

## Decision Trees and Random Forests Report

This report summarizes the implementation of tree-based models including Decision Trees and Random Forests for classification tasks. The work follows the provided Task 5 objectives and includes extra enhancements for better analysis.

### Comparison Table

Step	Mini Guide Description	Implemented Code	Extra Feature (If Any)
1	Train a Decision Tree Classifier and visualize the tree	Used <code>DecisionTreeClassifier</code> from <code>sklearn</code> and plotted with <code>plot_tree</code>	Added class names, feature names, and color-coded nodes
2	Analyze overfitting and control tree depth	Trained models with different <code>max_depth</code> values	Visualized accuracy vs depth to detect overfitting
3	Train a Random Forest and compare accuracy	Used <code>RandomForestClassifier</code> and compared test accuracy	Visualized test accuracy comparison in bar chart
4	Interpret feature importances	Plotted feature importances from Random Forest model	Sorted and labeled bar plot of features
5	Evaluate using cross-validation	Used <code>cross_val_score</code> on both models	Displayed mean and std of cross-validation scores

### Summary

The decision tree and random forest implementation successfully demonstrates key tree-based classification techniques. Visual outputs and performance metrics help in comparing models and identifying best practices such as limiting tree depth to reduce overfitting. Feature importance visualizations provide insights into which variables drive predictions.