Importing the Dependencies

```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score
```

Data Collection

```
# loading the dataset to a Pandas DataFrame
wine_dataset = pd.read_csv('/content/winequality-red (2).csv')
```

```
# number of rows & columns in the dataset
wine_dataset.shape
```

```
(1599, 12)
```

```
# first 5 rows of the dataset
wine_dataset.head()
```

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

```
# checking for missing values
wine_dataset.isnull().sum()
```

```
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
```

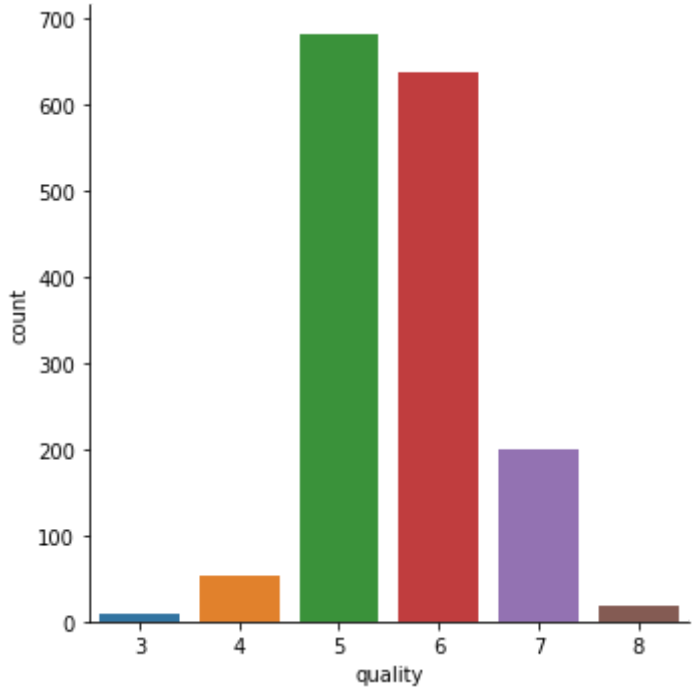
Data Analysis and Visulaization

```
# statistical measures of the dataset
wine_dataset.describe()
```

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	dens
count	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000000	1599.000
mean	8.319637	0.527821	0.270976	2.538806	0.087467	15.874922	46.467792	0.996

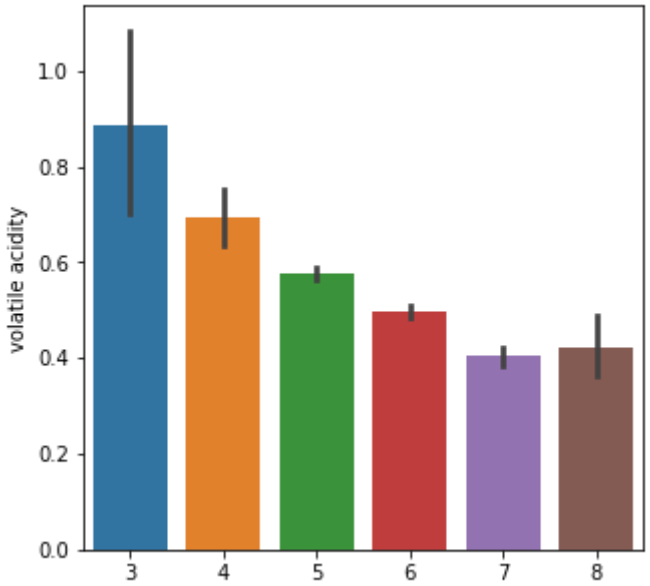
```
# number of values for each quality
sns.catplot(x='quality', data = wine_dataset, kind = 'count')
```

```
<seaborn.axisgrid.FacetGrid at 0x7ff9f38ac590>
```




```
# volatile acidity vs Quality
plot = plt.figure(figsize=(5,5))
sns.barplot(x='quality', y = 'volatile acidity', data = wine_dataset)
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff9efac2990>
```



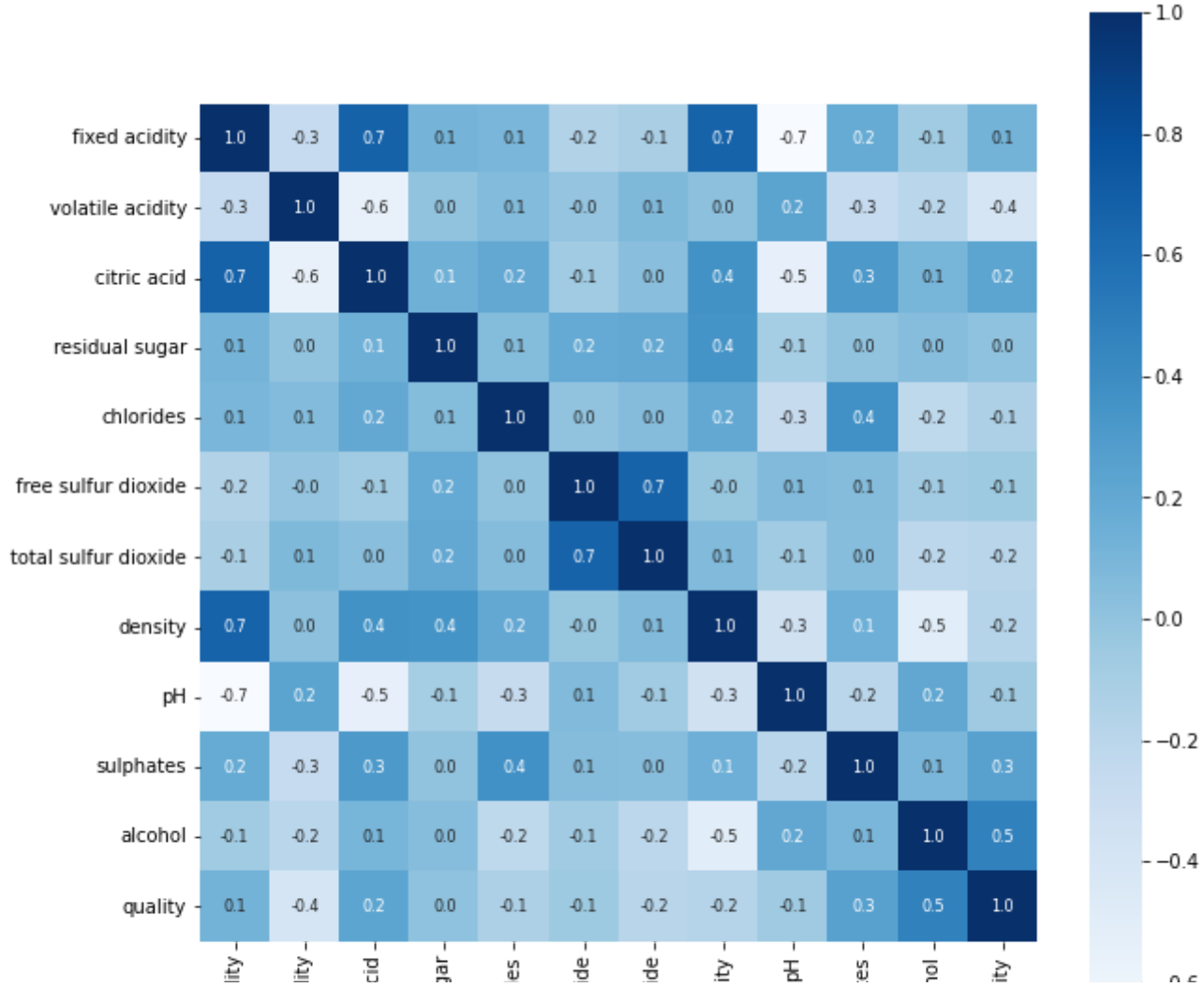
Correlation

1. Positive Correlation
2. Negative Correlation

```
correlation = wine_dataset.corr()
```

```
# constructing a heatmap to understand the correlation between the columns
plt.figure(figsize=(10,10))
sns.heatmap(correlation, cbar=True, square=True, fmt = '.1f', annot = True, annot_kws={'size':8}, cmap = 'Blues')
```

```
<matplotlib.axes._subplots.AxesSubplot at 0x7ff9ee2dd550>
```




```
# separate the data and Label
X = wine_dataset.drop('quality',axis=1)
```

```
print(X)
```

```
      fixed acidity  volatile acidity  citric acid  ...    pH  sulphates  alcohol
0               7.4             0.700         0.00  ...  3.51       0.56      9.4
```

```
1              7.8             0.880         0.00  ...  3.20       0.68      9.8
2              7.8             0.760         0.04  ...  3.26       0.65      9.8
3             11.2             0.280         0.56  ...  3.16       0.58      9.8
4              7.4             0.700         0.00  ...  3.51       0.56      9.4
...            ...               ...          ...  ...   ...        ...      ...
1594           6.2             0.600         0.08  ...  3.45       0.58     10.5
1595           5.9             0.550         0.10  ...  3.52       0.76     11.2
1596           6.3             0.510         0.13  ...  3.42       0.75     11.0
1597           5.9             0.645         0.12  ...  3.57       0.71     10.2
1598           6.0             0.310         0.47  ...  3.39       0.66     11.0

[1599 rows x 11 columns]
```

Label Binarizaton

```
Y = wine_dataset['quality'].apply(lambda y_value: 1 if y_value>=7 else 0)
```

```
print(Y)
```

```
0       0
1       0
2       0
3       0
4       0
       ..
1594    0
1595    0
1596    0
1597    0
1598    0
Name: quality, Length: 1599, dtype: int64
```

Train & Test Split

```
X_train, X_test, Y_train, Y_test = train_test_split(X, Y, test_size=0.2, random_state=3)
```

```
print(Y.shape, Y_train.shape, Y_test.shape)
```

```
(1599,) (1279,) (320,)
```

Model Training:

Random Forest Classifier

```
model = RandomForestClassifier()
```

```
model.fit(X_train, Y_train)
```

```
RandomForestClassifier(bootstrap=True, ccp_alpha=0.0, class_weight=None,
                       criterion='gini', max_depth=None, max_features='auto',
                       max_leaf_nodes=None, max_samples=None,
                       min_impurity_decrease=0.0, min_impurity_split=None,
                       min_samples_leaf=1, min_samples_split=2,
                       min_weight_fraction_leaf=0.0, n_estimators=100,
                       n_jobs=None, oob_score=False, random_state=None,
                       verbose=0, warm_start=False)
```

Model Evaluation

Accuracy Score

```
# accuracy on test data
X_test_prediction = model.predict(X_test)
test_data_accuracy = accuracy_score(X_test_prediction, Y_test)
```

```
print('Accuracy : ', test_data_accuracy)
```

```
Accuracy :  0.921875
```

Building a Predictive System

```
input_data = (7.5,0.5,0.36,6.1,0.071,17.0,102.0,0.9978,3.35,0.8,10.5)

# changing the input data to a numpy array
input_data_as_numpy_array = np.asarray(input_data)

# reshape the data as we are predicting the label for only one instance
input_data_reshaped = input_data_as_numpy_array.reshape(1,-1)

prediction = model.predict(input_data_reshaped)
print(prediction)

if (prediction[0]==1):
  print('Good Quality Wine')
else:
  print('Bad Quality Wine')
```

```
[0]
Bad Quality Wine
```

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