
In [45]: final_image = cv2.resize(face_roi , (224 , 224)) ##  
final_image = np.expand_dims(final_image , axis=0) ##need fourth dimension  
final_image = final_image/255.0##normalizing
```

```
In [46]: predictions = new_model.predict(final_image)
```

```
In [47]: predictions[0]
```

```
Out[47]: array([9.999999e-01, 8.029849e-08], dtype=float32)
```

```
In [48]: np.argmax(predictions)
```

```
Out[48]: 0
```

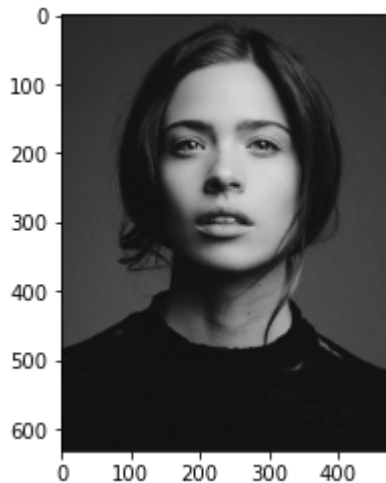
```
In [49]: frame = cv2.imread("N.jfif")
```

```
In [50]: frame.shape
```

```
Out[50]: (632, 474, 3)
```

```
In [51]: plt.imshow(cv2.cvtColor(frame, cv2.COLOR_BGR2RGB))
```

```
Out[51]: <matplotlib.image.AxesImage at 0x1b9832b7dc0>
```



```
In [52]: faceCascade = cv2.CascadeClassifier(cv2.data.harcascades + 'haarcascade_frontalface')
```

```
In [53]: gray = cv2.cvtColor(frame, cv2.COLOR_BGR2GRAY)
```

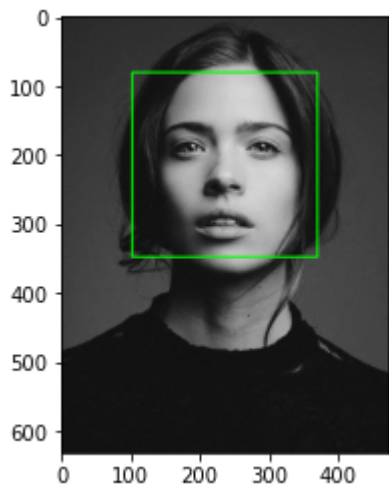
```
In [54]: gray.shape
```

```
Out[54]: (632, 474)
```

```
In [55]: faces = faceCascade.detectMultiScale(gray,1.1,4)
for x,y,w,h in faces:
    roi_gray = gray[y:y+h , x:x+w]
    roi_color = frame[y:y+h , x:x+w]
    cv2.rectangle(frame, (x , y) , (x + w , y + h) , (0 , 255 , 0) , 2)
    facess = faceCascade.detectMultiScale(roi_gray)
    if len(facess) == 0:
        print("Face not detected")
    else:
        for (ex , ey , ew , eh) in facess:
            face_roi = roi_color[ey: ey+eh, ex:ex+ew]
```

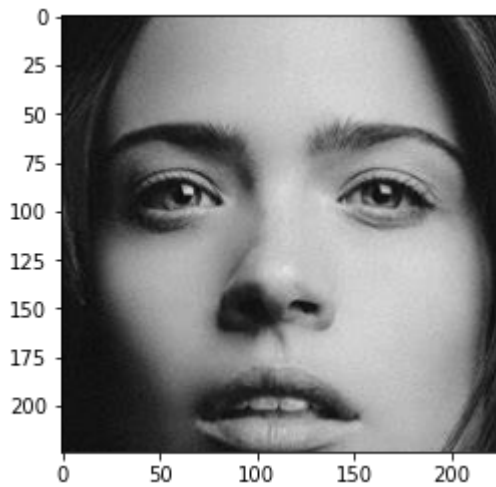
```
In [56]: plt.imshow(cv2.cvtColor(frame , cv2.COLOR_BGR2RGB))
```

```
Out[56]: <matplotlib.image.AxesImage at 0x1b983279520>
```



```
In [57]: plt.imshow(cv2.cvtColor(face_roi , cv2.COLOR_BGR2RGB))
```

```
Out[57]: <matplotlib.image.AxesImage at 0x1b9809ad2b0>
```



```
In [58]: final_image = cv2.resize(face_roi , (224 , 224)) ##  
final_image = np.expand_dims(final_image , axis=0) ##need fourth dimension  
final_image = final_image/255.0##normalizing
```

```
In [59]: predictions = new_model.predict(final_image)
```

```
In [60]: predictions[0]
```

```
Out[60]: array([0.00142596, 0.998574  ], dtype=float32)
```

```
In [61]: np.argmax(predictions)
```

```
Out[61]: 1
```

```
In [62]: final_image = cv2.resize(face_roi , (224 , 224)) ##  
final_image = np.expand_dims(final_image , axis=0) ##need fourth dimension
```

```
final_image = final_image/255.0##normalizing
```

```
In [63]: predictions = new_model.predict(final_image)
```

```
In [64]: predictions[0]
```

```
Out[64]: array([0.00142596, 0.998574 ], dtype=float32)
```

```
In [65]: np.argmax(predictions)
```

```
Out[65]: 1
```

```
In [66]: import cv2 #pip install opencv-python
```

```
In [67]: pip install deepface
```

```
Requirement already satisfied: deepface in d:\anaconda\lib\site-packages (0.0.70)  
Requirement already satisfied: pandas>=0.23.4 in d:\anaconda\lib\site-packages (from dee  
pface) (1.2.4)  
Requirement already satisfied: opencv-python>=3.4.4 in d:\anaconda\lib\site-packages (fr  
om deepface) (4.5.4.60)  
Requirement already satisfied: tqdm>=4.30.0 in d:\anaconda\lib\site-packages (from deepf  
ace) (4.59.0)  
Requirement already satisfied: keras>=2.2.0 in d:\anaconda\lib\site-packages (from deepf  
ace) (2.7.0)  
Requirement already satisfied: mtcnn>=0.1.0 in d:\anaconda\lib\site-packages (from deepf  
ace) (0.1.1)  
Requirement already satisfied: retina-face>=0.0.1 in d:\anaconda\lib\site-packages (from  
deepface) (0.0.7)  
Requirement already satisfied: Pillow>=5.2.0 in d:\anaconda\lib\site-packages (from dee  
pface) (8.2.0)  
Requirement already satisfied: numpy>=1.14.0 in d:\anaconda\lib\site-packages (from dee  
pface) (1.20.1)  
Requirement already satisfied: tensorflow>=1.9.0 in d:\anaconda\lib\site-packages (from  
deepface) (2.7.0)  
Requirement already satisfied: Flask>=1.1.2 in d:\anaconda\lib\site-packages (from deepf  
ace) (1.1.2)  
Requirement already satisfied: gdown>=3.10.1 in d:\anaconda\lib\site-packages (from dee  
pface) (4.2.0)  
Requirement already satisfied: itsdangerous>=0.24 in d:\anaconda\lib\site-packages (from  
Flask>=1.1.2->deepface) (1.1.0)  
Requirement already satisfied: click>=5.1 in d:\anaconda\lib\site-packages (from Flask>=  
1.1.2->deepface) (7.1.2)  
Requirement already satisfied: Jinja2>=2.10.1 in d:\anaconda\lib\site-packages (from Fla  
sk>=1.1.2->deepface) (2.11.3)  
Requirement already satisfied: Werkzeug>=0.15 in d:\anaconda\lib\site-packages (from Fla  
sk>=1.1.2->deepface) (1.0.1)  
Requirement already satisfied: requests[socks] in d:\anaconda\lib\site-packages (from gd  
own>=3.10.1->deepface) (2.25.1)  
Requirement already satisfied: six in d:\anaconda\lib\site-packages (from gdown>=3.10.1-  
>deepface) (1.15.0)  
Requirement already satisfied: filelock in d:\anaconda\lib\site-packages (from gdown>=3.  
10.1->deepface) (3.0.12)  
Requirement already satisfied: beautifulsoup4 in d:\anaconda\lib\site-packages (from gdo  
wn>=3.10.1->deepface) (4.9.3)  
Requirement already satisfied: MarkupSafe>=0.23 in d:\anaconda\lib\site-packages (from J
```

inja2>=2.10.1->Flask>=1.1.2->deepface) (1.1.1)  
Requirement already satisfied: pytz>=2017.3 in d:\anaconda\lib\site-packages (from pandas>=0.23.4->deepface) (2021.1)  
Requirement already satisfied: python-dateutil>=2.7.3 in d:\anaconda\lib\site-packages (from pandas>=0.23.4->deepface) (2.8.1)  
Requirement already satisfied: astunparse>=1.6.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.6.3)  
Requirement already satisfied: typing-extensions>=3.6.6 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (3.7.4.3)  
Requirement already satisfied: libclang>=9.0.1 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (12.0.0)  
Requirement already satisfied: flatbuffers<3.0,>=1.12 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (2.0)  
Requirement already satisfied: absl-py>=0.4.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.0.0)  
Requirement already satisfied: termcolor>=1.1.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.1.0)  
Requirement already satisfied: gast<0.5.0,>=0.2.1 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (0.4.0)  
Requirement already satisfied: opt-einsum>=2.3.2 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (3.3.0)  
Requirement already satisfied: tensorflow-io-gcs-filesystem>=0.21.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (0.22.0)  
Requirement already satisfied: google-pasta>=0.1.1 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (0.2.0)  
Requirement already satisfied: h5py>=2.9.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (2.10.0)  
Requirement already satisfied: wheel<1.0,>=0.32.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (0.36.2)  
Requirement already satisfied: wrapt>=1.11.0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.12.1)  
Requirement already satisfied: protobuf>=3.9.2 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (3.19.1)  
Requirement already satisfied: keras-preprocessing>=1.1.1 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.1.2)  
Requirement already satisfied: grpcio<2.0,>=1.24.3 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (1.41.1)  
Requirement already satisfied: tensorboard~=2.6 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (2.7.0)  
Requirement already satisfied: tensorflow-estimator<2.8,~=2.7.0rc0 in d:\anaconda\lib\site-packages (from tensorflow>=1.9.0->deepface) (2.7.0)  
Requirement already satisfied: markdown>=2.6.8 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (3.3.4)  
Requirement already satisfied: tensorboard-plugin-wit>=1.6.0 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (1.8.0)  
Requirement already satisfied: tensorboard-data-server<0.7.0,>=0.6.0 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (0.6.1)  
Requirement already satisfied: setuptools>=41.0.0 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (52.0.0.post20210125)  
Requirement already satisfied: google-auth<3,>=1.6.3 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (2.3.3)  
Requirement already satisfied: google-auth-oauthlib<0.5,>=0.4.1 in d:\anaconda\lib\site-packages (from tensorboard~=2.6->tensorflow>=1.9.0->deepface) (0.4.6)  
Requirement already satisfied: rsa<5,>=3.1.4 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow>=1.9.0->deepface) (4.7.2)  
Requirement already satisfied: pyasn1-modules>=0.2.1 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow>=1.9.0->deepface) (0.2.8)  
Requirement already satisfied: cachetools<5.0,>=2.0.0 in d:\anaconda\lib\site-packages (from google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow>=1.9.0->deepface) (4.2.4)  
Requirement already satisfied: requests-oauthlib>=0.7.0 in d:\anaconda\lib\site-packages (from google-auth-oauthlib<0.5,>=0.4.1->tensorboard~=2.6->tensorflow>=1.9.0->deepface) (1.3.0)  
Requirement already satisfied: pyasn1<0.5.0,>=0.4.6 in d:\anaconda\lib\site-packages (from pyasn1-modules>=0.2.1->google-auth<3,>=1.6.3->tensorboard~=2.6->tensorflow>=1.9.0->deepface) (0.4.8)

Requirement already satisfied: idna<3,>=2.5 in d:\anaconda\lib\site-packages (from requests[socks]->gdown>=3.10.1->deepface) (2.10)  
 Requirement already satisfied: chardet<5,>=3.0.2 in d:\anaconda\lib\site-packages (from requests[socks]->gdown>=3.10.1->deepface) (4.0.0)  
 Requirement already satisfied: certifi>=2017.4.17 in d:\anaconda\lib\site-packages (from requests[socks]->gdown>=3.10.1->deepface) (2021.10.8)  
 Requirement already satisfied: urllib3<1.27,>=1.21.1 in d:\anaconda\lib\site-packages (from requests[socks]->gdown>=3.10.1->deepface) (1.26.4)  
 Requirement already satisfied: oauthlib>=3.0.0 in d:\anaconda\lib\site-packages (from requests-oauthlib>=0.7.0->google-auth-oauthlib<0.5,>=0.4.1->tensorboard~>=2.6->tensorflow>=1.9.0->deepface) (3.1.1)  
 Requirement already satisfied: soupsieve>1.2 in d:\anaconda\lib\site-packages (from beautifulsoup4->gdown>=3.10.1->deepface) (2.2.1)  
 Requirement already satisfied: PySocks!=1.5.7,>=1.5.6 in d:\anaconda\lib\site-packages (from requests[socks]->gdown>=3.10.1->deepface) (1.7.1)  
 Note: you may need to restart the kernel to use updated packages.

```
In [68]: import deepface
```

```
In [69]: path = "haarcascade_frontalface_default.xml"
```

```
In [70]: font_scale = 1.5
```

```
In [71]: font = cv2.FONT_HERSHEY_PLAIN
```

```
In [72]: rectangle_bgr = (255 , 255 , 255)
```

```
In [73]: img = np.zeros((500 , 500))
```

```
In [74]: text = "Some text in a box"
```

```
In [75]: (text_width , text_height) = cv2.getTextSize(text , font , fontScale = font_scale , i
```

```
In [76]: text_offset_x = 10
text_offset_y = img.shape[0] - 25
#make the cords of the box with a small padding of two pixel
box_coords = ((text_offset_x , text_offset_y) , (text_offset_x + text_width + 2 , text_
cv2.rectangle(img , box_coords[0] , box_coords[1] , rectangle_bgr , cv2.FILLED)
cv2.putText(img , text , (text_offset_x , text_offset_y) , font , fontScale = font_scal
```

```
Out[76]: array([[0., 0., 0., ..., 0., 0., 0.],
[0., 0., 0., ..., 0., 0., 0.],
[0., 0., 0., ..., 0., 0., 0.],
...,
[0., 0., 0., ..., 0., 0., 0.],
[0., 0., 0., ..., 0., 0., 0.],
[0., 0., 0., ..., 0., 0., 0.]])
```

```
In [78]: cap = cv2.VideoCapture(1)
```

```

# checked if the web cam is opened corectly
if not cap.isOpened():
    cap = cv2.VideoCapture(0)
if not cap.isOpened():
    raise IOError("Can not open webcam")

while True:
    ret, frame = cap.read()
    #eye_cascade = cv2.CascadeClassifier(cv2.data.harcascades + 'haarcascades_eye.xml')
    faceCascade = cv2.CascadeClassifier(cv2.data.harcascades + 'haarcascade_frontalface')
    gray = cv2.cvtColor(frame , cv2.COLOR_BGR2GRAY)
    #print (faceCascade.empty())
    faces = faceCascade.detectMultiScale(gray , 1.1 , 4)
    for x,y,w,h in faces:
        roi_gray = gray[y:y+h, x:x+w]
        roi_color = frame[y:y+h, x:x+w]
        cv2.rectangle(frame, (x,y), (x+w, y+h), (255,0,0),2)
        faces = faceCascade.detectMultiScale(roi_gray)
        if len(faces) == 0:
            print("Face not Detected")
        else:
            for (ex,ey,ew,eh) in faces:
                face_roi = roi_color[ey: ey+eh, ex:ex + ew] # cropping the face
    final_image = cv2.resize(face_roi,(224,224))
    final_image = np.expand_dims(final_image, axis=0)# need fourth dimension
    final_image = final_image/255.0

    font = cv2.FONT_HERSHEY_SIMPLEX

    predictions = new_model.predict(final_image)

    font_scale = 1.5
    font = cv2.FONT_HERSHEY_PLAIN

    if (np.argmax(predictions)==0):
        status = "Happy"

        x1,y1,w1,h1 = 0,0,175,75
        ##Draw black background rectangle
        cv2.rectangle(frame, (x1,x1) , (x1 + w1 , y1 + h1), (0,0,0), -1)
        #Add text
        cv2.putText(frame, status, (x1 + int(w1/10), y1 + int(h1/2)), cv2.FONT_HERSHEY_
        cv2.putText(frame,status,(100,150), font, 3, (0,0,255),2,cv2.LINE_4)
        cv2.rectangle(frame, (x,y), (x+w , y+h), (0,0,255))

    elif(np.argmax(predictions)==1):
        status = "neutral"

        x1,y1,w1,h1 = 0,0,175,75
        ##Draw black background rectangle
        cv2.rectangle(frame, (x1,x1) , (x1 + w1 , y1 + h1), (0,0,0), -1)
        #Add text
        cv2.putText(frame, status, (x1 + int(w1/10), y1 + int(h1/2)), cv2.FONT_HERSHEY_
        cv2.putText(frame,status,(100,150), font, 3, (0,0,255),2,cv2.LINE_4)
        cv2.rectangle(frame, (x,y), (x+w , y+h), (0,0,255))

    else:
        status = "angry"

```



```

x1,y1,w1,h1 = 0,0,175,75
##Draw black background rectangle
cv2.rectangle(frame, (x1,x1) , (x1 + w1 , y1 + h1), (0,0,0), -1)
#Add text
cv2.putText(frame, status, (x1 + int(w1/10), y1 + int(h1/2)), cv2.FONT_HERSHEY_
cv2.putText(frame,status,(100,150), font, 3, (0,0,255),2,cv2.LINE_4)
cv2.rectangle(frame, (x,y), (x+w , y+h), (0,0,255))

```

```

cv2.imshow('Face Emotion Recognition',frame)

```

```

if cv2.waitKey(2) & 0xFF == ord('q'):
    break

```

```

cap.release()
cv2.destroyAllWindows()

```

Face not Detected  
Face not Detected

In [ ]:

```

elif(np.argmax(predictions)==2):
    status = "angry"

    x1,y1,w1,h1 = 0,0,175,75
    ##Draw black background rectangle
    cv2.rectangle(frame, (x1,x1) , (x1 + w1 , y1 + h1), (0,0,0), -1)
    #Add text
    cv2.putText(frame, status, (x1 + int(w1/10), y1 + int(h1/2)), cv2.FONT_HERSHEY_
    cv2.putText(frame,status,(100,150), font, 3, (0,0,255),2,cv2.LINE_4)
    cv2.rectangle(frame, (x,y), (x+w , y+h), (0,0,255))elif(np.argmax(predictions)=
    status = "angry"

    x1,y1,w1,h1 = 0,0,175,75
    ##Draw black background rectangle
    cv2.rectangle(frame, (x1,x1) , (x1 + w1 , y1 + h1), (0,0,0), -1)
    #Add text
    cv2.putText(frame, status, (x1 + int(w1/10), y1 + int(h1/2)), cv2.FONT_HERSHEY_
    cv2.putText(frame,status,(100,150), font, 3, (0,0,255),2,cv2.LINE_4)
    cv2.rectangle(frame, (x,y), (x+w , y+h), (0,0,255))

```

In [ ]: