HUMAN ACTIVITY RECOGNITION USING SMARTPHONES

Name: Divya Muraleedharan Student ID: 22030331

Introduction

Smartphones have become one of the most useful tools for communication in our lives, as they provide intelligent support to users in their daily activities. Most smartphones feature accelerometer and gyroscope sensors, the data from which can be utilised to detect human actions given smartphone accelerometer and gyroscope measurements. The dataset is used to train Naive Bayes, Decision Trees, and Random Forest models, and the results are evaluated in order to choose the best model.

Dataset Overview and Analysis

The "Human Activity Recognition with Smartphones" dataset collects sensor data from a Samsung Galaxy SII worn by 30 subjects. It comprises acceleration, body acceleration, angular velocity, and a 561-feature vector. Visual tests reveal consistent data bias among participants, while label counts suggest a broadly even class distribution. Overall, it appears well-balanced for analysis. StandardScaler is used in this case to standardise the chosen attributes for uniform scaling. Furthermore, the Random Forest Classifier was utilised to choose features. The obtained characteristics were then utilised to train and test the model using SelectFromModel.

Model Comparison

On the dataset, three machine learning models were evaluated based on classification reports and confusion matrices. Random Forest surpassed both Naive Bayes and Decision Tree in terms of accuracy and overall performance. While Naïve Bayes shown results in some areas, it was uneven. Decision Tree struggled to identify specific actions. In comparison to the other two models, the confusion matrix analysis demonstrated that Random Forest excelled at appropriately categorising human actions.

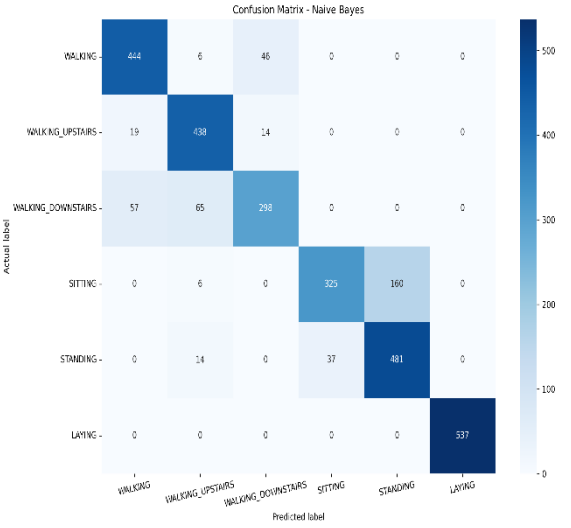

Figure 1

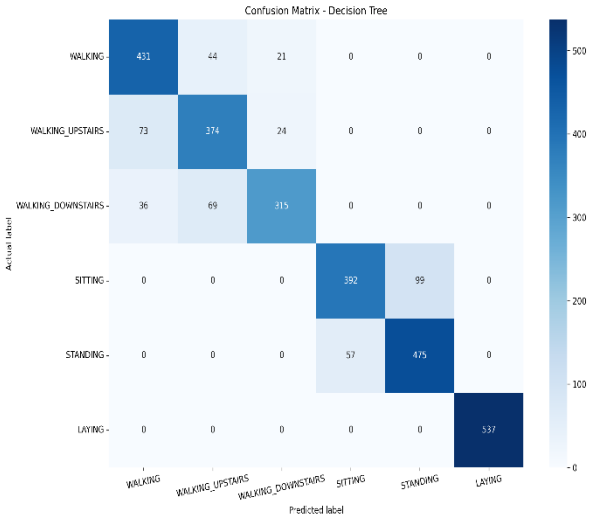

Figure 2

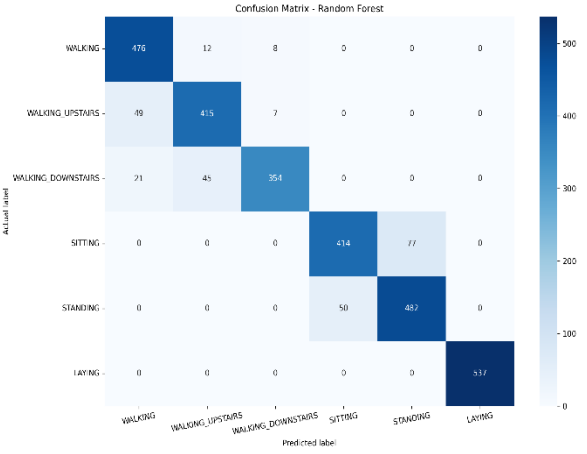

Figure 3

The Random Forest Model consistently achieves high AUC values in ROC curve analysis and maintains consistent performance across all activity classes. Decision Trees performs moderately at various AUC values, but Naive Bayes performs well and accurately classifies diverse activities.

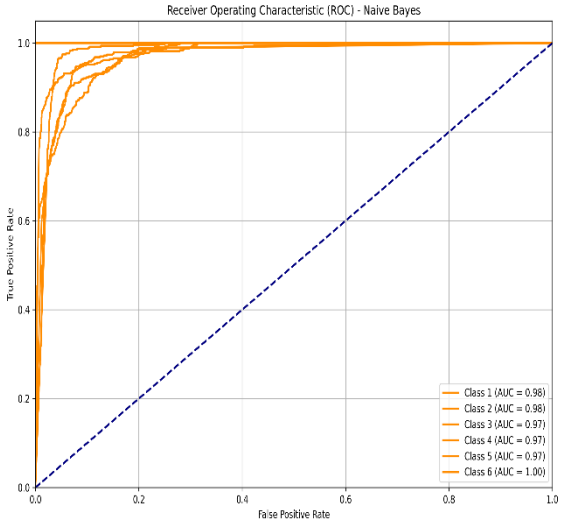

Figure 4

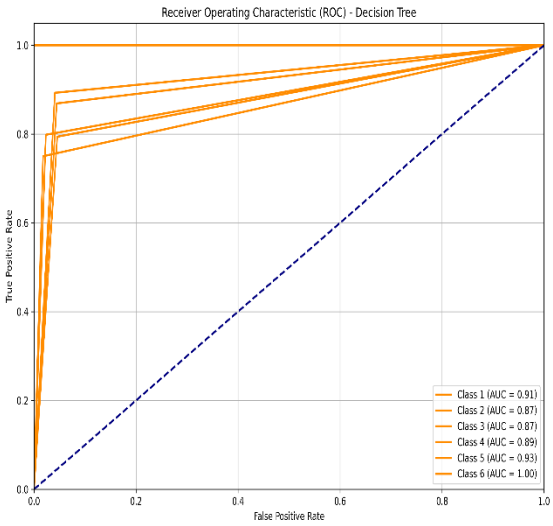

Figure 5

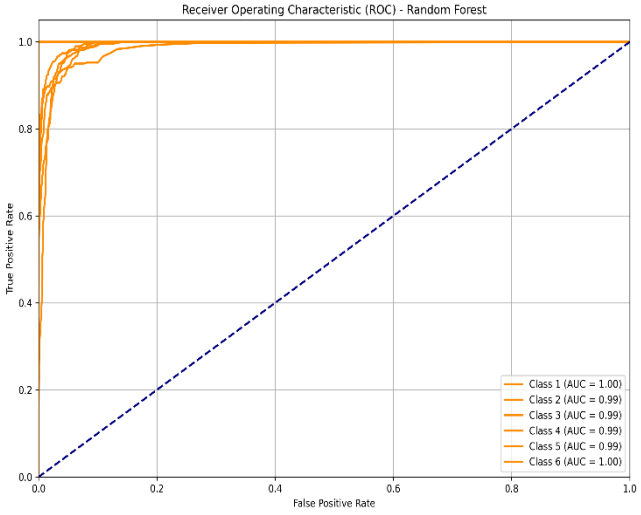

Figure 6

Summary

In terms of accuracy (90.87%) and F1 score (90.85%), the Random Forest model exceeds the Naive Bayes and Decision Tree models. These results show Random Forest's ability to correctly detect human behaviours using sensor data.

Comparing Models

Model Name	Accuracy	Error	F1 Score
Naive Bayes	85.61%	14.39%	85.35%
Decision Tree	85.65%	14.35%	85.62%
Random Forest	90.87%	9.13%	90.85%

Table 1 Summary

Reference

Bhanot, K. (2018). Activity Recognition using Smartphones—Machine Learning application. [online] Medium. Available at: https://towardsdatascience.com/activity-recognition-using-smartphones-machine-learning-application-a10e7b5578f9.

Garcia-Gonzalez, D., Rivero, D., Fernandez-Blanco, E. and Luaces, M.R. (2023). New machine learning approaches for real-life human activity recognition using smartphone sensor-based data. Knowledge-Based Systems, 262, p.110260. doi:https://doi.org/10.1016/j.knosys.2023.110260.