In [155…
```python
import dlib
```

In [156…
```python
import cv2
```

In [157…
```python
from imutils import face_utils
```

In [158…
```python
from scipy.spatial import distance
```

In [159…
```python
import math
```

In [160…
```python
import pandas as pd
```

In [161…
```python
import numpy as np
```

In [162…
```python
from sklearn.base import BaseEstimator, TransformerMixin
```

In [163…
```python
import pandas as pd
```

In [164…
```python
from sklearn.model_selection import train_test_split
```

In [165…
```python
from sklearn.metrics import roc_curve, roc_auc_score, f1_score
```

In [166…
```python
from sklearn.naive_bayes import GaussianNB
```

In [167…
```python
from sklearn.linear_model import LogisticRegression
```

In [168…
```python
from sklearn.neural_network import MLPClassifier
```

In [169…
```python
from sklearn.naive_bayes import BernoulliNB
```

In [170…
```python
from sklearn.tree import DecisionTreeClassifier
```

In [171…
```python
import numpy as np
```

In [172…
```python
import seaborn as sb
```

In [173…
```python
from sklearn.pipeline import Pipeline, FeatureUnion
```

In [174…
```python
from sklearn.metrics import accuracy_score
```

In [175…
```python
from sklearn.metrics import confusion_matrix
```

In [176…
```python
from sklearn import metrics
```

In [177…
```python
import warnings
```

In [178…
```python
from sklearn import preprocessing
```

In [179…
```python
import matplotlib.pyplot as plt
```

In [180…
```python
p = "C:/Users/mahalakshmi/Downloads/shape_predictor_68_face_landmarks.dat"
detector = dlib.get_frontal_face_detector()
predictor = dlib.shape_predictor(p)
```

In [181…
```python
def eye_aspect_ratio(eye):
        A = distance.euclidean(eye[1], eye[5])
        B = distance.euclidean(eye[2], eye[4])
        C = distance.euclidean(eye[0], eye[3])
        ear = (A + B) / (2.0 * C)
        return ear

def mouth_aspect_ratio(mouth):
    A = distance.euclidean(mouth[14], mouth[18])
    C = distance.euclidean(mouth[12], mouth[16])
    mar = (A ) / (C)
    return mar

def circularity(eye):
    A = distance.euclidean(eye[1], eye[4])
    radius  = A/2.0
    Area = math.pi * (radius ** 2)
    p = 0
    p += distance.euclidean(eye[0], eye[1])
    p += distance.euclidean(eye[1], eye[2])
    p += distance.euclidean(eye[2], eye[3])
    p += distance.euclidean(eye[3], eye[4])
    p += distance.euclidean(eye[4], eye[5])
    p += distance.euclidean(eye[5], eye[0])
    return 4 * math.pi * Area /(p**2)
def mouth_over_eye(eye):
    ear = eye_aspect_ratio(eye)
    mar = mouth_aspect_ratio(eye)
    mouth_eye = mar/ear
    return mouth_eye


def average(y_pred):
    for i in range(len(y_pred)):
        if i % 240 == 0 or (i+1) % 240 == 0:
            pass
        else:
            average = float(y_pred[i-1] +  y_pred[i] + y_pred[i+1])/3
            if average >= 0.5:
                y_pred[i] = 1
            else:
                y_pred[i] = 0
    return y_pred
```

In [182…
```python
import pandas as pd
df = pd.read_csv('C:/Users/mahalakshmi/Downloads/totalmaindata.csv',sep=',')
participants = set(df.Participant)
df = df.drop(["Participant"], axis=1)
df = df[df.Y != 5.0]  # form a binary problem, delete the 5.0 ones
df.loc[df.Y == 0.0, "Y"] = int(0)
df.loc[df.Y == 10.0, "Y"] = int(1)

train_percentage = 14/18 # based on max uniq. participants
train_samples = int(len(df) * train_percentage)
test_samples = len(df) - train_samples

df_train = df[:train_samples]
df_test = df[-test_samples:]

X_test = df_test.drop(["Y"], axis=1)
y_test = df_test["Y"]

X_train = df_train.drop('Y', axis=1)
y_train = df_train['Y']
print(f'X_test: {X_test.shape} \ny_test: {y_test.shape} \nX_train: {X_train.shape} \ny_train: {y_train.shape}')
df_train
```

```
X_test: (1920, 8)
y_test: (1920,)
X_train: (6720, 8)
y_train: (6720,)
```

Out[182…

	Y	MOE	EAR	MAR	Circularity	EAR_N	MAR_N	Circularity_N	MOE_N
0	0	2.534145	0.312688	0.792397	0.432896	-0.999551	0.802437	-0.948848	0.877172
1	0	2.379947	0.321940	0.766199	0.486923	-0.000897	0.317858	1.044306	0.211742
2	0	2.078550	0.331216	0.688449	0.456029	1.000448	-1.120295	-0.095458	-1.088914
3	0	2.509767	0.309246	0.776136	0.452655	-1.371052	0.501666	-0.219920	0.771970
4	0	3.586821	0.204691	0.734189	0.361123	-12.657205	-0.274242	-3.596686	5.419921
...	...	...	...	...	...	...	...	...	...
9595	1	3.516036	0.308254	1.083833	0.440628	-3.087456	3.700493	-1.776452	4.040717
9596	1	3.585545	0.301381	1.080614	0.447949	-3.694883	3.646635	-1.472575	4.322363
9597	1	3.750118	0.286855	1.075740	0.450278	-4.978551	3.565087	-1.375905	4.989206
9598	1	4.123695	0.260188	1.072936	0.403545	-7.335156	3.518178	-3.315660	6.502924
9599	1	3.734268	0.284039	1.060679	0.437864	-5.227374	3.313096	-1.891200	4.924982

6720 rows × 9 columns

In [183…
```python
acc3_list = []
f1_score3_list = []
roc_3_list = []
from sklearn.neighbors import KNeighborsClassifier
for i in range(1,30):
    neigh = KNeighborsClassifier(n_neighbors=i)
    neigh.fit(X_train, y_train)
    pred_KN = neigh.predict(X_test)
    pred_KN = average(pred_KN)
    y_score_3 = neigh.predict_proba(X_test)[:,1]
    acc3_list.append(accuracy_score(y_test, pred_KN))
    f1_score3_list.append(metrics.f1_score(y_test, pred_KN))
    roc_3_list.append(metrics.roc_auc_score(y_test, y_score_3))


neigh = KNeighborsClassifier(n_neighbors=acc3_list.index(max(acc3_list))+1)
neigh.fit(X_train, y_train)
pred_KN = neigh.predict(X_test)
pred_KN = average(pred_KN)
y_score_3 = neigh.predict_proba(X_test)[:,1]
acc3 = accuracy_score(y_test, pred_KN)
f1_score_3 = metrics.f1_score(y_test, pred_KN)
roc_3 = metrics.roc_auc_score(y_test, y_score_3)
print([acc3,f1_score_3,roc_3])
print(confusion_matrix(y_test, pred_KN))
```

```
[0.7005208333333334, 0.6335245379222434, 0.7379096137152779]
[[848 112]
 [463 497]]
```

In [184…
```python
def average(y_pred):
    """Averaging sequential frames for classifier"""
    for i in range(len(y_pred)-1):
        if i % 240 == 0 or (i+1) % 240 == 0:
            pass
        else:
            average = float(y_pred[i-1] + y_pred[i] + y_pred[i+1])/3
            if average >= 0.5:
                y_pred[i] = 1
            else:
                y_pred[i] = 0
    return y_pred

acc3_list = []
f1_score3_list = []
roc_3_list = []

# take 45 runs and save best one
for i in range(1, 45):
    neigh = KNeighborsClassifier(n_neighbors=i)
    neigh.fit(X_train, y_train)
    pred_KN = neigh.predict(X_test)
    pred_KN = average(pred_KN)
    y_score_3 = neigh.predict_proba(X_test)[:,1]
    acc3_list.append(accuracy_score(y_test, pred_KN))
    f1_score3_list.append(metrics.f1_score(y_test, pred_KN))
    roc_3_list.append(metrics.roc_auc_score(y_test, y_score_3))
neigh = KNeighborsClassifier(n_neighbors=acc3_list.index(max(acc3_list))+1)
print(f"Neighbors: {neigh.get_params()['n_neighbors']}")
neigh.fit(X_train, y_train)
acc3 = accuracy_score(y_test, pred_KN)
print(acc3)
```

```
Neighbors: 38
0.6963541666666667
```

In [185…
```python
def model(landmarks):

    features = pd.DataFrame(columns=["EAR","MAR","Circularity","MOE"])

    eye = landmarks[36:68]
    ear = eye_aspect_ratio(eye)
    mar = mouth_aspect_ratio(eye)
    cir = circularity(eye)
    mouth_eye = mouth_over_eye(eye)

    df = features.append({"EAR":ear,"MAR": mar,"Circularity": cir,"MOE": mouth_eye},ignore_index=True)

    df["EAR_N"] = (df["EAR"]-mean["EAR"])/ std["EAR"]
    df["MAR_N"] = (df["MAR"]-mean["MAR"])/ std["MAR"]
    df["Circularity_N"] = (df["Circularity"]-mean["Circularity"])/ std["Circularity"]
    df["MOE_N"] = (df["MOE"]-mean["MOE"])/ std["MOE"]

    Result = neigh.predict(df)
    if Result == 1:
        Result_String = "Drowsy"
    else:
        Result_String = "Drive safe"


    return Result_String, df.values
```

In [186…
```python
def calibration():
    data = []
    cap = cv2.VideoCapture(0)

    while True:
        # Getting out image by webcam
        _, image = cap.read()
        # Converting the image to gray scale
        gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

        # Get faces into webcam's image
        rects = detector(image, 0)

        # For each detected face, find the landmark.
        for (i, rect) in enumerate(rects):
            # Make the prediction and transfom it to numpy array
            shape = predictor(gray, rect)
            shape = face_utils.shape_to_np(shape)
            data.append(shape)
            cv2.putText(image,"Calibrating...", bottomLeftCornerOfText, font, fontScale, fontColor,lineType)

            # Draw on our image, all the finded cordinate points (x,y)
            for (x, y) in shape:
                cv2.circle(image, (x, y), 2, (0, 255, 0), -1)

        # Show the image
        cv2.imshow("Output", image)

        k = cv2.waitKey(5) & 0xFF
        if k == 27:
            break

    cv2.destroyAllWindows()
    cap.release()


    features_test = []
    for d in data:
        eye = d[36:68]
        ear = eye_aspect_ratio(eye)
        mar = mouth_aspect_ratio(eye)
        cir = circularity(eye)
        mouth_eye = mouth_over_eye(eye)
        features_test.append([ear, mar, cir, mouth_eye])
    features_test = np.array(features_test)
    x = features_test
    y = pd.DataFrame(x,columns=["EAR","MAR","Circularity","MOE"])
    df_means = y.mean(axis=0)
    df_std = y.std(axis=0)

    return df_means,df_std

font                   = cv2.FONT_HERSHEY_SIMPLEX
bottomLeftCornerOfText = (10,400)
fontScale              = 1
fontColor              = (255,255,255)
lineType               = 2
```

In [187…
```python
def live():
    cap = cv2.VideoCapture(0)
    data = []
    result = []
    while True:
        # Getting out image by webcam
        _, image = cap.read()
        # Converting the image to gray scale
        gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)

        # Get faces into webcam's image
        rects = detector(image, 0)

        # For each detected face, find the landmark.
        for (i, rect) in enumerate(rects):
            # Make the prediction and transfom it to numpy array
            shape = predictor(gray, rect)
            shape = face_utils.shape_to_np(shape)
            Result_String, features = model(shape)
            cv2.putText(image,Result_String, bottomLeftCornerOfText, font, fontScale, fontColor,lineType)
            data.append (features)
            result.append(Result_String)

            # Draw on our image, all the finded cordinate points (x,y)
            for (x, y) in shape:
                cv2.circle(image, (x, y), 2, (0, 255, 0), -1)

        # Show the image
        cv2.imshow("Output", image)

        k = cv2.waitKey(300) & 0xFF
        if k == 27:
            break

    cv2.destroyAllWindows()
    cap.release()
    return data,result

font                   = cv2.FONT_HERSHEY_SIMPLEX
bottomLeftCornerOfText = (10,400)
fontScale              = 1
fontColor              = (255,255,255)
lineType               = 2
```

In [188…
```python
mean, std = calibration()
```

In [189…
```python
features, result = live()
```

```
C:\Users\mahalakshmi\.conda\envs\envname\lib\site-packages\sklearn\base.py:488: FutureWarning: The feature names should match those that were passed during fit. Starting version 1.2, an error will be raised.
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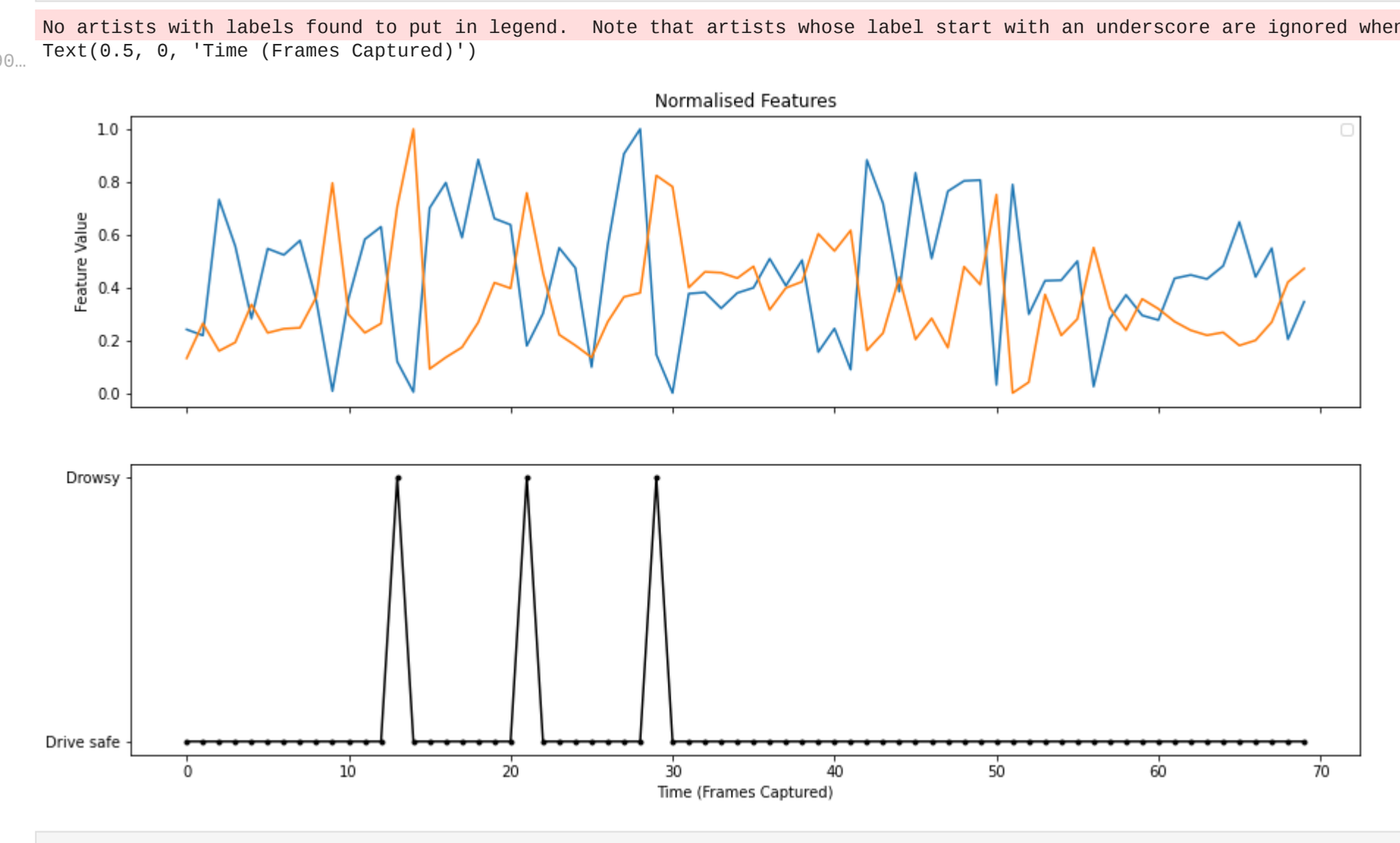
In [190…
```python
features =np.vstack(features)
y = pd.DataFrame(features,columns=["EAR","MAR","Circularity","MOE","EAR_N","MAR_N","Circularity_N","MOE_N"])
y = y.drop(columns=["EAR_N","MAR_N","Circularity_N","MOE_N"])

x = y.values #returns a numpy array
min_max_scaler = preprocessing.MinMaxScaler()
x_scaled = min_max_scaler.fit_transform(x)
y = pd.DataFrame(x_scaled,columns=["Eye Aspect Ratio","Mouth Aspect Ratio","Eye Circularity","Mouth over Eye"])


y ["Result"] = result


fig, (ax1, ax2) = plt.subplots(nrows=2,
                               ncols=1,
                               sharex=True,
                               sharey=False,
                               figsize=(15, 8))

ax1.set_title("Normalised Features")
#ax1.plot(y["Eye Aspect Ratio"])
#ax1.plot(y["Mouth Aspect Ratio"])
ax1.plot(y["Eye Circularity"])
ax1.plot(y["Mouth over Eye"])
ax1.legend(loc="best")
ax1.set_ylabel('Feature Value')


ax2.plot(y["Result"],marker = '.', color = "Black")
ax2.set_xlabel('Time (Frames Captured)')
```

```
No artists with labels found to put in legend.  Note that artists whose label start with an underscore are ignored when legend() is called with no argument.
```

Out[190…
```
Text(0.5, 0, 'Time (Frames Captured)')
```



In [2]:
```python
!bash
git clone https://github.com/18WH1A1244/MiniProject
```

```
  File "C:\Users\MAHALA~1\AppData\Local\Temp/ipykernel_15384/1373132075.py", line 2
    git clone https://github.com/18WH1A1244/MiniProject
        ^
SyntaxError: invalid syntax
```

In [ ]:

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