Practical implementattion of Decision Tree Algorithm

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Importing Necessary Library

In [56]:
```
## Importing Necessary Library
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score
from sklearn.model_selection import GridSearchCV

```

Importing CSV File

In [4]:
```
## Importing CSV File
df = pd.read_csv("https://raw.githubusercontent.com/shrikant-temburwar/Wine-
```

In [5]:
```
## Checking Top 5 Rows
df.head()
```

Out[5]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcohol
0	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	9.4
1	7.8	0.88	0.00	2.6	0.098	25.0	67.0	0.9968	3.20	0.68	9.8
2	7.8	0.76	0.04	2.3	0.092	15.0	54.0	0.9970	3.26	0.65	9.8
3	11.2	0.28	0.56	1.9	0.075	17.0	60.0	0.9980	3.16	0.58	9.8
4	7.4	0.70	0.00	1.9	0.076	11.0	34.0	0.9978	3.51	0.56	9.4

In [6]:
```
## Checking Bottom 5 Rows
df.tail()
```

Out[6]:

	fixed acidity	volatile acidity	citric acid	residual sugar	chlorides	free sulfur dioxide	total sulfur dioxide	density	pH	sulphates	alcoh
1594	6.2	0.600	0.08	2.0	0.090	32.0	44.0	0.99490	3.45	0.58	10
1595	5.9	0.550	0.10	2.2	0.062	39.0	51.0	0.99512	3.52	0.76	11
1596	6.3	0.510	0.13	2.3	0.076	29.0	40.0	0.99574	3.42	0.75	11
1597	5.9	0.645	0.12	2.0	0.075	32.0	44.0	0.99547	3.57	0.71	10
1598	6.0	0.310	0.47	3.6	0.067	18.0	42.0	0.99549	3.39	0.66	11

In [7]:
```
## Checking Shape of the Dataset, here there are total 1599 Rows and 12 Colu
df.shape
```

Out[7]:
```
(1599, 12)
```

In [8]:
```
## Checking Target Column Unique Details.
df['quality'].unique()
```

Out[8]:
```
array([5, 6, 7, 4, 8, 3], dtype=int64)
```

In [10]:
```
## Checking Length of target Columns Unique Details.
len(df['quality'].unique())
```

Out[10]:
```
6
```

In [9]:
```
## Checking Total Count of Target Columns Unique Details
df['quality'].value_counts()

```

Out[9]:
```
5    681
6    638
7    199
4     53
8     18
3     10
Name: quality, dtype: int64
```

In [11]:
```
## Checking Basic Statistics Analysis via Transpose
df.describe().T

```

Out[11]:

	count	mean	std	min	25%	50%	75%	max
fixed acidity	1599.0	8.319637	1.741096	4.60000	7.1000	7.90000	9.200000	15.90000
volatile acidity	1599.0	0.527821	0.179060	0.12000	0.3900	0.52000	0.640000	1.58000
citric acid	1599.0	0.270976	0.194801	0.00000	0.0900	0.26000	0.420000	1.00000
residual sugar	1599.0	2.538806	1.409928	0.90000	1.9000	2.20000	2.600000	15.50000
chlorides	1599.0	0.087467	0.047065	0.01200	0.0700	0.07900	0.090000	0.61100
free sulfur dioxide	1599.0	15.874922	10.460157	1.00000	7.0000	14.00000	21.000000	72.00000
total sulfur dioxide	1599.0	46.467792	32.895324	6.00000	22.0000	38.00000	62.000000	289.00000
density	1599.0	0.996747	0.001887	0.99007	0.9956	0.99675	0.997835	1.00369
pH	1599.0	3.311113	0.154386	2.74000	3.2100	3.31000	3.400000	4.01000
sulphates	1599.0	0.658149	0.169507	0.33000	0.5500	0.62000	0.730000	2.00000
alcohol	1599.0	10.422983	1.065668	8.40000	9.5000	10.20000	11.100000	14.90000
quality	1599.0	5.636023	0.807569	3.00000	5.0000	6.00000	6.000000	8.00000

In [12]:
```
## Checking Duplicate Rows in Dataset and there are total 240 Duplicate rows
df.duplicated().sum()

```

Out[12]:
```
240
```

In [13]:
```
## Droping Duplicate Rows from dataset.
df = df.drop_duplicates()

```

In [14]:
```
## Again Checking Duplicate Rows in dataset, Now Dupliacte Row is Zero after
df.duplicated().sum()

```

Out[14]:
```
0
```

Creating Independent Feature

In [16]:
```
X = df.drop("quality", axis =1)
```

Creating Dependent Feature

In [17]:
```
y = df['quality']
```

Model Building

In [18]:
```
from sklearn.model_selection import train_test_split,GridSearchCV
```

In [36]:
```
X_train,X_test,y_train,y_test = train_test_split(X, y, test_size=0.3, random
```

In [37]:
```
## Scaling is not Required in Decision tree Problem

'''
from sklearn.preprocessing import StandardScaler
sclr = StandardScaler()
sclr.fit()
sclr.transform()
'''
```

Out[37]:
```
'\nfrom sklearn.preprocessing import StandardScaler\nsclr = StandardScaler()\ns
clr.fit()\nsclr.transform()\n'
```

Using Decision Tree classifier Algorithm

In [38]:
```
from sklearn.tree import DecisionTreeClassifier
model  = DecisionTreeClassifier()
```

In [39]:
```
## Model Fitting with Decision Tree Classifier on Training dataset
model.fit(X_train,y_train)
```

Out[39]:
```
DecisionTreeClassifier

DecisionTreeClassifier()
```

In [40]:
```
model.score(X_train,y_train)
```

Out[40]:
```
1.0
```

In [41]:
```
## Model Prediction on Testing Dataset
y_predict = model.predict(X_test)
```

In [42]:
```
from sklearn.metrics import accuracy_score
```

In [43]:
```
## Accuracy of the Model using Decision Tree Classifier Algorithm
accuracy_score(y_test,y_predict)

```

Out[43]:
```
0.5073529411764706
```

Observations

- Getting 51% approx Model Accuracy using Decision Tree classifier Algorithm

In [44]:
```
## Try to check with diff.. diff.. Algorithm
### Logistic Regression, SVR,etc
## Going forward [DT,AB,XG]
## EXtra :- Do Feature Engineering Details by your own on above Dataset.
```

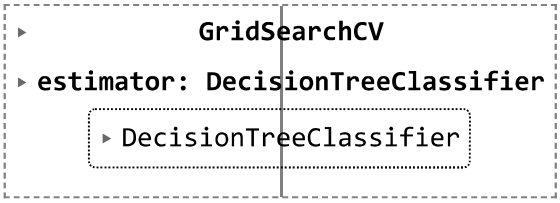
Applying GridSearchCV Hyperparameter tuning

In [46]:
```
## Applying Different different Parameter Using gridSearchCV

grid_param = {
    'criterion': ['gini', 'entropy'],
    'max_depth' : range(2,32,1),
    'min_samples_leaf' : range(1,10,1),
    'min_samples_split': range(2,10,1),
    'splitter' : ['best', 'random']

}
```

In [47]:
```
## Importing GridSearchCV Library

from sklearn.model_selection import GridSearchCV
grid_search = GridSearchCV(estimator= model, param_grid = grid_param, cv = 5

```

In [49]:
```
## GridSearchCV take a lot of time to RUN.
grid_search.fit(X_train,y_train)

```

Out[49]:



In [50]:
```
## Finding Best param Model using GridSearch
grid_search.best_params_

```

Out[50]:
```
{'criterion': 'gini',
 'max_depth': 4,
 'min_samples_leaf': 6,
 'min_samples_split': 7,
 'splitter': 'random'}
```

In [52]:
```
## Applying Best Param Model.
model_with_best_params = DecisionTreeClassifier( criterion = 'gini',
                                                 max_depth = 4,
                                                 min_samples_leaf = 6,
                                                 min_samples_split = 7,
                                                 splitter = 'random')

```

In [53]:
```
## Fitting Best Param Model to Training Dataset.
model_with_best_params.fit(X_train,y_train)

```

Out[53]:
```
DecisionTreeClassifier(max_depth=4, min_samples_leaf=6, min_samples_split=7,
                       splitter='random')
```

In [54]:
```
## Applying Prediction with Best Param Model
y_prediction2 = model_with_best_params.predict(X_test)

```

In [55]:
```
## Checking Accuracy of Model After Doing HyperParameter Tuning using GridSe
accuracy_score(y_test, y_prediction2)

```

Out[55]:
```
0.571078431372549
```

Observations

- Current Accuracy is Approx. 57% (After doing Hyperparameter Tuning)
- Previous Accuracy is Approx. 51% (Before hyperparameter Tuning)

Summary

- After Doing Hyperparameter Tuning Approx. 6% Accuracy improve.

Thank You