INFORMATION BELOW IS THE ORIGINAL DESCRIPTION OF THE EXPERIMENT

“”””””””==================================================================

Human Activity Recognition Using Smartphones Dataset

Version 1.0

==================================================================

Jorge L. Reyes-Ortiz, Davide Anguita, Alessandro Ghio, Luca Oneto.

Smartlab - Non Linear Complex Systems Laboratory

DITEN - Universit‡ degli Studi di Genova.

Via Opera Pia 11A, I-16145, Genoa, Italy.

activityrecognition@smartlab.ws

www.smartlab.ws

==================================================================

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.

For each record 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.

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.

“”””””””””

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

==================================================================

—List of Subject and Description of their activities

—Averages for the mean and standard deviation for each variable for each activity and each subject

Variables’ Names & Description

==================================================================

VARIABLE DATA TYPE DESCRIPTION

Subject Character,68 "integer" - a group of 30 volunteers within an age bracket of 19-48 years

Activity Character,68 "factor" - activities WALKING, WALKING\_UPSTAIRS, WALKING\_DOWNSTAIRS, SITTING, STANDING, and LAYING performed by Subject

—Averages for the mean and standard deviation for each variable for each activity and each subject

VARIABLE DATA TYPE MIN VALUE MAX VALUE

tBodyAcc-mean()-X "numeric" "0.22159824394" "0.3014610196"

tBodyAcc-mean()-Y "numeric" "-0.0405139534294" "-0.00130828765170213"

tBodyAcc-mean()-Z "numeric" "-0.152513899520833" "-0.07537846886"

tBodyAcc-std()-X "numeric" "-0.996068635384615" "0.626917070512821"

tBodyAcc-std()-Y "numeric" "-0.990240946666667" "0.616937015333333"

tBodyAcc-std()-Z "numeric" "-0.987658662307692" "0.609017879074074"

tGravityAcc-mean()-X "numeric" "-0.680043155060241" "0.974508732"

tGravityAcc-mean()-Y "numeric" "-0.479894842941176" "0.956593814210526"

tGravityAcc-mean()-Z "numeric" "-0.49508872037037" "0.9578730416"

tGravityAcc-std()-X "numeric" "-0.996764227384615" "-0.829554947808219"

tGravityAcc-std()-Y "numeric" "-0.99424764884058" "-0.643578361424658"

tGravityAcc-std()-Z "numeric" "-0.990957249538462" "-0.610161166287671"

tBodyAccJerk-mean()-X "numeric" "0.0426880986186441" "0.130193043809524"

tBodyAccJerk-mean()-Y "numeric" "-0.0386872111282051" "0.056818586275"

tBodyAccJerk-mean()-Z "numeric" "-0.0674583919268293" "0.0380533591627451"

tBodyAccJerk-std()-X "numeric" "-0.994604542264151" "0.544273037307692"

tBodyAccJerk-std()-Y "numeric" "-0.989513565652174" "0.355306716915385"

tBodyAccJerk-std()-Z "numeric" "-0.993288313333333" "0.0310157077775926"

tBodyGyro-mean()-X "numeric" "-0.205775427307692" "0.19270447595122"

tBodyGyro-mean()-Y "numeric" "-0.204205356087805" "0.0274707556666667"

tBodyGyro-mean()-Z "numeric" "-0.0724546025804878" "0.179102058245614"

tBodyGyro-std()-X "numeric" "-0.994276591304348" "0.267657219333333"

tBodyGyro-std()-Y "numeric" "-0.994210471914894" "0.476518714444444"

tBodyGyro-std()-Z "numeric" "-0.985538363333333" "0.564875818162963"

tBodyGyroJerk-mean()-X "numeric" "-0.157212539189362" "-0.0220916265065217"

tBodyGyroJerk-mean()-Y "numeric" "-0.0768089915604167" "-0.0132022768074468"

tBodyGyroJerk-mean()-Z "numeric" "-0.0924998531372549" "-0.00694066389361702"

tBodyGyroJerk-std()-X "numeric" "-0.99654254057971" "0.179148649684615"

tBodyGyroJerk-std()-Y "numeric" "-0.997081575652174" "0.295945926186441"

tBodyGyroJerk-std()-Z "numeric" "-0.995380794637681" "0.193206498960417"

tBodyAccMag-mean() "numeric" "-0.986493196666667" "0.644604325128205"

tBodyAccMag-std() "numeric" "-0.986464542615385" "0.428405922622222"

tGravityAccMag-mean() "numeric" "-0.986493196666667" "0.644604325128205"

tGravityAccMag-std() "numeric" "-0.986464542615385" "0.428405922622222"

tBodyAccJerkMag-mean() "numeric" "-0.99281471515625" "0.434490400974359"

tBodyAccJerkMag-std() "numeric" "-0.994646916811594" "0.450612065720513"

tBodyGyroMag-mean() "numeric" "-0.980740846769231" "0.418004608615385"

tBodyGyroMag-std() "numeric" "-0.981372675614035" "0.299975979851852"

tBodyGyroJerkMag-mean() "numeric" "-0.997322526811594" "0.0875816618205128"

tBodyGyroJerkMag-std() "numeric" "-0.997666071594203" "0.250173204117966"

fBodyAcc-mean()-X "numeric" "-0.995249932641509" "0.537012022051282"

fBodyAcc-mean()-Y "numeric" "-0.989034304057971" "0.524187686888889"

fBodyAcc-mean()-Z "numeric" "-0.989473926666667" "0.280735952206667"

fBodyAcc-std()-X "numeric" "-0.996604570307692" "0.658506543333333"

fBodyAcc-std()-Y "numeric" "-0.990680395362319" "0.560191344"

fBodyAcc-std()-Z "numeric" "-0.987224804307692" "0.687124163703704"

fBodyAccJerk-mean()-X "numeric" "-0.994630797358491" "0.474317256051282"

fBodyAccJerk-mean()-Y "numeric" "-0.989398823913043" "0.276716853307692"

fBodyAccJerk-mean()-Z "numeric" "-0.992018447826087" "0.157775692377778"

fBodyAccJerk-std()-X "numeric" "-0.995073759245283" "0.476803887476923"

fBodyAccJerk-std()-Y "numeric" "-0.990468082753623" "0.349771285415897"

fBodyAccJerk-std()-Z "numeric" "-0.993107759855072" "-0.00623647528983051"

fBodyGyro-mean()-X "numeric" "-0.99312260884058" "0.474962448333333"

fBodyGyro-mean()-Y "numeric" "-0.994025488297872" "0.328817010088889"

fBodyGyro-mean()-Z "numeric" "-0.985957788" "0.492414379822222"

fBodyGyro-std()-X "numeric" "-0.994652185217391" "0.196613286661538"

fBodyGyro-std()-Y "numeric" "-0.994353086595745" "0.646233637037037"

fBodyGyro-std()-Z "numeric" "-0.986725274871795" "0.522454216314815"

fBodyAccMag-mean() "numeric" "-0.986800645362319" "0.586637550769231"

fBodyAccMag-std() "numeric" "-0.987648484461539" "0.178684580868889"

fBodyBodyAccJerkMag-mean() "numeric" "-0.993998275797101" "0.538404846128205"

fBodyBodyAccJerkMag-std() "numeric" "-0.994366667681159" "0.316346415348718"

fBodyBodyGyroMag-mean() "numeric" "-0.986535242105263" "0.203979764835897"

fBodyBodyGyroMag-std() "numeric" "-0.981468841692308" "0.236659662496296"

fBodyBodyGyroJerkMag-mean() "numeric" "-0.997617389275362" "0.146618569064407"

fBodyBodyGyroJerkMag-std() "numeric" "-0.99758523057971" "0.287834616098305"