Codebook

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

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

gravityMean

tBodyAccMean

tBodyAccJerkMean

tBodyGyroMean

tBodyGyroJerkMean

Variables included in the tidy data set	**Variables not included in the tidy data set**
mean(): Mean value std(): Standard deviation meanFreq(): Weighted average of the frequency components to obtain a mean frequency angle(): Angle between to vectors for the following means : angle(tBodyAccMean,gravity)", angle(tBodyAccJerkMean),gravityMean)	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

angle(tBodyGyroMean,gravityMean) angle(tBodyGyroJerkMean,gravityMean) angle(X,gravityMean) angle(Y,gravityMean) angle(Z,gravityMean)	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 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. .