Wine Quality Prediction

Objective

This data frame contains the following columns:

Input variables (based on physicochemical tests):
1 - fixed acidity
2 - volatile acidity
3 - citric acid
4 - residual sugar
5 - chlorides
6 - free sulfur dioxide
7 - total sulfur dioxide
8 - density
9 - pH
10 - sulphates
11 - alcohol
Output variable (based on sensory data):
12 - quality (score between 0 and 10)

```
#import library
import pandas as pd
import numpy as np
```

```
#importing CSV file
df = pd.read_csv('winequality-red.csv')
```

```
# to get first five rows of dataset
df.head()
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality
0	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	9.4	5
1	7.8	0.88	0.00	2.6	0.098	25.0	67.0	0.9968	3.20	0.68	9.8	5
2	7.8	0.76	0.04	2.3	0.092	15.0	54.0	0.9970	3.26	0.65	9.8	5
3	11.2	0.28	0.56	1.9	0.075	17.0	60.0	0.9980	3.16	0.58	9.8	6

```
#to get information of dataset
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 1599 entries, 0 to 1598
Data columns (total 12 columns):
 #   Column                Non-Null Count  Dtype
---  ------                --------------  -----
 0   fixed acidity         1599 non-null   float64
 1   volatile acidity      1599 non-null   float64
 2   citric acid           1599 non-null   float64
 3   residual sugar        1599 non-null   float64
 4   chlorides             1599 non-null   float64
 5   free sulfur dioxide   1599 non-null   float64
 6   total sulfur dioxide  1599 non-null   float64
 7   density               1599 non-null   float64
 8   pH                    1599 non-null   float64
 9   sulphates             1599 non-null   float64
 10  alcohol               1599 non-null   float64
 11  quality               1599 non-null   int64
dtypes: float64(11), int64(1)
memory usage: 150.0 KB
```

```
# for shape i.e No.of rows and columns
df.shape
```

```
(1599, 12)
```

```
# Get unique values of variable Y
df['quality'].value_counts()
```

```
quality
5    681
6    638
7    199
4     53
8     18
3     10
Name: count, dtype: int64
```

```
df.groupby('quality').mean()
```

quality	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol
3	8.360000	0.884500	0.171000	2.635000	0.122500	11.000000	24.900000	0.997464	3.398000	0.570000	9.955000
4	7.779245	0.693962	0.174151	2.694340	0.090679	12.264151	36.245283	0.996542	3.381509	0.596415	10.265094
5	8.167254	0.577041	0.243686	2.528855	0.092736	16.983847	56.513950	0.997104	3.304949	0.620969	9.899706
6	8.347179	0.497484	0.273824	2.477194	0.084956	15.711599	40.869906	0.996615	3.318072	0.675329	10.629519
7	8.872362	0.403920	0.375176	2.720603	0.076588	14.045226	35.020101	0.996104	3.290754	0.741256	11.465913

```
#Define Y(dependent) and X(independent) variables
x = df.drop(['quality'],axis=1)
y = df['quality']
```

```
x.shape,y.shape
```

```
((1599, 11), (1599,))
```

```
from re import S
from sklearn.preprocessing import StandardScaler
S_scaler = StandardScaler() # assining
x_scaled = S_scaler.fit_transform(x) # scled data
x_scaled
```

```
array([[-0.52835961,  0.96187667, -1.39147228, ...,  1.28864292,
        -0.57920652, -0.96024611],
       [-0.29854743,  1.96744245, -1.39147228, ..., -0.7199333 ,
         0.1289504 , -0.58477711],
       [-0.29854743,  1.29706527, -1.18607043, ..., -0.33117661,
        -0.04808883, -0.58477711],
       ...,
       [-1.1603431 , -0.09955388, -0.72391627, ...,  0.70550789,
         0.54204194,  0.54162988],
       [-1.39015528,  0.65462046, -0.77526673, ...,  1.6773996 ,
         0.30598963, -0.20930812],
       [-1.33270223, -1.21684919,  1.02199944, ...,  0.51112954,
         0.01092425,  0.54162988]])
```

```
#split train and test data
from sklearn.model_selection import train_test_split
x_train,x_test,y_train,y_test = train_test_split(x_scaled,y,test_size=0.2,random_state=42)
```

```
x_train.shape,x_test.shape,y_train.shape,y_test.shape
```

```
((1279, 11), (320, 11), (1279,), (320,))
```

```
#importing libraries for Scaling which preprocesses the data
from sklearn.svm import SVC
model = SVC()
model.fit(x_train,y_train)
```

```
SVC()
```

```
from sklearn.linear_model import LinearRegression
LR = LinearRegression()
LR.fit(x_train,y_train)
```

```
▾ LinearRegression
LinearRegression()
```

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

```
array([5, 5, 6, 5, 6, 5, 5, 5, 6, 6, 6, 5, 6, 5, 5, 6, 5, 6, 7, 5, 5, 5,
       6, 6, 5, 5, 6, 5, 5, 6, 5, 5, 6, 5, 5, 6, 6, 6, 6, 5, 6, 5,
       6, 6, 6, 6, 5, 6, 5, 5, 6, 7, 5, 5, 6, 5, 6, 5, 6, 6, 5, 5, 6, 5,
       6, 5, 7, 5, 6, 5, 6, 6, 6, 5, 7, 5, 6, 7, 5, 7, 5, 5, 6, 6, 5, 6,
       6, 5, 6, 5, 5, 6, 5, 5, 6, 5, 6, 5, 5, 5, 5, 6, 6, 6, 6, 6, 5, 6, 5,
       6, 5, 6, 5, 6, 6, 6, 5, 5, 6, 6, 6, 6, 5, 5, 5, 6, 6, 5, 6, 6, 5,
       5, 6, 6, 5, 5, 5, 5, 6, 6, 6, 6, 5, 6, 5, 6, 5, 6, 5, 6, 6, 5, 6,
       6, 6, 5, 6, 5, 6, 6, 6, 6, 5, 5, 6, 5, 5, 5, 5, 5, 5, 6, 5, 7, 6,
       6, 5, 5, 5, 5, 6, 5, 7, 5, 6, 6, 6, 7, 5, 6, 6, 5, 6, 6, 5, 5, 5,
       6, 6, 5, 5, 5, 5, 7, 6, 5, 5, 6, 5, 7, 5, 6, 6, 6, 6, 6, 5, 6, 5,
       5, 6, 6, 6, 5, 5, 5, 7, 5, 5, 5, 5, 6, 6, 5, 6, 5, 6, 6, 5, 5, 5,
       6, 6, 5, 6, 6, 5, 6, 5, 6, 5, 5, 6, 5, 5, 5, 6, 6, 6, 6, 6, 5, 7,
       6, 6, 5, 5, 6, 6, 5, 6, 5, 5, 6, 5, 6, 6, 6, 5, 7, 5, 5, 5, 5, 6,
       5, 6, 5, 6, 5, 7, 6, 5, 5, 6, 5, 6, 6, 6, 5, 5, 6, 5, 5, 5, 6, 6,
       6, 7, 6, 6, 6, 6, 5, 6, 5, 5, 6, 5])
```

```
from sklearn.metrics import accuracy_score
accuracy_score1 = accuracy_score(y_test,y_pred)
print(accuracy_score1)
```

```
0.603125
```

```
y_pred.shape
```

```
(320,)
```

```
from sklearn.metrics import confusion_matrix,classification_report
cm = confusion_matrix(y_test,y_pred)
print(cm)
```

```
[[ 0  0  1  0  0  0]
 [ 0  0  8  2  0  0]
 [ 0  0 99 31  0  0]
 [ 0  0 43 85  4  0]
 [ 0  0  1 32  9  0]
 [ 0  0  0  2  3  0]]
```

```
cr = classification_report(y_test,y_pred)
print(cr)
```

```
              precision    recall  f1-score   support

           3       0.00      0.00      0.00         1
           4       0.00      0.00      0.00        10
           5       0.65      0.76      0.70       130
           6       0.56      0.64      0.60       132
           7       0.56      0.21      0.31        42
           8       0.00      0.00      0.00         5

    accuracy                           0.60       320
   macro avg       0.30      0.27      0.27       320
weighted avg       0.57      0.60      0.57       320

/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are i
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are i
  _warn_prf(average, modifier, msg_start, len(result))
/usr/local/lib/python3.10/dist-packages/sklearn/metrics/_classification.py:1344: UndefinedMetricWarning: Precision and F-score are i
  _warn_prf(average, modifier, msg_start, len(result))
```

Prediction

```
df_new = df.sample(1) #randomly selects a row from all data. using that row for prediction
df_new
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality

```
x_new = df_new.drop(['quality'],axis=1)
x_new = S_scaler.fit_transform(x_new)


y_pred1 = model.predict(x_new)
y_pred1
```

```
array([6])
```

```
df_new2 = df.sample(1)
df_new2
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol	quality

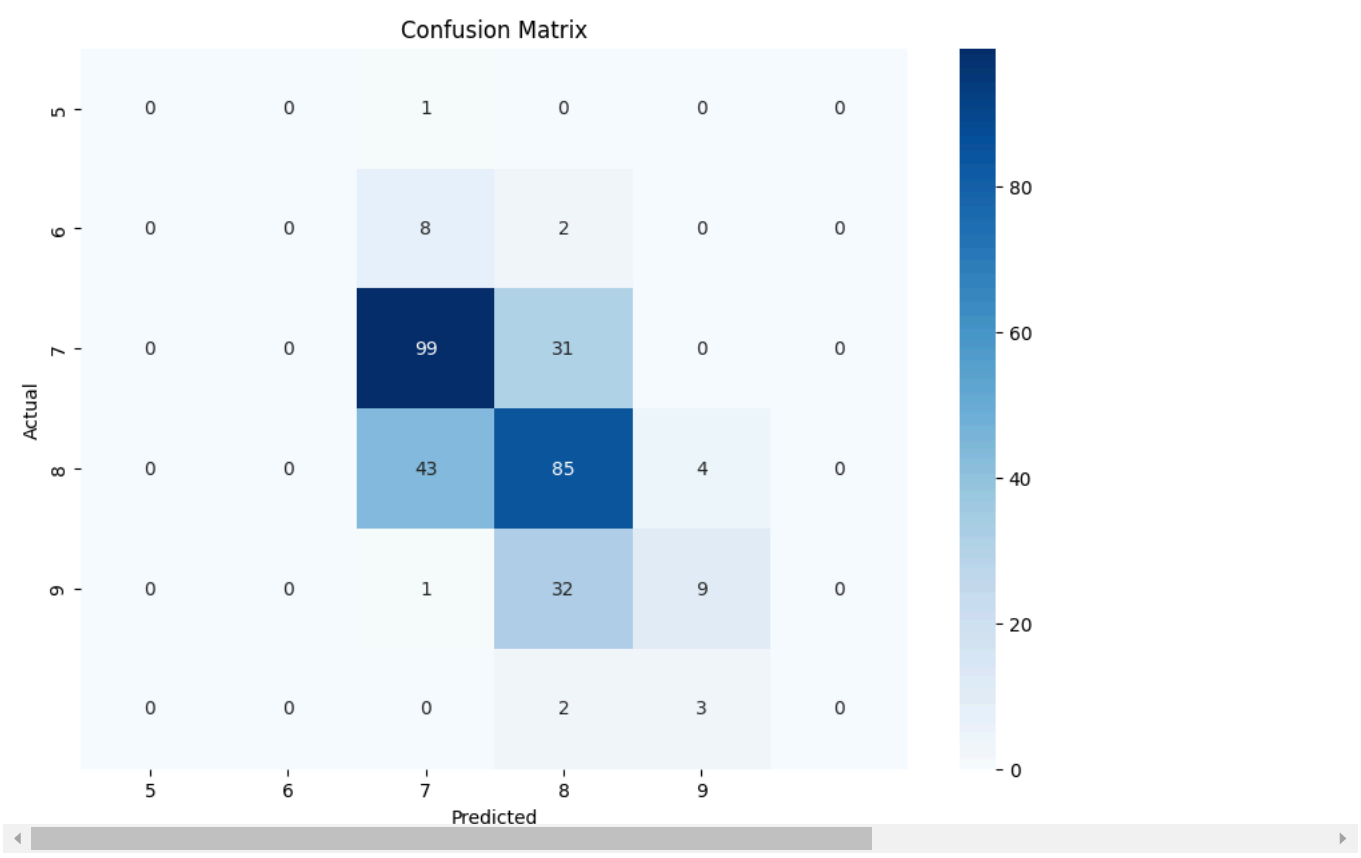
```
x_new2 = df_new2.drop(['quality'],axis=1)
x_new2 = S_scaler.fit_transform(x_new2)


y_pred2 = model.predict(x_new2)
y_pred2
```

```
array([6])
```

```
from sklearn.metrics import accuracy_score
print(accuracy_score(y_test,y_pred))
```

```
0.603125
```

```
import matplotlib.pyplot as plt
import seaborn as sns
plt.figure(figsize=(10, 7))
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues', xticklabels=[5, 6, 7, 8, 9], yticklabels=[5, 6, 7, 8, 9])
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.title('Confusion Matrix')
plt.show()
```



Overview and Explanation

I aimed to predict the quality of wine using a dataset obtained from Kaggle. The dataset includes various chemical properties of wine along with a quality rating. I utilized several machine learning techniques and libraries to build and evaluate my predictive model.

Libraries and Tools Used:

Pandas: For data manipulation and analysis. **NumPy**: For numerical operations. **Scikit-learn(sklearn)**: For machine learning models and evaluation metrics. **Matplotlib and Seaborn**: For data visualization.

Dataset Acquisition: The dataset from Kaggle provides a rich source of data for training and evaluating the model.

Libraries: Each library plays a specific role in data handling, model training, and visualization, making the process efficient and effective.

Data Preprocessing: Ensures that the data is clean and ready for modeling, which is crucial for accurate predictions.

Splitting the Data: Helps in evaluating the model's performance on unseen data, ensuring that the model generalizes well. Model Selection: SVC is a robust choice for classification tasks, especially with high-dimensional data.

Model Evaluation: Using confusion matrix and classification report provides a comprehensive view of the model's performance, highlighting areas of strength and weakness.

Prediction and Visualization: Visualizing the results helps in interpreting the model's performance and understanding its predictive capabilities.