# BUILDING EMPLOYEE SECURITY SYSTEM USING GAIT ANALYSIS

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Link to GitHub Repo- https://github.com/theshredbox/Employee-Security-System

Link to the Dataset- UCI HAR Dataset

- **PROBLEM STATEMENT**

You have come up with a new idea that uses the employee's smartphone and machine learning to provide a contactless system where when an employee enters the firm's territory, his or her smartphone connects to the server and transmits data from the employee smartphone sensor data like the accelerometer's data. The server performs the calculations and determines this person as
one of the employees using Gait analysis. Essentially it compares the current pattern of the employee's gait with the historical pattern and if there is a match, the doors automatically open for the employee to walk in.

You have built a dataset of 30 employees and their daily activities to test your idea Design and develop a system that will perform the gait analysis.

- **DATASET DESCRIPTION**

The experiments have been carried out with a group of 30 volunteers within an age bracket of 19-48 years. Each person performed six activities (WALKING, WALKING_UPSTAIRS, WALKING_DOWNSTAIRS, SITTING, STANDING, LAYING) wearing a smartphone (Samsung Galaxy S II) on the waist. Using its embedded accelerometer and gyroscope, we captured 3-axial linear acceleration and 3-axial angular velocity at a constant rate of 50Hz. The experiments have been video-recorded to label the data manually. The obtained dataset has been randomly partitioned into two sets, where 70% of the volunteers were selected for generating the training data and 30% for the test data.

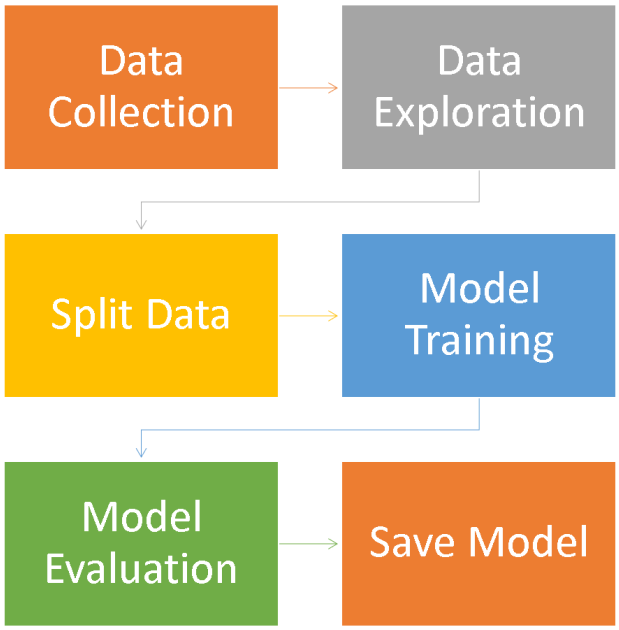
The sensor signals (accelerometer and gyroscope) were pre-processed by applying noise filters and then sampled in fixed-width sliding windows of 2.56 sec and 50% overlap (128 readings/window). The sensor acceleration signal, which has gravitational and body motion components, was separated using a Butterworth low-pass filter into body acceleration and gravity. The gravitational force is assumed to have only low-frequency components, therefore a

filter with a 0.3 Hz cutoff frequency was used. From each window, a vector of features was obtained by calculating variables from the time and frequency domain

**Attribute Description**

- For each record in the dataset, it is provided:
  - Triaxial acceleration from the accelerometer (total acceleration) and the estimated body acceleration.
  - Triaxial Angular velocity from the gyroscope.
  - A 561 feature vector with time and frequency domain variables.
  - Its activity label.
  - An identifier of the subject who carried out the experiment.

- **MODULE WORKFLOW**




- **TASKS PERFORMED AND RESULTS ACHIEVED**

Two different strategies were used in order to achieve accuracy-

1. Took each frame of the data into 128 steps and created 561 different possible calculations and passed them using machine learning algorithms like Logistic Regression, KNN, Decision Trees, Random Forest, Support Vector Machine, etc.

   Below are the metrics which are resulted from the above method.

| Model Name | Accuracy |
|---|---|
| Linear SVM | 96% |
| Decision Tree | 86.4% |
| Random Forest | 91.8% |
| KNN | 91% |

2. We took each frame of data and passed it to the recurrent neural network i.e., LSTM, and predicted the activity it belongs to. The model achieved an accuracy of 91.4%.

- **FUTURE WORK**

1. Create Android Application and connect to firebase for data collection
2. Need to deploy the model in Mobile
3. Make it available in Play Store

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