

Behavioural Context Detection



Activity Recognition and Data Analysis from Mobile Sensors

TA Guide:
Garvit Chugh

Course Instructor:
Suchetana Chakraborty

Presented by:
Abhijit S Iyer (M21CS001)
Shruti Sureshan(M21CS015)

Brief Introduction

In this project, we look forward to analyse data that has been obtained from various sensors present in smartphones and smart watches, based on which we will try and find how a unique combination of these data points can be used to identify a user uniquely.

To facilitate our purpose, we have taken data from the 'Extrasensory Dataset' that contains sensor data taken from various smartphone sensors of different users at different points of time.

The Extrasensory Dataset

The extrasensory dataset contains sensory data and labels collected from over 60 smartphone users in a span of 7 days.

There are about a thousand instances of data for each user, and every instance contains data collected from sensors such as accelerometer, gyroscope, magnetometer, phone state, etc.

Experiments Performed - Pre Mid Sem Evaluation

- Activity detection (walking) based on features - phone accelerometer and smartwatch accelerometer
- Activity detection (walking) based on features - phone accelerometer, watch accelerometer, gyroscope and location sensor.
- Activity detection (walking) based on features - location sensor and audio
- Clustering data based on every feature, i.e sensor available using K-Means Clustering
- Clustering data based on all features, using GMM
- Dimensionality reduction using PCA and checking for prediction accuracy
- Clustering data based on accelerometer and gyroscope features only (using K-means clustering and GMM)

Experiments Performed - Post Mid Sem Evaluation

- Activity Recognition of user based on sensor data from phone accelerometer and watch accelerometer by performing multiclass classification.
- Activity Recognition of user based on sensor data from phone accelerometer and watch accelerometer, gyroscope and location data by performing multiclass classification
- Activity Recognition of user based on sensor data from phone's location data and audio data at certain timestamps, by performing multiclass classification
- Making use of an Artificial Neural Network to perform binary classification of any activity of a user - walking in this instance using smartphone accelerometer and watch accelerometer
- Binary classification using ANN, performing binary classification of user activity based on gyroscope data, location and audio features.

Results - Multiclass Classification using Multilayer Perceptron

Multi class Classification of user activity was performed based on the the data collected from the mentioned sensors. The results can be seen as follows

Activity	Prediction Score
Walking	96.06%
Lying Down	94.03%
Sitting	85.73%
Standing	93.30%
Sleeping	94.03%

Wacc, Acc, Gyro, Loc

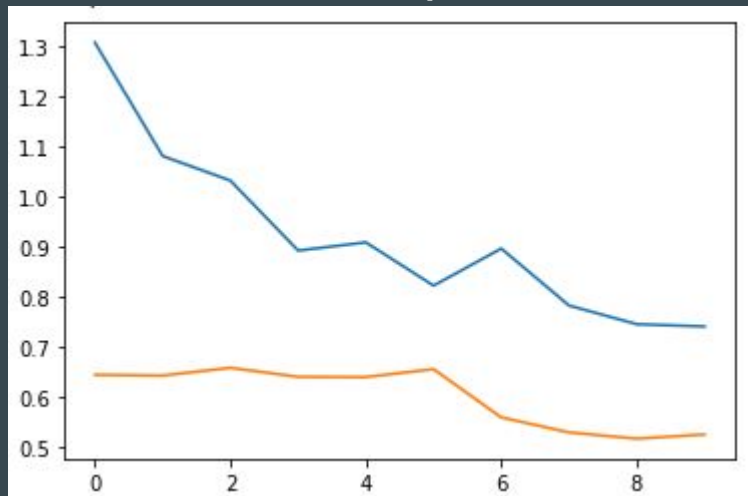
Activity	Prediction Score
Walking	93.59%
Lying Down	96.06%
Sitting	88.64%
Standing	91.12%
Sleeping	95.19%

Loc, Audio

Results - Binary Classification using ANN

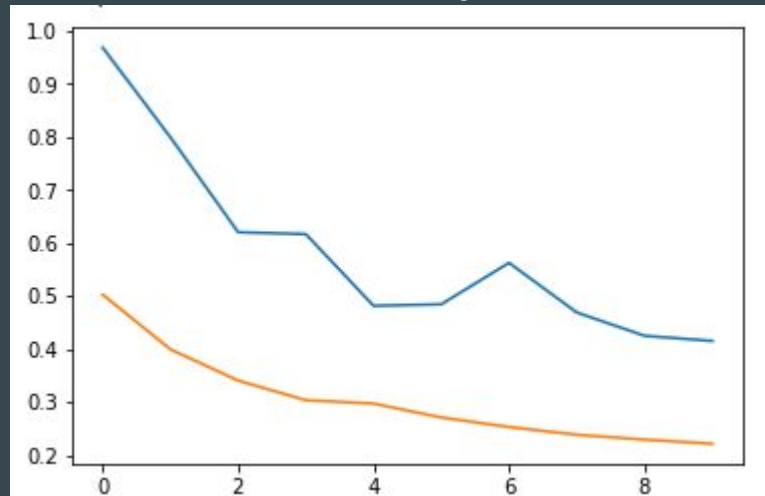
Binary Classification of user activity of 'walking' was performed based on the the data collected from the mentioned sensors. The results can be seen as follows:

Loss Graph



Prediction Accuracy - 93.30%

Loss Graph



Prediction Accuracy - 93.04%

Conclusion

- The extrasensory dataset provides enough data for us to classify amongst the various activities that a human being is doing.
- However, to recognize a human being individually, the problem lies in the fact that we do not have annotated data that can be used to train models to uniquely detect a human being.
- Hence, a major step needs to be taken in the direction where we can publicly make annotated data available for human behaviour detection and unique identification.

Thank You