Feature Selection

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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.

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'