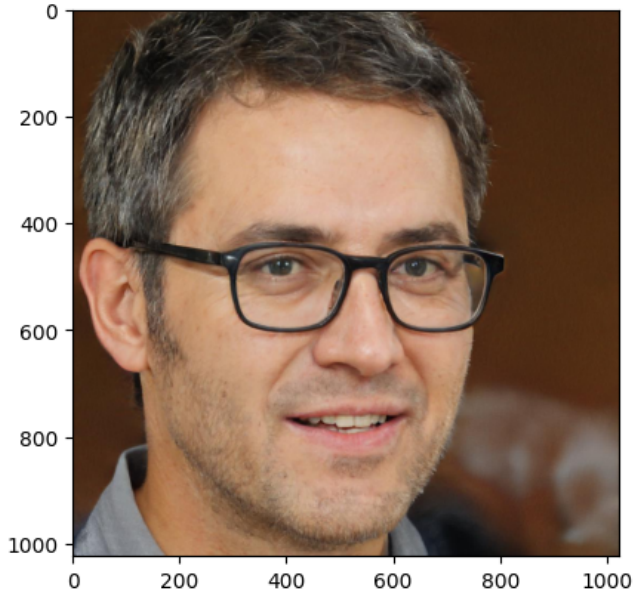
```
import os
import random
from matplotlib import image
from matplotlib import pyplot
import matplotlib.pyplot as plt
import matplotlib.image as mpimg
from sklearn.model_selection import train_test_split
import pandas as pd
import numpy as np
import cv2
```

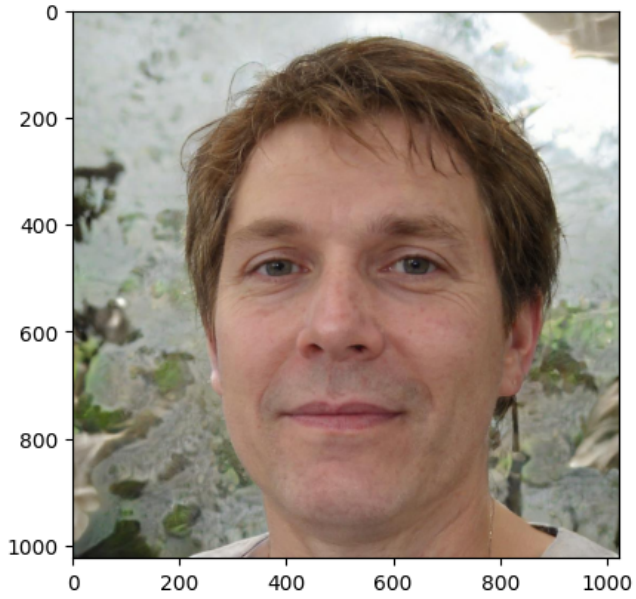
```
data = image.imread('/content/drive/MyDrive/FaceGlassDetection/Images/glasses/face-2684.jpg')
print(data.dtype)
print(data.shape)
pyplot.imshow(data)
pyplot.show()
```

```
uint8
(1024, 1024, 3)
```




```
data = image.imread('/content/drive/MyDrive/FaceGlassDetection/Images/no_glasses/face-2689.jpg')
print(data.dtype)
print(data.shape)
pyplot.imshow(data)
pyplot.show()
```

```
uint8
(1024, 1024, 3)
```




```
labels = ['glasses','no_glasses']
img_size = 200
data = []
def get_training_data(data_dir):
  for label in labels:
    path=os.path.join (data_dir, label)
    class_num = labels.index(label)
    print(class_num)
    for img in os.listdir (path):
      try:
        img_arr = cv2.imread(os.path. join (path, img), cv2.COLOR_BAYER_GB2RGB)
        # print(img_arr.shape)
        resized_arr = cv2.resize(img_arr, (img_size, img_size))
        data.append ([resized_arr, class_num])
      except Exception as e:
        print(e)
  return np.array(data)
train = get_training_data('/content/drive/MyDrive/FaceGlassDetection/Images')
print(data)
```

```
0
1
<ipython-input-4-ce36a82bfcdc>:17: VisibleDeprecationWarning: Creating an ndarray from ragged nested sequences (which is a list-or-tuple of lists-or-tuples-or ndarrays with
  return np.array(data)
[[array([[[ 85, 161, 160],
        [ 90, 166, 165],
```

```
       [ 90, 166, 165],
       ...,
       [ 70, 138, 132],
       [ 75, 142, 138],
       [ 75, 141, 140]],

      [[ 87, 163, 162],
       [ 87, 163, 162],
       [ 89, 165, 164],
       ...,
       [ 74, 144, 131],
       [ 75, 145, 134],
       [ 76, 144, 137]],

      [[ 89, 165, 164],
       [ 88, 164, 163],
       [ 89, 165, 164],
       ...,
       [ 80, 148, 140],
       [ 81, 148, 142],
       [ 81, 147, 145]],

      ...,

      [[132, 146, 137],
       [128, 140, 135],
       [111, 123, 120],
       ...,
       [ 50,  70,  68],
       [ 50,  62,  62],
       [ 48,  64,  63]],

      [[133, 152, 140],
       [131, 150, 138],
       [122, 141, 129],
       ...,
       [ 43,  69,  63],
       [ 47,  61,  57],
       [ 41,  56,  52]],

      [[148, 171, 168],
       [136, 159, 154],
       [135, 160, 150],
       ...,
       [ 54,  92,  93],
       [ 57,  80,  83],
       [ 41,  60,  64]]], dtype=uint8), 0], [array([[[152, 170, 177],
       [154, 172, 179],
       [155, 173, 180],
```

```
for label in labels:
  print(labels.index(label))
```

```
0
1
```

```
x=[]
y=[]
for i,j in data:
  x.append(i)
  y.append(j)
print(y)
```

```
[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, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 6
```

```
x
```

```
[array([[[ 85, 161, 160],
         [ 90, 166, 165],
         [ 90, 166, 165],
         ...,
         [ 70, 138, 132],
         [ 75, 142, 138],
         [ 75, 141, 140]],

        [[ 87, 163, 162],
         [ 87, 163, 162],
         [ 89, 165, 164],
         ...,
         [ 74, 144, 131],
         [ 75, 145, 134],
         [ 76, 144, 137]],

        [[ 89, 165, 164],
         [ 88, 164, 163],
         [ 89, 165, 164],
         ...,
         [ 80, 148, 140],
         [ 81, 148, 142],
         [ 81, 147, 145]],

        ...,

        [[132, 146, 137],
         [128, 140, 135],
         [111, 123, 120],
         ...,
         [ 50,  70,  68],
         [ 50,  62,  62],
         [ 48,  64,  63]],

        [[133, 152, 140],
         [131, 150, 138],
         [122, 141, 129],
```

```
        ...,
        [ 43,  69,  63],
        [ 47,  61,  57],
        [ 41,  56,  52]],

       [[148, 171, 168],
        [136, 159, 154],
        [135, 160, 150],
        ...,
        [ 54,  92,  93],
        [ 57,  80,  83],
        [ 41,  60,  64]]], dtype=uint8),
 array([[[152, 170, 177],
        [154, 172, 179],
        [155, 173, 180],
        ...,
        [150, 169, 177],
        [150, 169, 177],
        [150, 169, 177]],
```

```
y
```

```
[0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
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 0,
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 0,
```

```
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
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 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
 0,
```

```
xtrain, xtest, ytrain, ytest = train_test_split(x, y, test_size = 0.25, random_state = 47)
```

```
xtrain
```

```
[array([[[ 5, 18, 34],
         [ 6, 19, 35],
         [ 7, 20, 35],
         ...,
         [ 8, 21, 43],
         [10, 20, 40],
         [ 8, 15, 34]],

        [[ 8, 21, 37],
         [ 7, 20, 36],
         [ 8, 21, 37],
         ...,
         [ 9, 23, 47],
         [10, 23, 45],
         [11, 21, 41]],

        [[ 9, 22, 38],
         [ 9, 22, 38],
         [ 9, 22, 38],
         ...,
         [ 6, 23, 50],
         [ 9, 23, 47],
         [ 9, 22, 44]],
```

```
               ...,

               [[ 7, 21, 43],
                [ 6, 23, 49],
                [ 3, 24, 55],
                ...,
                [15, 34, 65],
                [17, 32, 59],
                [ 5, 17, 39]],

               [[ 7, 20, 39],
                [10, 25, 49],
                [ 5, 25, 53],
                ...,
                [12, 30, 64],
                [12, 26, 55],
                [ 7, 19, 43]],

               [[ 9, 19, 36],
                [ 8, 22, 44],
                [ 8, 27, 54],
                ...,
                [16, 34, 71],
                [16, 30, 61],
                [ 6, 16, 43]]], dtype=uint8),
        array([[[221, 226, 225],
                [223, 228, 227],
                [222, 227, 226],
                ...,
                [220, 226, 224],
                [223, 228, 227],
                [223, 228, 227]],

               [[222, 226, 226]
```

```
print(np.array(xtrain).shape)
```

```
(1710, 200, 200, 3)
```

```
print(np.array(ytest).shape)
```

```
(571,)
```

```
x=np.array(x).reshape(2281,120000)
x
```

```
array([[ 85, 161, 160, ...,  41,  60,  64],
       [152, 170, 177, ..., 160, 176, 179],
       [ 24,  67,  82, ..., 182, 192, 196],
       ...,
       [110, 150, 138, ..., 111, 132, 166],
```

```
            [ 70,  95, 111, ...,  67,  83,  94],
            [ 79,  96, 109, ..., 105, 119, 125]], dtype=uint8)
```

```
x1=np.array(x).shape
```

```
x1
```

```
(2281, 120000)
```

```
x
```

```
array([[ 85, 161, 160, ...,  41,  60,  64],
       [152, 170, 177, ..., 160, 176, 179],
       [ 24,  67,  82, ..., 182, 192, 196],
       ...,
       [110, 150, 138, ..., 111, 132, 166],
       [ 70,  95, 111, ...,  67,  83,  94],
       [ 79,  96, 109, ..., 105, 119, 125]], dtype=uint8)
```

```
y1=np.array(y).shape
y1
```

```
(2281,)
```

```
d=np.array(xtrain).reshape(1710,120000)
d
```

```
array([[  5,  18,  34, ...,   6,  16,  43],
       [221, 226, 225, ..., 225, 229, 223],
       [176, 209, 210, ..., 111,  94,  82],
       ...,
       [239, 230, 226, ...,  67,  48,  45],
       [ 94, 102, 115, ...,  28,  29,  51],
       [ 13,  30,  21, ..., 153, 122,  93]], dtype=uint8)
```

```
e=np.array(xtest).reshape(571,120000)
e
```

```
array([[150, 165, 167, ..., 130, 142, 145],
       [107, 112, 113, ...,  93,  94,  98],
       [149, 164, 166, ..., 144, 168, 216],
       ...,
       [ 51,  88, 101, ...,  85, 103, 120],
       [ 36,  74,  59, ..., 193, 187, 190],
       [ 68, 100, 109, ...,  62,  81,  88]], dtype=uint8)
```

```
print(np.asarray(d.shape))
```

```
      [  1710 120000]


from sklearn.preprocessing import StandardScaler
sc_x = StandardScaler()
d= sc_x.fit_transform(d)#normalizing
e = sc_x.transform(e)


from sklearn.linear_model import LogisticRegression
model = LogisticRegression(random_state = 0)


model.fit(d, ytrain)

     /usr/local/lib/python3.9/dist-packages/sklearn/linear_model/_logistic.py:458: ConvergenceWarning: lbfgs failed to converge (status=1):
     STOP: TOTAL NO. of ITERATIONS REACHED LIMIT.

     Increase the number of iterations (max_iter) or scale the data as shown in:
         https://scikit-learn.org/stable/modules/preprocessing.html
     Please also refer to the documentation for alternative solver options:
         https://scikit-learn.org/stable/modules/linear_model.html#logistic-regression
       n_iter_i = _check_optimize_result(
     ▾        LogisticRegression
     LogisticRegression(random_state=0)


y_pred=model.predict(e)
y_pred

     array([1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0,
            0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1,
            1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0,
            0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
            0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1,
            1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0,
            0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1,
            1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1,
            1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0,
            0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1,
            1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0,
            1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0,
            0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0,
            0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0,
            0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1,
            1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0,
            0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1,
            1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1,
            1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 0,
            1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0,
            0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0,
            0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
            1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1,
```

```
       0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 0, 1,
       0, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0,
       1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0])
```

```
from sklearn.metrics import confusion_matrix
cm=confusion_matrix(ytest,y_pred)
print("Confusion matrix:\n",cm)
```

```
Confusion matrix:
 [[304   8]
 [  1 258]]
```

```
from sklearn.metrics import accuracy_score
print("Accuracy:",accuracy_score(ytest,y_pred))
```

```
Accuracy: 0.9842381786339754
```

```
from sklearn.neighbors import KNeighborsClassifier
knn=KNeighborsClassifier(n_neighbors=12)#k value
```

```
knn.fit(d,ytrain)
```

```
KNeighborsClassifier
KNeighborsClassifier(n_neighbors=12)
```

```
y_pred = model.predict(e)
y_pred
```

```
array([1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1,
       1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0,
       0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1,
       1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0,
       0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1,
       1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0,
       0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0,
       1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0,
       0, 1, 1, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0,
       0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1,
       1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0,
       0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 1, 1, 0,
       1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0,
       0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0,
```

```
       0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1,
       0, 0, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 0, 1,
       0, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0,
       1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0])
```

```
print("predicted value for training value",knn.score(d,ytrain))
print("predicted value for testing value",knn.score(e,ytest))
print("Overall Accuracy:",knn.score(sc_x.transform(x),y))
```

```
predicted value for training value 0.8228070175438597
predicted value for testing value 0.7565674255691769
Overall Accuracy: 0.8062253397632617
```

```
y_pred=knn.predict(e)
```

```
y_pred
```

```
array([1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 1, 0,
       0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 0, 1,
       1, 0, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0,
       0, 0, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0,
       0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0,
       0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0,
       0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1,
       1, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0,
       0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1,
       0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 0, 1, 0,
       1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1,
       0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0,
       0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0,
       1, 0, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 1, 1, 1,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 0,
       0, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 0,
       0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 0,
       0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 1,
       0, 1, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1,
       0, 0, 0, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0,
       1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0])
```

```
from sklearn.metrics import confusion_matrix
knns=confusion_matrix(ytest,y_pred)
print("Confusion matrix:\n",knns)
```

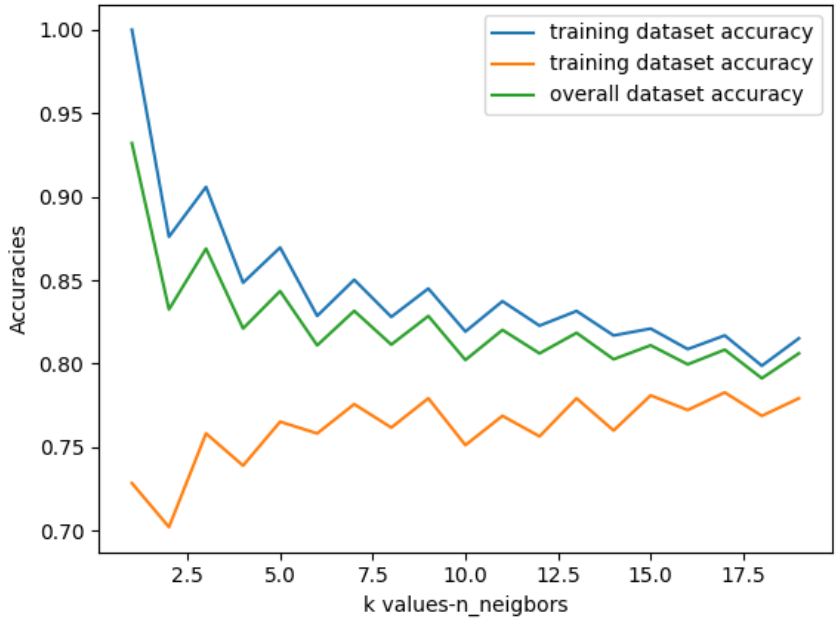
```
Confusion matrix:
 [[287  25]
```

```
       [114 145]]
```

```
#this code is useful to find best k value using graphs
neighbors=np.arange(1,20)
train_accuracy=np.empty(len(neighbors))
test_accuracy=np.empty(len(neighbors))
overall_accuracy=np.empty(len(neighbors))
#loop over k values
for i,k in enumerate(neighbors):
  knn=KNeighborsClassifier(n_neighbors=k)
  knn.fit(d,ytrain)
  #compute the training and testing accuracy of ML model
  train_accuracy[i]=knn.score(d,ytrain)
  test_accuracy[i]=knn.score(e,ytest)

  #overall score
  overall_accuracy[i]=knn.score(sc_x.transform(x),y)

import matplotlib.pyplot as plt
plt.plot(neighbors,train_accuracy,label="training dataset accuracy")
plt.plot(neighbors,test_accuracy,label="training dataset accuracy")
plt.plot(neighbors,overall_accuracy,label="overall dataset accuracy")
plt.legend()
plt.xlabel('k values-n_neigbors')
plt.ylabel('Accuracies')
plt.show()
```



```
from sklearn import svm
SVM= svm.SVC()
```

```
SVM.fit(d, ytrain)
```

▾ SVC

SVC()

```
print("Training Accuracy",SVM.score(d,ytrain))
print("Testing Accuracy",SVM.score(e,ytest))
print("Overall Accuracy:",SVM.score(sc_x.transform(x),y))
```

```
Training Accuracy 0.9953216374269006
Testing Accuracy 0.9737302977232924
Overall Accuracy: 0.9899167032003507
```

```
y_pred=SVM.predict(e)
y_pred
```

```
array([1, 1, 0, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 0,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1,
       1, 0, 1, 1, 0, 1, 1, 1, 1, 0, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0,
       0, 1, 1, 1, 1, 1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 1,
       1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0,
       0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 0, 1, 0, 0, 1, 1, 0, 1,
       1, 0, 1, 1, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0,
       0, 1, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0,
       1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1,
       0, 1, 1, 0, 1, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0,
       0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1,
       1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0,
       0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 1, 1,
       1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0,
       1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0,
       0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0,
       0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 1, 0, 1,
       0, 0, 0, 1, 1, 1, 1, 0, 1, 1, 0, 1, 1, 0, 0, 1, 1, 0, 0, 1, 0, 1,
       0, 0, 0, 0, 1, 0, 0, 1, 1, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0,
       1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0])
```

```
from sklearn.metrics import confusion_matrix
SVMS=confusion_matrix(ytest,y_pred)
print("Confusion matrix:\n",SVMS)
```

```
Confusion matrix:
 [[300  12]
 [  3 256]]
```

```
from sklearn.tree import DecisionTreeClassifier
dtc=DecisionTreeClassifier()
```

```
dtc.fit(d,ytrain)
```

```
DecisionTreeClassifier
DecisionTreeClassifier()
```

```
print("Training Accuracy",dtc.score(d,ytrain))
print("Testing Accuracy",dtc.score(e,ytest))
print("Overall Accuracy:",dtc.score(sc_x.transform(x),y))
```

```
Training Accuracy 1.0
Testing Accuracy 0.9422066549912435
Overall Accuracy: 0.9855326611135466
```

```
y_pred=dtc.predict(e)
y_pred
```

```
array([1, 1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 1, 1, 1, 0, 0, 0, 1, 1,
       0, 0, 0, 0, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 0, 1, 1,
       1, 0, 1, 1, 0, 1, 0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0,
       0, 1, 1, 1, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 1,
       0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 1, 0, 1, 1, 0, 1, 0,
       1, 0, 0, 1, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 1, 1, 0, 0, 1,
       1, 0, 1, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 1, 0, 1, 0, 0, 1, 1, 0, 0,
       1, 0, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0, 1, 1, 0, 1, 1, 0, 0,
       0, 0, 1, 1, 0, 1, 1, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0, 1,
       1, 1, 1, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 0, 1, 0, 1, 0,
       1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0, 0, 0,
       0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0,
       0, 1, 0, 0, 1, 1, 1, 1, 1, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0,
       0, 0, 1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1,
       1, 0, 0, 0, 1, 1, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0,
       0, 1, 1, 1, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1,
       1, 1, 0, 1, 0, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 1, 0, 1, 1, 1, 0,
       1, 0, 1, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 1, 1, 1, 1, 1, 0, 0,
       0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 0, 1, 1, 0, 0,
       0, 0, 1, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0, 1, 1,
```

```
            0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 1, 1, 0, 0, 1, 0, 0, 0, 1, 0, 1,
            0, 0, 0, 0, 1, 0, 1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 0, 0, 1, 1, 0,
            1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 1, 1, 1, 1, 0, 0, 1, 0, 0])
```

```
from sklearn.metrics import confusion_matrix
dtcs=confusion_matrix(ytest,y_pred)
print("Confusion matrix:\n",dtcs)
```

```
     Confusion matrix:
      [[302  10]
      [ 23 236]]
```

```
from sklearn.metrics import accuracy_score
accuracy_model = accuracy_score(y,model.predict(sc_x.transform(x)))
print("Logistic regression:",accuracy_model)
accuracy_knn = accuracy_score(y,knn.predict(sc_x.transform(x)))
print("KNN:",accuracy_knn)
accuracy_SVM = accuracy_score(y,SVM.predict(sc_x.transform(x)))
print("Support vector machine:",accuracy_SVM)
accuracy_dtc = accuracy_score(y,dtc.predict(sc_x.transform(x)))
print("Descision tree:",accuracy_dtc)
```

```
     Logistic regression: 0.9960543621218764
     KNN: 0.8062253397632617
     Support vector machine: 0.9899167032003507
     Descision tree: 0.9855326611135466
```

```
fig = plt.figure()

ax = fig.add_axes([0,0,1,1])

algo = ['LOGISTIC REGRESSION','KNN CLASSIFIER','SVM','DECISION TREE']

accuracy = [accuracy_model*100,accuracy_knn*100,accuracy_SVM*100,accuracy_dtc*100]

ax.bar(algo[0],accuracy[0],color = 'orange')

ax.bar(algo[1],accuracy[1],color = 'b')

ax.bar(algo[2],accuracy[2],color = 'r')


ax.bar(algo[3],accuracy[3],color = 'violet')


plt.xlabel('Classifiers------->')

plt.ylabel('Accuracies-------->')

plt.title('ACCURACIES RESULTED')
```

```
plt.show()
```