

1)

Decisiontree model trained.

Training accuracy: 0.9934

Decision Tree Params: {'Criterion': 'entropy', 'Max Depth': 8, 'Min Samples Split': 8}

Random forest model trained.

Training accuracy: 0.9319

Random Forest Params: {'Criterion': 'entropy', 'n estimators': 8, 'Max Depth': 2, 'Min Samples Split': 2, 'Min Samples Leaf': 1}

AdaBoost model trained.

Training Accuracy: 1.0000

Random Forest Params: {'n estimators': 50, 'Learning Rate': 1}

Model Performance Comparison:

Decision Tree:

Accuracy: 0.9561

Precision: 0.9569

Recall: 0.9561

Confusion Matrix:

[[39 4]

[1 70]]

F1-Score: 0.9558

=====

Random Forest:

Accuracy: 0.9649

Precision: 0.9668

Recall: 0.9649

Confusion Matrix:

```
[[39  4]
```

```
 [ 0 71]]
```

F1-Score: 0.9645

=====

AdaBoost:

Accuracy: 0.9649

Precision: 0.9652

Recall: 0.9649

Confusion Matrix:

```
[[40  3]
```

```
 [ 1 70]]
```

F1-Score: 0.9647

The best-performing model is: AdaBoost

2)

Decision tree model trained.

Training accuracy: 0.9978

Decision Tree Params: {'Criterion': 'gini', 'Max Depth': 16, 'Min Samples Split': 4}

Random forest model trained.

Training accuracy: 0.9890

Random Forest Params: {'Criterion': 'entropy', 'n_estimators': 16, 'Max Depth': 4, 'Min Samples Split': 4, 'Min Samples Leaf': 1}

AdaBoost model trained.

Training Accuracy: 1.0000

Random Forest Params: {'n_estimators': 40, 'Learning Rate': 1.2}

Model Performance Comparison:

Decision Tree:

Accuracy: 0.9386

Precision: 0.9390

Recall: 0.9386

Confusion Matrix:

[[40 3]

[4 67]]

F1-Score: 0.9387

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Random Forest:

Accuracy: 0.9737

Precision: 0.9748

Recall: 0.9737

Confusion Matrix:

[[40 3]

[0 71]]

F1-Score: 0.9735

=====

AdaBoost:

Accuracy: 0.9649

Precision: 0.9649

Recall: 0.9649

Confusion Matrix:

[[41 2]

[2 69]]

F1-Score: 0.9649

The best-performing model is: Random Forest

3)

Decision tree model trained.

Training accuracy: 0.9978

Decision Tree Params: {'Criterion': 'entropy', 'Max Depth': 24, 'Min Samples Split': 3}

Random forest model trained.

Training accuracy: 0.9714

Random Forest Params: {'Criterion': 'gini', 'n estimators': 12, 'Max Depth': 3, 'Min Samples Split': 3, 'Min Samples Leaf': 1}

AdaBoost model trained.

Training Accuracy: 0.9846

Random Forest Params: {'n estimators': 20, 'Learning Rate': 0.5}

Model Performance Comparison:

Decision Tree:

Accuracy: 0.9474

Precision: 0.9475

Recall: 0.9474

Confusion Matrix:

```
[[39  4]
```

```
 [ 2 69]]
```

F1-Score: 0.9471

=====

Random Forest:

Accuracy: 0.9649

Precision: 0.9652

Recall: 0.9649

Confusion Matrix:

```
[[40  3]
```

```
 [ 1 70]]
```

F1-Score: 0.9647

=====

AdaBoost:

Accuracy: 0.9649

Precision: 0.9652

Recall: 0.9649

Confusion Matrix:

```
[[40  3]
```

```
 [ 1 70]]
```

F1-Score: 0.9647

The best-performing model is: AdaBoost

4)

Decision tree model trained.

Training accuracy: 1.0000

Decision Tree Params: {'Criterion': 'gini', 'Max Depth': 10, 'Min Samples Split': 2}

Random forest model trained.

Training accuracy: 0.9912

Random Forest Params: {'Criterion': 'gini', 'n estimators': 15, 'Max Depth': 5, 'Min Samples Split': 2, 'Min Samples Leaf': 1}

AdaBoost model trained.

Training Accuracy: 1.0000

Random Forest Params: {'n estimators': 20, 'Learning Rate': 1.3}

Model Performance Comparison:

Decision Tree:

Accuracy: 0.9386

Precision: 0.9385

Recall: 0.9386

Confusion Matrix:

[[39 4]

[3 68]]

F1-Score: 0.9384

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Random Forest:

Accuracy: 0.9561

Precision: 0.9561

Recall: 0.9561

Confusion Matrix:

[[40 3]

[2 69]]

F1-Score: 0.9560

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AdaBoost:

Accuracy: 0.9825

Precision: 0.9829

Recall: 0.9825

Confusion Matrix:

[[41 2]

[0 71]]

F1-Score: 0.9824

The best-performing model is: AdaBoost

5)

Decision tree model trained.

Training accuracy: 0.9978

Decision Tree Params: {'Criterion': 'gini', 'Max Depth': 6, 'Min Samples Split': 3}

Random forest model trained.

Training accuracy: 0.9978

Random Forest Params: {'Criterion': 'entropy', 'n_estimators': 25, 'Max Depth': 9, 'Min Samples Split': 3, 'Min Samples Leaf': 1}

AdaBoost model trained.

Training Accuracy: 0.9824

Random Forest Params: {'n_estimators': 10, 'Learning Rate': 1.1}

Model Performance Comparison:

Decision Tree:

Accuracy: 0.9474

Precision: 0.9474

Recall: 0.9474

Confusion Matrix:

[[40 3]

[3 68]]

F1-Score: 0.9474

=====

Random Forest:

Accuracy: 0.9561

Precision: 0.9561

Recall: 0.9561

Confusion Matrix:

[[40 3]

[2 69]]

F1-Score: 0.9560

=====

AdaBoost:

Accuracy: 0.9649

Precision: 0.9668

Recall: 0.9649

Confusion Matrix:

```
[[39 4]
```

```
[ 0 71]]
```

F1-Score: 0.9645

The best-performing model is: AdaBoost

Git**hub** link:-

https://github.com/nizimoko/ML/blob/main/Nizar_moklada_ex1.ipynb