Activity Recognition Using Human Smartphones Dataset

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 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.

Activity labels

WALKING -

WALKING\_UPSTAIRS,

WALKING\_DOWNSTAIRS

SITTING

STANDING

LAYING

Data included in each record

- 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.

Files included in the dataset along with the description

- 'README.txt'

- 'features\_info.txt': Shows information about the variables used on the feature vector.

- 'features.txt': List of all features.

- 'activity\_labels.txt': Links the class labels with their activity name.

- 'train/X\_train.txt': Training set.

- 'train/y\_train.txt': Training labels.

- 'test/X\_test.txt': Test set.

- 'test/y\_test.txt': Test labels.

Identifiers

Subject – ID of the test subject

Activity – type of activity performed during time of measurement

Files available for the train and test data. Their descriptions are equivalent.

. 'train/subject\_train.txt': Each row identifies the subject who performed the activity for each window sample. Its range is from 1 to 30.

. 'train/Inertial Signals/total\_acc\_x\_train.txt': The acceleration signal from the smartphone accelerometer X axis in standard gravity units 'g'. Every row shows a 128 element vector. The same description applies for the 'total\_acc\_x\_train.txt' and 'total\_acc\_z\_train.txt' files for the Y and Z axis.

. 'train/Inertial Signals/body\_acc\_x\_train.txt': The body acceleration signal obtained by subtracting the gravity from the total acceleration.

. 'train/Inertial Signals/body\_gyro\_x\_train.txt': The angular velocity vector measured by the gyroscope for each window sample. The units are radians/second.

Signals that 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.

tBodyAcc-XYZ

tGravityAcc-XYZ

tBodyAccJerk-XYZ

tBodyGyro-XYZ

tBodyGyroJerk-XYZ

tBodyAccMag

tGravityAccMag

tBodyAccJerkMag

tBodyGyroMag

tBodyGyroJerkMag

fBodyAcc-XYZ

fBodyAccJerk-XYZ

fBodyGyro-XYZ

fBodyAccMag

fBodyAccJerkMag

fBodyGyroMag

fBodyGyroJerkMag

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

mean(): Mean value

std(): Standard deviation

mad(): Median absolute deviation

max(): Largest value in array

min(): Smallest value in array

sma(): Signal magnitude area

energy(): Energy measure. Sum of the squares divided by the number of values.

iqr(): Interquartile range

entropy(): Signal entropy

arCoeff(): Autorregresion coefficients with Burg order equal to 4

correlation(): correlation coefficient between two signals

maxInds(): index of the frequency component with largest magnitude

meanFreq(): Weighted average of the frequency components to obtain a mean frequency

skewness(): skewness of the frequency domain signal

kurtosis(): kurtosis of the frequency domain signal

bandsEnergy(): Energy of a frequency interval within the 64 bins of the FFT of each window.

angle(): Angle between to vectors.

Additional vectors obtained by averaging the signals in a signal window sample. These are used on the angle() variable:

gravityMean

tBodyAccMean

tBodyAccJerkMean

tBodyGyroMean

tBodyGyroJerkMean

The complete list of variables of each feature vector is available in 'features.txt'

Notes:

- Features are normalized and bounded within [-1,1].

- Each feature vector is a row on the text file.

Reference:

[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

Jorge L. Reyes-Ortiz, Alessandro Ghio, Luca Oneto, Davide Anguita. November 2012.