# Code Book

## The Variables

For each record the following are 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.

The set of variables that were estimated from these signals are:

* mean(): Mean value
* std(): Standard deviation

The variables in the data set are as follows:

* activityLabel – The activity being performed
* subject – The number of the subject
* tBodyAcc-mean()-X
* tBodyAcc-mean()-Y
* tBodyAcc-mean()-Z
* tBodyAcc-std()-X
* tBodyAcc-std()-Y
* tBodyAcc-std()-Z
* tGravityAcc-mean()-X
* tGravityAcc-mean()-Y
* tGravityAcc-mean()-Z
* tGravityAcc-std()-X
* tGravityAcc-std()-Y
* tGravityAcc-std()-Z
* tBodyAccJerk-mean()-X
* tBodyAccJerk-mean()-Y
* tBodyAccJerk-mean()-Z
* tBodyAccJerk-std()-X
* tBodyAccJerk-std()-Y
* tBodyAccJerk-std()-Z
* tBodyGyro-mean()-X
* tBodyGyro-mean()-Y
* tBodyGyro-mean()-Z
* tBodyGyro-std()-X
* tBodyGyro-std()-Y
* tBodyGyro-std()-Z
* tBodyGyroJerk-mean()-X
* tBodyGyroJerk-mean()-Y
* tBodyGyroJerk-mean()-Z
* tBodyGyroJerk-std()-X
* tBodyGyroJerk-std()-Y
* tBodyGyroJerk-std()-Z
* tBodyAccMag-mean()
* tBodyAccMag-std()
* tGravityAccMag-mean()
* tGravityAccMag-std()
* tBodyAccJerkMag-mean()
* tBodyAccJerkMag-std()
* tBodyGyroMag-mean()
* tBodyGyroMag-std()
* tBodyGyroJerkMag-mean()
* tBodyGyroJerkMag-std()
* fBodyAcc-mean()-X
* fBodyAcc-mean()-Y
* fBodyAcc-mean()-Z
* fBodyAcc-std()-X
* fBodyAcc-std()-Y
* fBodyAcc-std()-Z
* fBodyAcc-meanFreq()-X
* fBodyAcc-meanFreq()-Y
* fBodyAcc-meanFreq()-Z
* fBodyAccJerk-mean()-X
* fBodyAccJerk-mean()-Y
* fBodyAccJerk-mean()-Z
* fBodyAccJerk-std()-X
* fBodyAccJerk-std()-Y
* fBodyAccJerk-std()-Z
* fBodyAccJerk-meanFreq()-X
* fBodyAccJerk-meanFreq()-Y
* fBodyAccJerk-meanFreq()-Z
* fBodyGyro-mean()-X
* fBodyGyro-mean()-Y
* fBodyGyro-mean()-Z
* fBodyGyro-std()-X
* fBodyGyro-std()-Y
* fBodyGyro-std()-Z
* fBodyGyro-meanFreq()-X
* fBodyGyro-meanFreq()-Y
* fBodyGyro-meanFreq()-Z
* fBodyAccMag-mean()
* fBodyAccMag-std()
* fBodyAccMag-meanFreq()
* fBodyBodyAccJerkMag-mean()
* fBodyBodyAccJerkMag-std()
* fBodyBodyAccJerkMag-meanFreq()
* fBodyBodyGyroMag-mean()
* fBodyBodyGyroMag-std()
* fBodyBodyGyroMag-meanFreq()
* fBodyBodyGyroJerkMag-mean()
* fBodyBodyGyroJerkMag-std()
* fBodyBodyGyroJerkMag-meanFreq()

## Summary Choices

The following steps were taken to clean and summarize the data, which are performed by the run\_analysis R script:

1. Merged the training and the test sets to create one data set.
2. Extracted only the measurements on the mean and standard deviation for each measurement.
3. Used descriptive activity names to name the activities in the data set
4. Appropriately labelled the data set with descriptive variable names.
5. From the data set in step 4, created a second, independent tidy data set with the average of each variable for each activity and each subject.

## Experimental Study Design

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.

## References

[1] Davide Anguita, Alessandro Ghio, Luca Oneto, Xavier Parra and Jorge L. Reyes-Ortiz. Human Activity Recognition on Smartphones using a Multiclass Hardware-Friendly Support Vector Machine. International Workshop of Ambient Assisted Living (IWAAL 2012). Vitoria-Gasteiz, Spain. Dec 2012