Assignment No.1

Title: Principal Component Analysis(PCA)

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Batch :C

In [1]:
```
import pandas as pd
import seaborn as sns
import sklearn as sk
import matplotlib.pyplot as plt
%matplotlib inline
```

In [3]:
```
df = pd.read_csv("/home/admin1/winequalityN.csv")
```

In [5]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 6497 entries, 0 to 6496
Data columns (total 13 columns):
 #   Column                Non-Null Count  Dtype  
---  ------                --------------  -----  
 0   type                  6497 non-null   object 
 1   fixed acidity         6487 non-null   float64
 2   volatile acidity      6489 non-null   float64
 3   citric acid           6494 non-null   float64
 4   residual sugar        6495 non-null   float64
 5   chlorides             6495 non-null   float64
 6   free sulfur dioxide   6497 non-null   float64
 7   total sulfur dioxide  6497 non-null   float64
 8   density               6497 non-null   float64
 9   pH                    6488 non-null   float64
 10  sulphates             6493 non-null   float64
 11  alcohol               6497 non-null   float64
 12  quality               6497 non-null   int64  
dtypes: float64(11), int64(1), object(1)
memory usage: 660.0+ KB
```

In [7]:
```
df.describe()
```

Out[7]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	t
count	6487.000000	6489.000000	6494.000000	6495.000000	6495.000000	6497.000000	6
mean	7.216579	0.339691	0.318722	5.444326	0.056042	30.525319	
std	1.296750	0.164649	0.145265	4.758125	0.035036	17.749400	
min	3.800000	0.080000	0.000000	0.600000	0.009000	1.000000	
25%	6.400000	0.230000	0.250000	1.800000	0.038000	17.000000	
50%	7.000000	0.290000	0.310000	3.000000	0.047000	29.000000	
75%	7.700000	0.400000	0.390000	8.100000	0.065000	41.000000	
max	15.900000	1.580000	1.660000	65.800000	0.611000	289.000000	

In [9]:
```
df.isnull().sum()
```

Out[9]:
```
type                    0
fixed acidity          10
volatile acidity        8
citric acid             3
residual sugar          2
chlorides               2
free sulfur dioxide     0
total sulfur dioxide    0
density                 0
pH                      9
sulphates               4
alcohol                 0
quality                 0
dtype: int64
```

In [11]:
```
df.isnull().sum()
```

Out[11]:
```
type                    0
fixed acidity          10
volatile acidity        8
citric acid             3
residual sugar          2
chlorides               2
free sulfur dioxide     0
total sulfur dioxide    0
density                 0
pH                      9
sulphates               4
alcohol                 0
quality                 0
dtype: int64
```

In [13]:
```
df.isna().sum()
```

Out[13]:
```
type                   0
fixed acidity         10
volatile acidity       8
citric acid            3
residual sugar         2
chlorides              2
free sulfur dioxide    0
total sulfur dioxide   0
density                0
pH                     9
sulphates              4
alcohol                0
quality                0
dtype: int64
```

In [15]:
```
df1 = df.copy()
```

In [17]:
```
import warnings
warnings.filterwarnings('ignore')
```

In [19]:
```
df1.dropna(inplace =True)
```

In [21]:
```
df1.isnull().sum()
```

Out[21]:
```
type                   0
fixed acidity          0
volatile acidity       0
citric acid            0
residual sugar         0
chlorides              0
free sulfur dioxide    0
total sulfur dioxide   0
density                0
pH                     0
sulphates              0
alcohol                0
quality                0
dtype: int64
```

In [23]:
```
df1['type'].value_counts()
```

Out[23]:
```
type
white    4870
red      1593
Name: count, dtype: int64
```

In [25]:
```
from sklearn.preprocessing import LabelEncoder
le = LabelEncoder()
df1['type'] = le.fit_transform(df1['type'])
```

In [27]:
```
df1
```

Out[27]:

	type	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH
0	1	7.0	0.270	0.36	20.7	0.045	45.0	170.0	1.00100	3.00
1	1	6.3	0.300	0.34	1.6	0.049	14.0	132.0	0.99400	3.30
2	1	8.1	0.280	0.40	6.9	0.050	30.0	97.0	0.99510	3.26
3	1	7.2	0.230	0.32	8.5	0.058	47.0	186.0	0.99560	3.19
4	1	7.2	0.230	0.32	8.5	0.058	47.0	186.0	0.99560	3.19
...	...	...	...	...	...	...	...	...	...	...
6491	0	6.8	0.620	0.08	1.9	0.068	28.0	38.0	0.99651	3.42
6492	0	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45
6494	0	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42
6495	0	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57
6496	0	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39

6463 rows × 13 columns

In [29]:
```
x = df1.drop('type', axis=1)
y = df1['type']
```

In [31]:
```
x
```

Out[31]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulph
0	7.0	0.270	0.36	20.7	0.045	45.0	170.0	1.00100	3.00	
1	6.3	0.300	0.34	1.6	0.049	14.0	132.0	0.99400	3.30	
2	8.1	0.280	0.40	6.9	0.050	30.0	97.0	0.99510	3.26	
3	7.2	0.230	0.32	8.5	0.058	47.0	186.0	0.99560	3.19	
4	7.2	0.230	0.32	8.5	0.058	47.0	186.0	0.99560	3.19	
...	...	...	...	...	...	...	...	...	...	
6491	6.8	0.620	0.08	1.9	0.068	28.0	38.0	0.99651	3.42	
6492	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45	
6494	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42	
6495	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57	
6496	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39	

6463 rows × 12 columns

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

Out[33]:
```
0       1
1       1
2       1
3       1
4       1
       ..
6491    0
6492    0
6494    0
6495    0
6496    0
Name: type, Length: 6463, dtype: int64
```

In [35]:
```
from sklearn.preprocessing import StandardScaler
sta = StandardScaler()
x_scaled = sta.fit_transform(x)
```

In [37]:
```
from sklearn.decomposition import PCA
model = PCA(n_components=5)
```

In [39]:
```
data_pca = model.fit_transform(x_scaled)
```

In [41]:
```
data_pca
```

Out[41]:
```
array([[ 2.49836923,  3.16466701, -0.10742263,  0.09531147,  1.91336261],
       [-0.08269753, -0.47392403, -0.4210178 , -0.16154951, -0.37486192],
       [ 0.18303919,  0.29170561,  0.52759909, -0.22941658,  0.4508861 ],
       ...,
       [-2.20830864, -0.65283135, -1.29031679,  1.41103409,  0.07446737],
       [-2.53751532, -0.21505932, -2.6294559 ,  1.11390783, -0.50310317],
       [-1.17991877, -0.62370364,  0.32226459,  1.0176013 , -0.22178485]])
```

In [328…
```
model.explained_variance_
```

Out[328…
```
array([3.04385697, 2.64958447, 1.64109737, 1.06870618, 0.841535  ])
```

In [49]:
```
model.score
```

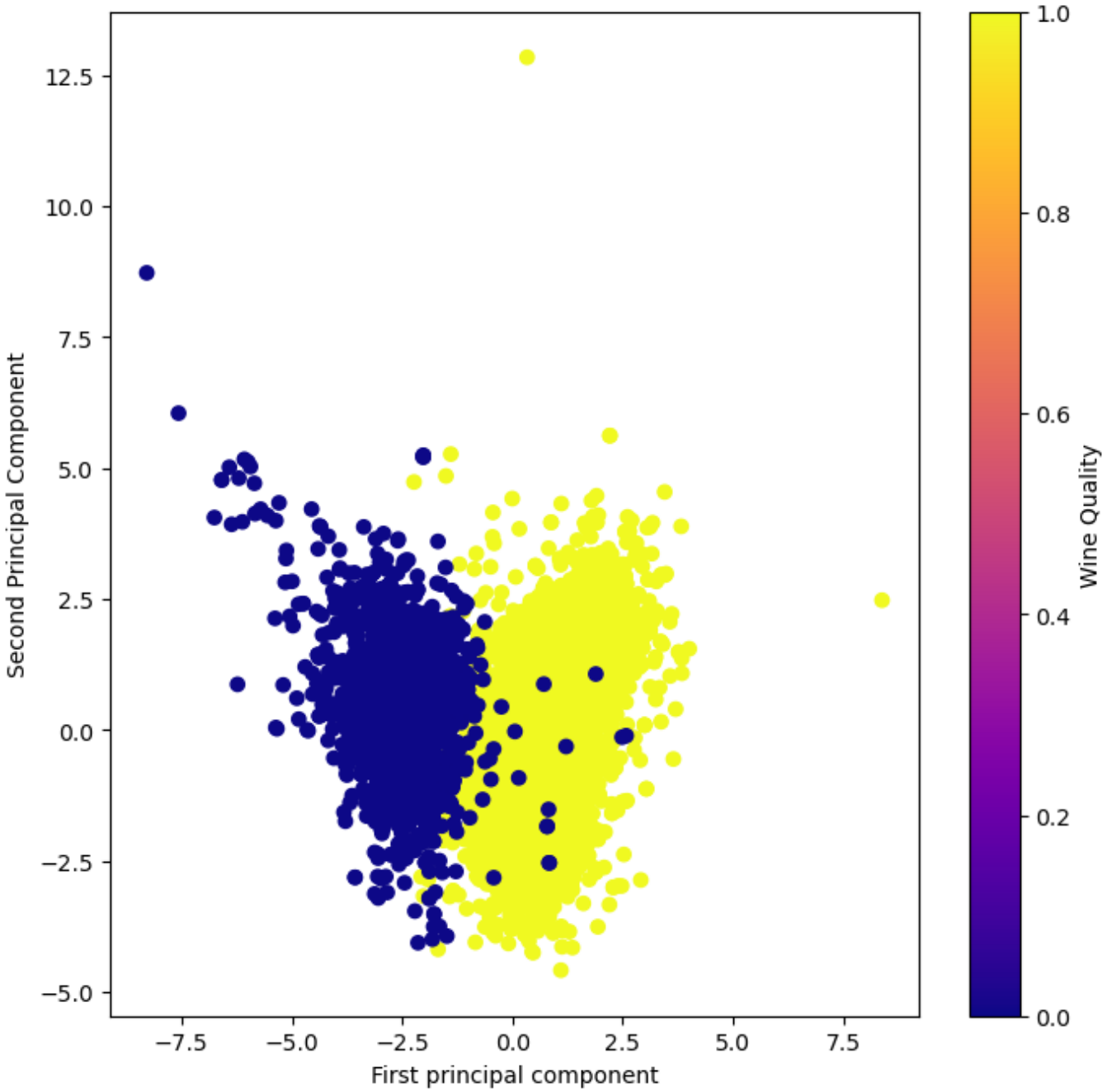
Out[49]:
```
<bound method PCA.score of PCA(n_components=5)>
```

In [51]:
```
model.explained_variance_ratio_
```

Out[51]:
```
array([0.2536155 , 0.22076454, 0.13673695, 0.08904507, 0.07011707])
```

In [53]:
```
plt.figure(figsize=(8,8))
plt.scatter(data_pca[:,0],data_pca[:,1],c=df1['type'],cmap='plasma')
plt.colorbar(label='Wine Quality')
plt.xlabel('First principal component')
plt.ylabel('Second Principal Component')
```

Out[53]:
```
Text(0, 0.5, 'Second Principal Component')
```



In [55]:
```
from sklearn.model_selection import train_test_split
x_train, x_test, y_train, y_test = train_test_split(data_pca, y, test_size=0.2, rando
```

In [57]:
```
from sklearn.neighbors import KNeighborsClassifier
model = KNeighborsClassifier()
model.fit(x_train, y_train)
```

Out[57]:
```
▾ KNeighborsClassifier
KNeighborsClassifier()
```

In [59]:
```
y_pred = model.predict(x_test)
```

In [61]:
```
from sklearn.linear_model import LogisticRegression
model1 = LogisticRegression()
model1.fit(x_train,y_train)
```

Out[61]:
```
▾ LogisticRegression
LogisticRegression()
```

In [63]:
```
y_pred1 = model1.predict(x_test)
```

In [65]:
```
from sklearn.metrics import accuracy_score,classification_report
acc = accuracy_score(y_test, y_pred)
cr = classification_report(y_test,y_pred)
print(cr)
print("Accuracy after PCA on KNn:", acc)
```

```
              precision    recall  f1-score   support

           0       0.97      0.97      0.97       322
           1       0.99      0.99      0.99       971

    accuracy                           0.99      1293
   macro avg       0.98      0.98      0.98      1293
weighted avg       0.99      0.99      0.99      1293

Accuracy after PCA on KNn: 0.9853054911059551
```

In [67]:
```
cr1 = classification_report(y_test,y_pred1)
print(cr1)
acc1 = accuracy_score(y_test, y_pred1)
print("Accuracy after PCA on Logistic regression:", acc1)
```

```
              precision    recall  f1-score   support

           0       0.96      0.98      0.97       322
           1       0.99      0.99      0.99       971

    accuracy                           0.99      1293
   macro avg       0.98      0.98      0.98      1293
weighted avg       0.99      0.99      0.99      1293

Accuracy after PCA on Logistic regression: 0.9853054911059551
```

In [ ]:

In [ ]: