Random-Forest-Classification

January 14, 2025

[ ]:
```
'''
   Random Forest Classification -->

   Random Forest is an ensemble machine learning algorithm primarily used for
   classification and regression tasks. It operates by constructing a␣
 ↪collection of
   decision trees during training and combining their outputs to improve␣
 ↪prediction
   accuracy and control overfitting.
'''
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[ ]:
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'''
   How Random Forest Works -->

   Dataset Splitting :
   Random Forest uses bootstrap sampling to create subsets of the training␣
 ↪data (bagging).

   Tree Construction :
   Each decision tree is built independently using a random subset of features␣
 ↪at each
   split (feature bagging).

   Prediction :
   For classification, each tree votes for a class, and the majority vote is␣
 ↪taken
   as the final prediction.

   Reduction in Overfitting :

   Combining multiple trees reduces overfitting compared to a single decision␣
 ↪tree.
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'''
   Hyperparameters -->
```

```
    n_estimators : Number of trees in the forest.
    max_depth : Maximum depth of each tree.
    min_samples_split : Minimum number of samples required to split an internal␣
 ↪node.
    max_features : Number of features to consider at each split.
'''
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'''
    Advantages -->

    Handles large datasets and high dimensionality well.
    Robust against overfitting due to averaging multiple trees.
    Works well for both classification and regression tasks.
    Handles missing data effectively.

    Limitations -->

    Less interpretable compared to single decision trees.
    Can be computationally intensive with many trees or high-dimensional data.
'''
```

[1]:

```
#   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.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, confusion_matrix,␣
 ↪classification_report
```

[2]:

```
#   Importing Dataset -->

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

[2]:

```
   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
```

[3]:

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

[4]:

```
#   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)
```

[5]:

```
x_train
```

[5]:

```
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```

[6]:
```
y_train
```

[6]:
```
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       1, 0, 0, 0, 0, 1, 1, 0, 1, 0, 0, 0, 1, 1, 0, 1, 0, 0, 1, 0, 0, 0,
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       1, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0,
       1, 0, 0, 1, 0, 0, 1, 0, 1, 0, 1, 1, 0, 0, 1, 0, 1, 0, 0, 0, 0, 1,
       0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0,
       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)
```

[8]:
```
x_train
```

[8]:
```
array([[-1.06675246, -0.38634438],
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       [-0.57615058,  0.45724994]])
```

[9]:
```
x_test
```

[9]:
```
array([[ 0.79753468, -1.40447546],
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       [-0.28178945, -0.67723898],
       [-0.0855487 ,  0.22453427]])
```

[10]:
```
#   Building The Model -->

model = RandomForestClassifier(n_estimators=10, criterion='entropy',␣
 ↪random_state=42)
model.fit(x_train, y_train)
```

[10]:
```
RandomForestClassifier(criterion='entropy', n_estimators=10, random_state=42)
```

[11]:
```
#   Predicting The Result -->

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

[11]:
```
array([1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 0, 0, 0, 1, 1, 0, 0, 1, 0, 0,
       1, 0, 0, 1, 1, 0, 1, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 1,
       0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 1, 1, 0, 0, 0, 0, 1, 0, 0, 1,
       1, 1, 0, 1, 1, 0, 0, 0, 1, 0, 1, 1, 0, 0], dtype=int64)
```

[12]:
```
#   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)
```

[13]:
```
print("Accuracy Score --> ", acc_score)
```

```
Accuracy Score -->  0.8625
```

[14]:
```
print("Confusion Matrix -->\n\n", conf_matrix)
```

```
Confusion Matrix -->

 [[47  5]
 [ 6 22]]
```

[16]:
```
print("Classification Report -->\n\n", class_report)
```

```
Classification Report -->

               precision    recall  f1-score   support

           0       0.89      0.90      0.90        52
           1       0.81      0.79      0.80        28

    accuracy                           0.86        80
   macro avg       0.85      0.84      0.85        80
weighted avg       0.86      0.86      0.86        80
```