Decision-Tree-Classification

January 14, 2025

[ ]:
```
'''
   Decision Tree Classification -->

   Decision Tree Classification is a supervised machine learning algorithm␣
 ↪used for classification problems.
   It partitions the data into subsets based on feature values and creates a␣
 ↪tree-like structure where each
   node represents a decision based on an attribute, and each leaf node␣
 ↪represents a class label.

   Key Concepts -->

   Root Node : Represents the entire dataset and splits it into subsets.
   Internal Nodes : Represent decision points based on attributes.
   Leaf Nodes : Represent class labels or output

   How It Works -->

   The algorithm selects a feature and splits the data into groups based on␣
 ↪specific criteria,
   such as Gini Impurity or Information Gain.
   The process continues recursively until stopping conditions are met
   (e.g., maximum depth, minimum samples per leaf).
'''
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[ ]:
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'''
   Advantages -->

   Easy to understand and interpret.
   Can handle both numerical and categorical data.
   Requires little data preprocessing.

   Disadvantages -->

   Prone to overfitting if the tree grows too deep.
   Small changes in data can lead to entirely different splits
'''
```

[2]:
```
#   Importing Libraries -->

import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
from sklearn.preprocessing import StandardScaler
from sklearn.model_selection import train_test_split
from sklearn.tree import DecisionTreeClassifier
from sklearn.metrics import accuracy_score, classification_report,␣
 ↪confusion_matrix
```

[4]:
```
#   Importing Dataset -->

data = pd.read_csv('Data/Social_Network_Ads.csv')
data.head(10)
```

[4]:

	Age	EstimatedSalary	Purchased
0	19	19000	0
1	35	20000	0
2	26	43000	0
3	27	57000	0
4	19	76000	0
5	27	58000	0
6	27	84000	0
7	32	150000	1
8	25	33000	0
9	35	65000	0

[5]:
```
x_data = data.iloc[:, :-1].values
y_data = data.iloc[:, -1].values
```

[6]:
```
#   Splitting The Dataset -->

x_train, x_test, y_train, y_test = train_test_split(x_data, y_data, test_size=0.
 ↪2, random_state=42)
```

[7]:
```
x_train
```

[7]:
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```

[8]:
```
y_train
```

[8]:
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       0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 0, 0], dtype=int64)
```

[ ]:
```
#   Applying Feature Scaling -->

sc = StandardScaler()
x_train = sc.fit_transform(x_train)
x_test = sc.transform(x_test)
```

[10]:
```
x_train
```

[10]:
```
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```

[ ]:
```
x_test
```

[ ]:
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```

[ ]:
```
#   Building Model -->

model = DecisionTreeClassifier(criterion='entropy', random_state=42)
model.fit(x_train, y_train)
```

[ ]:
```
DecisionTreeClassifier(criterion='entropy', random_state=42)
```

[13]:
```
#   Predicting Result -->

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

[13]:
```
array([1, 1, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 1, 0, 1, 0, 0,
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       1, 0, 0, 1, 0, 0, 0, 0, 1, 0, 1, 1, 0, 0], dtype=int64)
```

[14]:
```
#   Checking Accuracy -->

acc_score = accuracy_score(y_test, y_pred)
conf_matrix = confusion_matrix(y_test, y_pred)
class_report = classification_report(y_test, y_pred)
```

[15]:
```
print("Accuracy Score --> ", acc_score)
```

```
Accuracy Score -->  0.8375
```

[16]:
```
print("Confusion Matrix -->\n\n", conf_matrix)
```

```
Confusion Matrix -->

 [[46  6]
 [ 7 21]]
```

[17]:
```
print("Classification Report -->\n\n", class_report)
```

```
Classification Report -->

              precision    recall  f1-score   support

           0       0.87      0.88      0.88        52
           1       0.78      0.75      0.76        28

    accuracy                           0.84        80
   macro avg       0.82      0.82      0.82        80
weighted avg       0.84      0.84      0.84        80
```