

## Tutorial No.5

IMPLEMENT FOLLOWING ALGORITHMS USING PYTHON ON SUITABLE DATA SETS. I. DECISION TREE II. NAÏVE BAYES III. RANDOM FOREST

```
[3]: import numpy as np
import pandas as pd
```

```
•[81]: dm=pd.read_csv('bankloan.csv')
```

```
[82]: df
```

	ID	Age	Experience	Income	ZIP.Code	Family	CCAvg	Education	Mortgage	Personal.Loan	Securities.Account	CD.Account	Online	CreditCard
0	1	25	1	49	91107	4	1.6	1	0	0	1	0	0	0
1	2	45	19	34	90089	3	1.5	1	0	0	1	0	0	0
2	3	39	15	11	94720	1	1.0	1	0	0	0	0	0	0
3	4	35	9	100	94112	1	2.7	2	0	0	0	0	0	0
4	5	35	8	45	91330	4	1.0	2	0	0	0	0	0	1
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
4995	4996	29	3	40	92697	1	1.9	3	0	0	0	0	1	0
4996	4997	30	4	15	92037	4	0.4	1	85	0	0	0	1	0
4997	4998	63	39	24	93023	2	0.3	3	0	0	0	0	0	0
4998	4999	65	40	49	90034	3	0.5	2	0	0	0	0	1	0
4999	5000	28	4	83	92612	3	0.8	1	0	0	0	0	1	1

5000 rows × 14 columns

```
[83]: import numpy as np
import pandas as pd
from sklearn.tree import DecisionTreeClassifier
from sklearn.model_selection import train_test_split
from sklearn import metrics
```

```
[84]: dm.head()
```

	ID	Age	Experience	Income	ZIP.Code	Family	CCAvg	Education	Mortgage	Personal.Loan	Securities.Account	CD.Account	Online	CreditCard
0	1	25	1	49	91107	4	1.6	1	0	0	1	0	0	0
1	2	45	19	34	90089	3	1.5	1	0	0	1	0	0	0
2	3	39	15	11	94720	1	1.0	1	0	0	0	0	0	0
3	4	35	9	100	94112	1	2.7	2	0	0	0	0	0	0
4	5	35	8	45	91330	4	1.0	2	0	0	0	0	0	1

```
[85]: from sklearn.preprocessing import LabelEncoder
```

```
[86]: le = LabelEncoder()
```

```
[87]: cols = ['Outlook', 'Temperature', 'Humidity', 'Wind', 'Play Tennis']
```

```
[20]: for col in cols:
    dm[col]=le.fit_transform(df[col])
dm.head()
```

```
[22]: dm
```

```
[22]:
```

	Outlook	Temperature	Humidity	Wind	Play Tennis
0	2	1	0	1	0
1	2	1	0	0	0
2	0	1	0	1	1
3	1	2	0	1	1
4	1	0	1	1	1
5	1	0	1	0	0
6	0	0	1	0	1
7	2	2	0	1	0
8	2	0	1	1	1
9	1	2	1	1	1
10	2	2	1	0	1
11	0	2	0	0	1
12	0	1	1	1	1
13	1	2	0	0	0

```
[24]: X = dm.drop(['Play Tennis'], axis = 1)
      y = dm['Play Tennis']
```

```
[25]: X
```

```
[25]:
```

	Outlook	Temperature	Humidity	Wind
0	2	1	0	1
1	2	1	0	0
2	0	1	0	1
3	1	2	0	1
4	1	0	1	1
5	1	0	1	0
6	0	0	1	0
7	2	2	0	1
8	2	0	1	1
9	1	2	1	1
10	2	2	1	0
11	0	2	0	0
12	0	1	1	1
13	1	2	0	0

```
[26]: y
```

```
[26]: 0    0
```

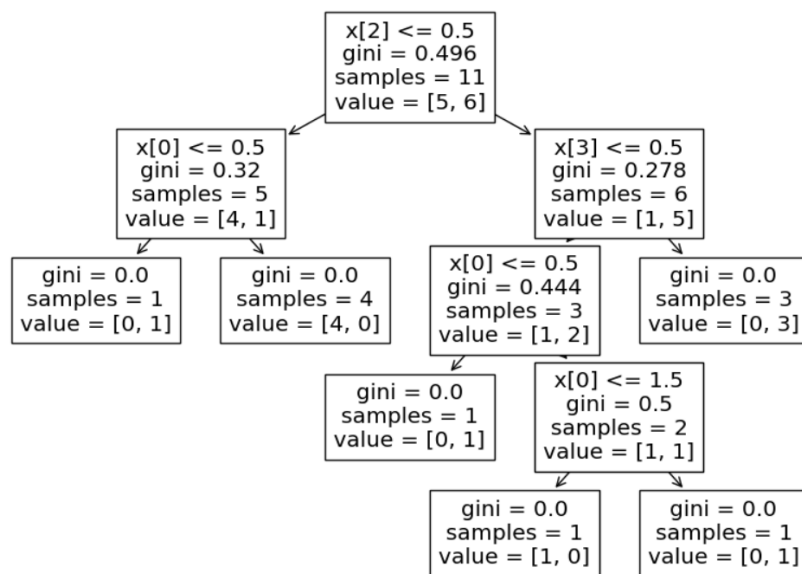
```
[26]: y
[26]: 0  0
      1  0
      2  1
      3  1
      4  1
      5  0
      6  1
      7  0
      8  1
      9  1
     10  1
     11  1
     12  1
     13  0
      Name: Play Tennis, dtype: int64

[27]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.2, random_state = 69)
      print(X_train.shape, X_test.shape, y_train.shape, y_test.shape)

      (11, 4) (3, 4) (11,) (3,)

[28]: from sklearn.tree import DecisionTreeClassifier
      model = DecisionTreeClassifier(random_state = 42)
      model.fit(X_train, y_train)
      y_pred = model.predict(X_test)

[29]: import seaborn as sns
      import matplotlib.pyplot as plt
      from sklearn import tree
      fig = plt.figure(figsize = (10, 7))
      tree.plot_tree(model)
      plt.show()
```



```
[32]: print("Accuracy:", metrics.accuracy_score(y_test, y_pred))
```

```
Accuracy: 0.6666666666666666
```

```
[33]: X_pred = model.predict(X)
      X_pred == y
```

```
[33]: 0      True
      1      True
      2      True
      3     False
      4      True
      5      True
      6      True
      7      True
      8      True
      9      True
     10      True
     11      True
     12      True
     13      True
      Name: Play Tennis, dtype: bool
```

## Naïve Bayes Theorem

```
[34]: #naive
      from sklearn.model_selection import train_test_split
      from sklearn.naive_bayes import MultinomialNB
      from sklearn.metrics import accuracy_score
```

```
[52]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size = 0.3, random_state = 43)
```

```
[56]: model = MultinomialNB()
```

```
[58]: dm.dtypes
```

```
[58]: Outlook      int64
      Temperature int64
      Humidity     int64
      Wind         int64
      Play Tennis  int64
      dtype: object
```

```
[54]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

```
[59]: model = MultinomialNB()
```

```
[61]: df_encoded = pd.get_dummies(df.drop('Play Tennis', axis=1))
```

```
[62]: X = df_encoded
```

```
[64]: y = df['Play Tennis']
```

```
[65]: model = MultinomialNB()
```

```
[66]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

```
[67]: model.fit(X_train, y_train)
```

```
[67]: + MultinomialNB ⓘ
      MultinomialNB()
```

```
[68]: y_pred = model.predict(X_test)
```

```
[69]: print("Accuracy:", accuracy_score(y_test, y_pred))
```

```
Accuracy: 0.6
```

```
[71]: import pandas as pd
      from sklearn.model_selection import train_test_split
      from sklearn.ensemble import RandomForestClassifier
      from sklearn.metrics import accuracy_score
```

## Random Forest

```
[70]: #m the randomforet
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score

# Load the dataset into a pandas DataFrame
data = {
    'Outlook': ['Sunny', 'Sunny', 'Overcast', 'Rain', 'Rain', 'Rain', 'Overcast', 'Sunny', 'Sunny', 'Rain', 'Sunny', 'Overcast', 'Overcast', 'Rain'],
    'Temperature': ['Hot', 'Hot', 'Hot', 'Mild', 'Cool', 'Cool', 'Cool', 'Mild', 'Cool', 'Mild', 'Mild', 'Hot', 'Mild'],
    'Humidity': ['High', 'High', 'High', 'High', 'Normal', 'Normal', 'Normal', 'High', 'Normal', 'Normal', 'Normal', 'High', 'Normal', 'High'],
    'Wind': ['Weak', 'Strong', 'Weak', 'Weak', 'Weak', 'Strong', 'Strong', 'Weak', 'Weak', 'Weak', 'Strong', 'Strong', 'Weak', 'Strong'],
    'Play Tennis': ['No', 'No', 'Yes', 'Yes', 'Yes', 'No', 'Yes', 'No', 'Yes', 'Yes', 'Yes', 'Yes', 'Yes', 'No']
}

df = pd.DataFrame(data)

# Perform one-hot encoding on categorical variables
df = pd.get_dummies(df)

# Define features (X) and target variable (y)
X = df.drop('Play Tennis_Yes', axis=1) # Exclude one of the encoded columns to avoid multicollinearity
y = df['Play Tennis_Yes']

# Split dataset into training and testing sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)

# Create Random Forest Classifier
rf_classifier = RandomForestClassifier(n_estimators=100, random_state=42)

# Train the classifier using the training sets
rf_classifier.fit(X_train, y_train)
```

```
# Train the classifier using the training sets
rf_classifier.fit(X_train, y_train)

# Predict the response for test dataset
y_pred = rf_classifier.predict(X_test)

# Model Accuracy, how often is the classifier correct?
print("Accuracy:", accuracy_score(y_test, y_pred))
```

Accuracy: 0.8

```
[72]: data = {
    'Outlook': ['Sunny', 'Sunny', 'Overcast', 'Rain', 'Rain', 'Rain', 'Overcast', 'Sunny', 'Sunny', 'Rain', 'Sunny', 'Overcast', 'Overcast', 'Rain'],
    'Temperature': ['Hot', 'Hot', 'Hot', 'Mild', 'Cool', 'Cool', 'Cool', 'Mild', 'Cool', 'Mild', 'Mild', 'Hot', 'Mild'],
    'Humidity': ['High', 'High', 'High', 'High', 'Normal', 'Normal', 'Normal', 'High', 'Normal', 'Normal', 'Normal', 'High', 'Normal', 'High'],
    'Wind': ['Weak', 'Strong', 'Weak', 'Weak', 'Weak', 'Strong', 'Strong', 'Weak', 'Weak', 'Weak', 'Strong', 'Strong', 'Weak', 'Strong'],
    'Play Tennis': ['No', 'No', 'Yes', 'Yes', 'Yes', 'No', 'Yes', 'No', 'Yes', 'Yes', 'Yes', 'Yes', 'Yes', 'No']
}

[73]: df = pd.DataFrame(data)

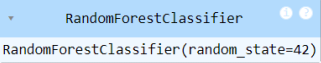
[74]: df = pd.get_dummies(df)

[75]: X = df.drop('Play Tennis_Yes', axis=1) # Exclude one of the encoded columns to avoid multicollinearity
y = df['Play Tennis_Yes']
```

```
[76]: X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.3, random_state=42)
```

```
[77]: rf_classifier = RandomForestClassifier(n_estimators=100, random_state=42)
```

```
[78]: rf_classifier.fit(X_train, y_train)
```

```
[78]: 
RandomForestClassifier(random_state=42)
```

```
[79]: y_pred = rf_classifier.predict(X_test)
```

```
[80]: print("Accuracy:", accuracy_score(y_test, y_pred))
```

Accuracy: 0.8