Driver drowsiness detection using KNN

Importing Drive

```
from google.colab import drive
drive.mount('/content/drive')
```

```
Mounted at /content/drive
```

Importing necessary libraries

```
%matplotlib inline
import numpy as np
import matplotlib.pyplot as plt
from scipy import stats
import seaborn as sns; sns.set()
import os
import glob
import skimage
from skimage import io, color
from skimage.feature.texture import graycomatrix, graycoprops
import pandas as pd
import cv2
from sklearn.model_selection import train_test_split
import tensorflow as tf
from tensorflow import keras
from keras import layers, callbacks
import sys
from IPython.display import display
from IPython.display import Image as _Imgdis
from PIL import Image
from time import time
from scipy.stats import kurtosis
from scipy.stats import skew
from scipy.stats import entropy
from time import sleep
from tensorflow import keras
from tensorflow.keras import layers
from google.colab import drive
```

Defining train dataset

```
train_data=('/content/drive/MyDrive/Train_Drowsiness')
```

Defining the categories

```
categories = ['drowsy','non-drowsy']
```

```
path1 = '/content/drive/MyDrive/Train_Drowsiness/drowsy/A0006.png'
image = io.imread(path1)
figure, axis = plt.subplots()
axis.set_title('Drowsy')
axis.imshow(image)

path2= '/content/drive/MyDrive/Train_Drowsiness/non-drowsy/a0002.png'
image = io.imread(path2)
figure, axis = plt.subplots()
axis.set_title('Non Drowsy')
axis.imshow(image)
```

```
<matplotlib.image.AxesImage at 0x7f528dc0fd60>
```


Feature extraction

```
from skimage.io import imread, imshow
from keras.preprocessing.image import ImageDataGenerator

featuresTrain = {}

featuresTrain['redMean'] = []
featuresTrain['blueMean'] = []
featuresTrain['greenMean'] = []

featuresTrain['redStd'] = []
featuresTrain['blueStd'] = []
featuresTrain['greenStd'] = []

featuresTrain['redSkew'] = []
featuresTrain['blueSkew'] = []
featuresTrain['greenSkew'] = []

featuresTrain['redKurt'] = []
featuresTrain['blueKurt'] = []
featuresTrain['greenKurt'] = []

featuresTrain['Entropy0'] = []

featuresTrain['Classes'] = []


for i in range(len(categories)):
  path = os.path.join(train_data,categories[i],'*')
  path = glob.glob(path)

  for p in path:
    featuresTrain['Classes'].append(i)
    image = io.imread(p)



    img_gs = cv2.imread(p,cv2.IMREAD_GRAYSCALE)
    img_gs = skimage.feature.graycomatrix(img_gs, [1], [np.pi/2])
    featuresTrain['Entropy0'].append(skimage.measure.shannon_entropy(np.reshape(img_gs,(256,256))))

    imgRed = image[:,:,0]
    featuresTrain['redMean'].append(np.mean(imgRed))
    featuresTrain['redStd'].append(np.std(imgRed))
    featuresTrain['redSkew'].append(np.mean(skew(imgRed)))
    featuresTrain['redKurt'].append(np.mean(kurtosis(imgRed)))

    imgBlue = image[:,:,1]
    featuresTrain['blueMean'].append(np.mean(imgBlue))
    featuresTrain['blueStd'].append(np.std(imgBlue))
    featuresTrain['blueSkew'].append(np.mean(skew(imgBlue)))
    featuresTrain['blueKurt'].append(np.mean(kurtosis(imgBlue)))

    imgGreen = image[:,:,2]
    featuresTrain['greenMean'].append(np.mean(imgGreen))
    featuresTrain['greenStd'].append(np.std(imgGreen))
    featuresTrain['greenSkew'].append(np.mean(skew(imgGreen)))
    featuresTrain['greenKurt'].append(np.mean(kurtosis(imgGreen)))
```

Creating train dataframe

```
train_dataFrame = pd.DataFrame.from_dict(featuresTrain)
from google.colab import files
```

```
train_dataFrame.to_csv('df', index = False)
```

```
df = pd.read_csv("/content/df")
df
```

	redMean	blueMean	greenMean	redStd	blueStd	greenStd	redSkew	blueSkew	greenSkew	redKurt	blueKurt	greenKurt	Entropy0	Classes
0	131.412098	102.875895	89.736362	60.891464	60.973115	58.284924	-0.589125	-0.440918	-0.262815	0.611043	0.512633	0.516771	0.866156	0
1	112.428885	79.669933	72.946554	75.149944	54.652683	45.801288	0.076564	0.279786	0.347022	-0.572996	-0.203384	0.068771	1.008737	0
2	130.995634	104.628908	92.081702	60.935711	62.169234	60.038991	-0.678127	-0.527175	-0.350405	0.102714	-0.122492	-0.253942	0.923232	0
3	120.647674	84.976421	77.167071	74.719250	54.551085	45.765412	-0.062233	0.152402	0.214497	-0.617467	-0.330530	-0.112438	0.991259	0
4	123.584836	86.806167	79.529449	76.181560	55.622968	46.828499	-0.161593	0.062306	0.130731	-0.859331	-0.436019	-0.214992	0.980507	0
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
3488	151.758583	117.515069	102.364358	51.732629	46.315595	43.295597	-1.282786	-1.132359	-1.042573	0.990221	0.555603	0.558674	0.869047	1
3489	152.763842	117.590153	103.038231	48.985278	43.940380	41.154747	-1.286493	-1.192425	-1.074932	1.113824	0.851657	0.725442	0.853737	1
3490	147.285761	113.529430	98.527412	53.856394	46.555795	43.403507	-1.057019	-1.001223	-0.913703	0.486952	0.487284	0.438237	0.899523	1
3491	152.107221	116.123115	100.862058	49.282753	43.682765	40.790286	-1.327353	-1.176951	-1.049181	1.181224	0.708807	0.624776	0.834961	1
3492	146.289158	113.205671	99.147839	54.673398	47.646968	44.629603	-1.021129	-0.960285	-0.887211	0.384761	0.365984	0.345113	0.906306	1

3493 rows × 14 columns

Checking if there is any missing value in the dataset

```
df.isna().sum()/len(df)  #checking the percentage of missing values in each column
```

```
redMean      0.000000
blueMean     0.000000
greenMean    0.000000
redStd       0.000000
blueStd      0.000000
greenStd     0.000000
redSkew      0.002577
blueSkew     0.002577
greenSkew    0.000859
```

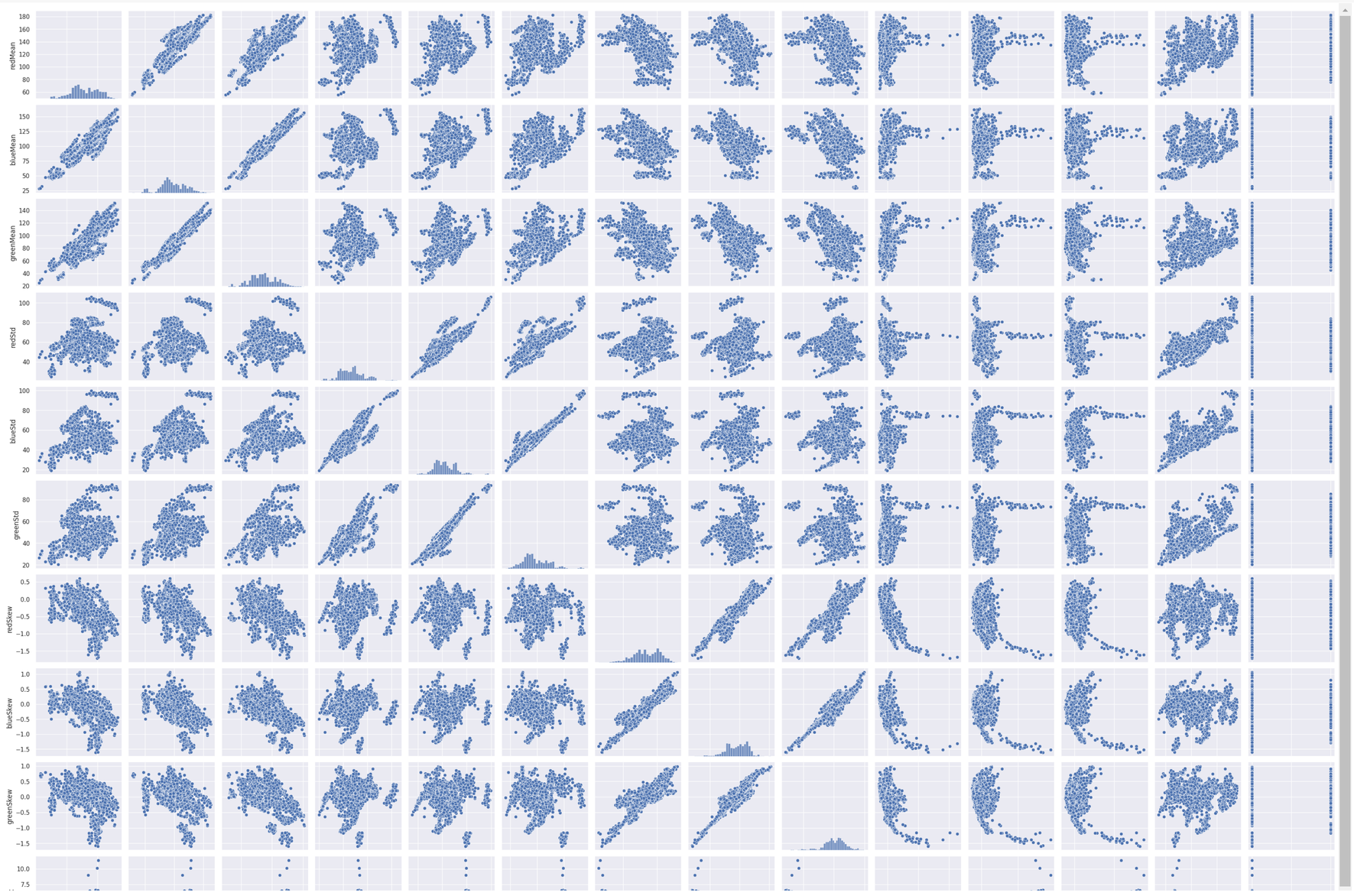
```
redKurt      0.002577
blueKurt     0.002577
greenKurt    0.000859
Entropy0     0.000000
Classes      0.000000
dtype: float64
```

Filling the missing values with zero

```
df = df.fillna(0)
```

Creating pairplot between features

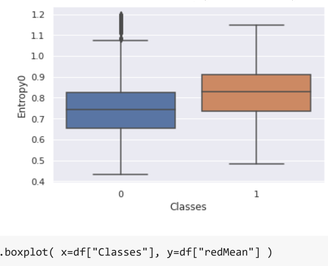
```
#Exploring dataset:
sns.pairplot(train_dataFrame, kind="scatter")
plt.show()
```



Creating boxplot between features

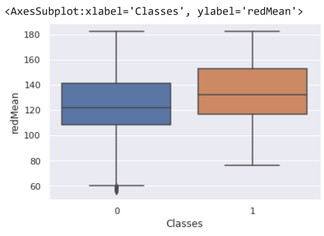
```
sns.boxplot( x=df["Classes"], y=df["Entropy0"] )
```

```
<AxesSubplot:xlabel='Classes', ylabel='Entropy0'>
```



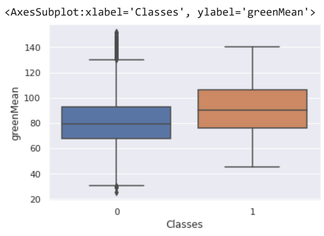

```
sns.boxplot( x=df["Classes"], y=df["redMean"] )
```

```
<AxesSubplot:xlabel='Classes', ylabel='redMean'>
```



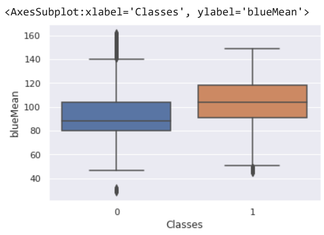

```
sns.boxplot( x=df["Classes"], y=df["greenMean"] )
```

```
<AxesSubplot:xlabel='Classes', ylabel='greenMean'>
```



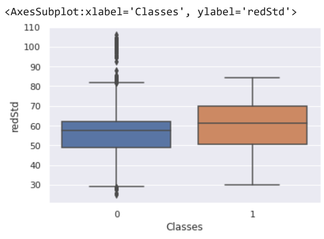

```
sns.boxplot( x=df["Classes"], y=df["blueMean"] )
```

```
<AxesSubplot:xlabel='Classes', ylabel='blueMean'>
```



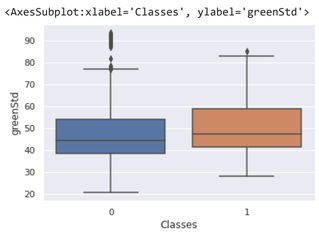

```
sns.boxplot( x=df["Classes"], y=df["redStd"] )
```

```
<AxesSubplot:xlabel='Classes', ylabel='redStd'>
```



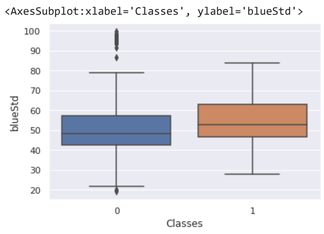

```
sns.boxplot( x=df["Classes"], y=df["greenStd"])
```

```
<AxesSubplot:xlabel='Classes', ylabel='greenStd'>
```



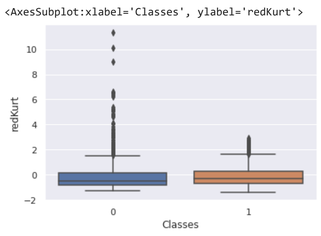

```
sns.boxplot( x=df["Classes"], y=df["blueStd"])
```

```
<AxesSubplot:xlabel='Classes', ylabel='blueStd'>
```




```
sns.boxplot(x=df["Classes"],y=df["redKurt"])
```

```
<AxesSubplot:xlabel='Classes', ylabel='redKurt'>
```



Defing X and y

```
X = df.drop('Classes', axis=1)

y = df['Classes']
```

Splitting test train dataset

```
X_train, X_val, y_train, y_val = train_test_split(X, y, test_size=0.20)
import seaborn as sns
from sklearn.model_selection import train_test_split
from mlxtend.plotting import plot_decision_regions
```

Creating the KNN model and training it

```
from sklearn.neighbors import KNeighborsClassifier
classifier1= KNeighborsClassifier(n_neighbors=10, metric='minkowski', p=2 )
classifier1.fit(X_train, y_train)
y_pred1 = classifier1.predict(X_val)
print("training set score: %f" % classifier1.score(X_train, y_train))
print("test set score: %f" % classifier1.score(X_val, y_val))
```

```
training set score: 0.985684
test set score: 0.982833
```

Defining test dataset

```
test_data = ('/content/drive/MyDrive/Val_Data')
```

Feature extraction of test dataset

```
featuresTest = {}

featuresTest['redMean'] = []
featuresTest['blueMean'] = []
featuresTest['greenMean'] = []

featuresTest['redStd'] = []
featuresTest['blueStd'] = []
featuresTest['greenStd'] = []

featuresTest['redSkew'] = []
featuresTest['blueSkew'] = []
featuresTest['greenSkew'] = []

featuresTest['redKurt'] = []
featuresTest['blueKurt'] = []
featuresTest['greenKurt'] = []

featuresTest['Entropy0'] = []

featuresTest['filename'] = []

for img in (os.listdir(test_data)):
  p = os.path.join(test_data,img)
  image = io.imread(p)

  img_gs = cv2.imread(p,cv2.IMREAD_GRAYSCALE)
  img_gs = skimage.feature.graycomatrix(img_gs, [1], [np.pi/2])

  featuresTest['Entropy0'].append(skimage.measure.shannon_entropy(np.reshape(img_gs,(256,256))))

  imgRed = image[:,:,0]
  featuresTest['redMean'].append(np.mean(imgRed))
  featuresTest['redStd'].append(np.std(imgRed))
  featuresTest['redSkew'].append(np.mean(skew(imgRed)))
  featuresTest['redKurt'].append(np.mean(kurtosis(imgRed)))

  imgBlue = image[:,:,1]
  featuresTest['blueMean'].append(np.mean(imgBlue))
  featuresTest['blueStd'].append(np.std(imgBlue))
  featuresTest['blueSkew'].append(np.mean(skew(imgBlue)))
  featuresTest['blueKurt'].append(np.mean(kurtosis(imgBlue)))

  imgGreen = image[:,:,2]
  featuresTest['greenMean'].append(np.mean(imgGreen))
  featuresTest['greenStd'].append(np.std(imgGreen))
  featuresTest['greenSkew'].append(np.mean(skew(imgGreen)))
  featuresTest['greenKurt'].append(np.mean(kurtosis(imgGreen)))

  featuresTest['filename'].append(img)
```

Defining test dataframe

```
test_dataFrame = pd.DataFrame.from_dict(featuresTest)
test_dataFrame.to_csv('df_test', index = False)
df_test = pd.read_csv("/content/df_test")
df_test
```

	redMean	blueMean	greenMean	redStd	blueStd	greenStd	redSkew	blueSkew	greenSkew	redKurt	blueKurt	greenKurt	Entropy0	filename
0	99.935784	77.306701	75.807681	68.586542	67.473707	68.163187	0.121908	0.264280	0.249352	-0.217026	-0.013612	0.028906	0.968482	C0244.png
1	144.324497	109.523220	100.062373	52.264815	54.267410	51.301800	-0.690451	-0.388255	-0.265980	-0.252370	-0.555816	-0.586401	0.810054	D0052.png
2	125.424712	85.454560	61.644957	65.695856	50.991141	40.938567	0.072912	0.342752	0.563319	-1.054245	-1.012501	-0.622670	0.800759	G0431.png
3	100.724776	78.663064	64.495352	50.668108	41.955875	35.792996	0.048022	0.156672	0.304281	-0.944333	-0.774874	-0.454704	0.789663	S0192.png
4	155.545363	103.260203	81.476683	43.054839	43.978437	30.738342	-0.353497	-0.065145	0.044513	-0.094703	1.220828	0.900246	0.708961	J0317.png
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
95	154.648004	118.474335	103.350249	49.787342	44.329519	41.203775	-1.378768	-1.213683	-1.110791	1.396813	0.822391	0.739330	0.824516	v0034.png
96	113.281725	73.580722	66.643832	69.262189	62.366783	57.919916	-0.340664	-0.039570	0.057255	-0.690446	-0.499913	-0.126881	0.869370	y0216.png
97	160.783656	131.044441	114.021580	64.908041	52.466674	46.279196	-0.293841	-0.220263	-0.136658	-0.067699	-0.308167	-0.446460	0.912897	r0158.png
98	117.984746	95.702672	88.923693	69.636340	70.487120	65.642590	-0.227535	0.043672	0.062288	-0.128469	-0.110581	-0.242273	0.640735	o0480.png
99	116.293214	94.055367	84.862796	74.501097	73.286328	69.705073	-0.075629	0.231757	0.280564	-0.415237	0.150935	0.411414	1.100493	a1001.png

100 rows × 14 columns

Defining X_test

```
X_test = df_test.drop('filename', axis = 1)
```

```
Y_test=classifier1.predict(X_test)
```

Making the prediction

```
Y_test
```

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

Assigning prediction values with corresponding classes

```
classes = []
for pred in Y_test:
  if(pred < 0.5): classes.append('drowsy')
  else: classes.append('non-drowsy')
```

```
test_dataFrame['class'] = classes
```

Creating resultant dataframe

Creating resultant dataframe

```
res_dataframe = test_dataFrame[['filename','class']]
```

```
res_dataframe
```

	filename	class
0	C0244.png	drowsy
1	D0052.png	drowsy
2	G0431.png	drowsy
3	S0192.png	drowsy
4	J0317.png	drowsy
...	...	...
95	v0034.png	non-drowsy
96	y0216.png	non-drowsy
97	r0158.png	non-drowsy
98	o0480.png	non-drowsy
99	a1001.png	non-drowsy

100 rows × 2 columns