CodeBook – Getting and Celaning Data – Course Project

# Overview

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 was selected for generating the training data and 30% 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 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. See 'features\_info.txt' for more details.

# Variables Description

**Subject ID**

identifies the subject who performed the activity for each window sample. Its range is from 1 to 30.

**activityType**

activity carried out during measurement

**activityID**

ID of the activity carried out during measurement

**Variables describing the features used:**

The features selected for this database come from the accelerometer and gyroscope 3-axial raw signals tAcc-XYZ and tGyro-XYZ. These time domain signals (prefix 't' to denote time) were captured at a constant rate of 50 Hz. Then they were filtered using a median filter and a 3rd order low pass Butterworth filter with a corner frequency of 20 Hz to remove noise. Similarly, the acceleration signal was then separated into body and gravity acceleration signals (tBodyAcc-XYZ and tGravityAcc-XYZ) using another low pass Butterworth filter with a corner frequency of 0.3 Hz.

Subsequently, the body linear acceleration and angular velocity were derived in time to obtain Jerk signals (tBodyAccJerk-XYZ and tBodyGyroJerk-XYZ). Also the magnitude of these three-dimensional signals were calculated using the Euclidean norm (tBodyAccMag, tGravityAccMag, tBodyAccJerkMag, tBodyGyroMag, tBodyGyroJerkMag).

Finally a Fast Fourier Transform (FFT) was applied to some of these signals producing fBodyAcc-XYZ, fBodyAccJerk-XYZ, fBodyGyro-XYZ, fBodyAccJerkMag, fBodyGyroMag, fBodyGyroJerkMag. (Note the 'f' to indicate frequency domain signals).

These signals were used to estimate variables of the feature vector for each pattern:

'-XYZ' is used to denote 3-axial signals in the X, Y and Z directions.

**In the dataset AverageTidyDataset.txt the following variables are used:**

**Mean Variables:**

tBodyAcc-mean()-X

tBodyAcc-mean()-Y

tBodyAcc-mean()-Z

tGravityAcc-mean()-X

tGravityAcc-mean()-Y

tGravityAcc-mean()-Z

tBodyAccJerk-mean()-X

tBodyAccJerk-mean()-Y

tBodyAccJerk-mean()-Z

tBodyGyro-mean()-X

tBodyGyro-mean()-Y

tBodyGyro-mean()-Z

tBodyGyroJerk-mean()-X

tBodyGyroJerk-mean()-Y

tBodyGyroJerk-mean()-Z

tBodyAccMag-mean()

tGravityAccMag-mean()

tBodyAccJerkMag-mean()

tBodyGyroMag-mean()

tBodyGyroJerkMag-mean()

fBodyAcc-mean()-X

fBodyAcc-mean()-Y

fBodyAcc-mean()-Z

fBodyAcc-meanFreq()-X

fBodyAcc-meanFreq()-Y

fBodyAcc-meanFreq()-Z

fBodyAccJerk-mean()-X

fBodyAccJerk-mean()-Y

fBodyAccJerk-mean()-Z

fBodyAccJerk-meanFreq()-X

fBodyAccJerk-meanFreq()-Y

fBodyAccJerk-meanFreq()-Z

fBodyGyro-mean()-X

fBodyGyro-mean()-Y

fBodyGyro-mean()-Z

fBodyGyro-meanFreq()-X

fBodyGyro-meanFreq()-Y

fBodyGyro-meanFreq()-Z

fBodyAccMag-mean()

fBodyAccMag-meanFreq()

fBodyBodyAccJerkMag-mean()

fBodyBodyAccJerkMag-meanFreq()

fBodyBodyGyroMag-mean()

fBodyBodyGyroMag-meanFreq()

fBodyBodyGyroJerkMag-mean()

fBodyBodyGyroJerkMag-meanFreq()

**Standard deviation variables:**

tBodyAcc-std()-X

tBodyAcc-std()-Y

tBodyAcc-std()-Z

tGravityAcc-std()-X

tGravityAcc-std()-Y

tGravityAcc-std()-Z

tBodyAccJerk-std()-X

tBodyAccJerk-std()-Y

tBodyAccJerk-std()-Z

tBodyGyro-std()-X

tBodyGyro-std()-Y

tBodyGyro-std()-Z

tBodyGyroJerk-std()-X

tBodyGyroJerk-std()-Y

tBodyGyroJerk-std()-Z

tBodyAccMag-std()

tGravityAccMag-std()

tBodyAccJerkMag-std()

tBodyGyroMag-std()

tBodyGyroJerkMag-std()

fBodyAcc-std()-X

fBodyAcc-std()-Y

fBodyAcc-std()-Z

fBodyAccJerk-std()-X

fBodyAccJerk-std()-Y

fBodyAccJerk-std()-Z

fBodyGyro-std()-X

fBodyGyro-std()-Y

fBodyGyro-std()-Z

fBodyAccMag-std()

fBodyBodyAccJerkMag-std()

fBodyBodyGyroMag-std()

fBodyBodyGyroJerkMag-std()