Human Activity Recognition Using Smartphones Data Set

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 (e.g. WALKING, WALKING_UPSTAIRS, WALKING_DOWNSTAIRS, SITTING, STANDING, LAYING) wearing a smartphone (Samsung Galaxy S II) on the waist.

Using its embedded accelerometer and gyroscope, data was captured on 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 "run_analysis.txt" file summarises the above data for each volunteer and activity. It contains the following 70 variables:

1. ID: Integer from 1 to 30, where each value corresponds to a unique volunteer.
2. Activity: Integer from 1 to 6, where each value corresponds to a different type of activity:

Integer value	Description
1	WALKING
2	WALKING_UPSTAIRS
3	WALKING_DOWNSTAIRS
4	SITTING
5	STANDING
6	LAYING

3. Activity name: Character vector with 6 levels, giving the name of the activities corresponding to the values in variable 2 above.
4. Interaction term: A factor with 180 levels, giving the interaction between subject and type of activity.

The remaining variables give information on features (e.g. triaxial acceleration, estimated body acceleration, or triaxial Angular velocity), where '-XYZ' is used to denote 3-axial signals in the X, Y and Z directions

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).

5. tBodyAcc-mean()-X: Mean T body acceleration, in X direction

6. tBodyAcc-mean()-Y: Mean T body acceleration, in Y direction
7. tBodyAcc-mean()-Z: Mean T body acceleration, in Z direction
8. tBodyAcc-std()-X: Standard deviation of T body acceleration, in X direction
9. tBodyAcc-std()-Y: Standard deviation of T body acceleration, in Y direction
10. tBodyAcc-std()-Z: Standard deviation of T body acceleration, in Z direction
11. tGravityAcc-mean()-X: Mean T gravity acceleration, in X direction
12. tGravityAcc-mean()-Y: Mean T gravity acceleration, in Y direction
13. tGravityAcc-mean()-Z: Mean T gravity acceleration, in Z direction
14. tGravityAcc-std()-X: Standard deviation of T gravity acceleration, in X direction
15. tGravityAcc-std()-Y: Standard deviation of T gravity acceleration, in Y direction
16. tGravityAcc-std()-Z: Standard deviation of T gravity acceleration, in Z direction
17. tBodyAccJerk-mean()-X: Mean T body acceleration jerk, in X direction
18. tBodyAccJerk-mean()-Y: Mean T body acceleration jerk, in Y direction
19. tBodyAccJerk-mean()-Z: Mean T body acceleration jerk, in Z direction
20. tBodyAccJerk-std()-X: Standard deviation of T body acceleration jerk, in X direction
21. tBodyAccJerk-std()-Y: Standard deviation of T body acceleration jerk, in Y direction
22. tBodyAccJerk-std()-Z: Standard deviation of T body acceleration jerk, in Z direction
23. tBodyGyro-mean()-X: Mean T body gyration, in X direction
24. tBodyGyro-mean()-Y: Mean T body gyration, in Y direction
25. tBodyGyro-mean()-Z: Mean T body gyration, in Z direction
26. tBodyGyro-std()-X: Standard deviation of T body gyration, in X direction
27. tBodyGyro-std()-Y: Standard deviation of T body gyration, in Y direction
28. tBodyGyro-std()-Z: Standard deviation of T body gyration, in Z direction
29. tBodyGyroJerk-mean()-X: Mean T body gyration jerk, in X direction
30. tBodyGyroJerk-mean()-Y: Mean T body gyration jerk, in Y direction
31. tBodyGyroJerk-mean()-Z: Mean T body gyration jerk, in Z direction
32. tBodyGyroJerk-std()-X: Standard deviation of T body gyration jerk, in X direction
33. tBodyGyroJerk-std()-Y: Standard deviation of T body gyration jerk, in Y direction
34. tBodyGyroJerk-std()-Z: Standard deviation of T body gyration jerk, in Z direction
35. tBodyAccMag-mean(): Mean T body acceleration
36. tBodyAccMag-std(): Standard deviation of T body acceleration
37. tGravityAccMag-mean(): Mean T gravity acceleration
38. tGravityAccMag-std(): Standard deviation of T body acceleration
39. tBodyAccJerkMag-mean(): Mean of T body acceleration jerk
40. tBodyAccJerkMag-std(): Standard deviation of T body acceleration jerk
41. tBodyGyroMag-mean(): Mean T body gyration
42. tBodyGyroMag-std(): Standard deviation of T body gyration
43. tBodyGyroJerkMag-mean(): Mean T body gyration jerk
44. tBodyGyroJerkMag-std(): Standard deviation of T body gyration jerk
45. fBodyAcc-mean()-X: Mean F body acceleration, in X direction
46. fBodyAcc-mean()-Y: Mean F body acceleration, in Y direction
47. fBodyAcc-mean()-Z: Mean F body acceleration, in Z direction
48. fBodyAcc-std()-X: Standard deviation of F body acceleration, in X direction
49. fBodyAcc-std()-Y: Standard deviation of F body acceleration, in Y direction
50. fBodyAcc-std()-Z: Standard deviation of F body acceleration, in Z direction
51. fBodyAccJerk-mean()-X: Mean F body acceleration jerk, in X direction
52. fBodyAccJerk-mean()-Y: Mean F body acceleration jerk, in Y direction
53. fBodyAccJerk-mean()-Z: Mean F body acceleration jerk, in Z direction
54. fBodyAccJerk-std()-X: Standard deviation of F body acceleration jerk, in X direction
55. fBodyAccJerk-std()-Y: Standard deviation of F body acceleration jerk, in Y direction
56. fBodyAccJerk-std()-Z: Standard deviation of F body acceleration jerk, in Z direction

57. fBodyGyro-mean()-X: Mean F body gyration, in X direction
58. fBodyGyro-mean()-Y: Mean F body gyration, in Y direction
59. fBodyGyro-mean()-Z: Mean F body gyration, in Z direction
60. fBodyGyro-std()-X: Standard deviation of F body gyration, in X direction
61. fBodyGyro-std()-Y: Standard deviation of F body gyration, in Y direction
62. fBodyGyro-std()-Z: Standard deviation of F body gyration, in Z direction
63. fBodyAccMag-mean(): Mean F body acceleration
64. fBodyAccMag-std(): Standard deviation of F body acceleration
65. fBodyBodyAccJerkMag-mean(): Mean of F body acceleration jerk
66. fBodyBodyAccJerkMag-std(): Standard deviation of T body acceleration jerk
67. fBodyBodyGyroMag-mean(): Mean F body gyration
68. fBodyBodyGyroMag-std(): Standard deviation of F body gyration
69. fBodyBodyGyroJerkMag-mean(): Mean F body gyration jerk
70. fBodyBodyGyroJerkMag-std(): Standard deviation of F body gyration jerk