subject

activity  
tBodyAcc\_mean\_X  
tBodyAcc\_mean\_Y  
tBodyAcc\_mean\_Z

tBodyAcc\_std\_X  
tBodyAcc\_std\_Y  
tBodyAcc\_std\_Z  
tGravityAcc\_mean\_X  
tGravityAcc\_mean\_Y

tGravityAcc\_mean\_Z  
tGravityAcc\_std\_X  
tGravityAcc\_std\_Y  
tGravityAcc\_std\_Z  
tBodyAccJerk\_mean\_X

tBodyAccJerk\_mean\_Y  
tBodyAccJerk\_mean\_Z  
tBodyAccJerk\_std\_X  
tBodyAccJerk\_std\_Y  
tBodyAccJerk\_std\_Z

tBodyGyro\_mean\_X  
tBodyGyro\_mean\_Y  
tBodyGyro\_mean\_Z  
tBodyGyro\_std\_X  
tBodyGyro\_std\_Y

tBodyGyro\_std\_Z  
tBodyGyroJerk\_mean\_X  
tBodyGyroJerk\_mean\_Y  
tBodyGyroJerk\_mean\_Z  
tBodyGyroJerk\_std\_X

tBodyGyroJerk\_std\_Y  
tBodyGyroJerk\_std\_Z  
tBodyAccMag\_mean  
tBodyAccMag\_std  
tGravityAccMag\_mean

tGravityAccMag\_std  
tBodyAccJerkMag\_mean  
tBodyAccJerkMag\_std  
tBodyGyroMag\_mean  
tBodyGyroMag\_std

tBodyGyroJerkMag\_mean  
tBodyGyroJerkMag\_std  
fBodyAcc\_mean\_X  
fBodyAcc\_mean\_Y  
fBodyAcc\_mean\_Z

fBodyAcc\_std\_X  
fBodyAcc\_std\_Y  
fBodyAcc\_std\_Z  
fBodyAcc\_meanFreq\_X  
fBodyAcc\_meanFreq\_Y

fBodyAcc\_meanFreq\_Z  
fBodyAccJerk\_mean\_X  
fBodyAccJerk\_mean\_Y  
fBodyAccJerk\_mean\_Z  
fBodyAccJerk\_std\_X

fBodyAccJerk\_std\_Y  
fBodyAccJerk\_std\_Z  
fBodyAccJerk\_meanFreq\_X  
fBodyAccJerk\_meanFreq\_Y  
fBodyAccJerk\_meanFreq\_Z

fBodyGyro\_mean\_X  
fBodyGyro\_mean\_Y  
fBodyGyro\_mean\_Z  
fBodyGyro\_std\_X  
fBodyGyro\_std\_Y

fBodyGyro\_std\_Z  
fBodyGyro\_meanFreq\_X  
fBodyGyro\_meanFreq\_Y  
fBodyGyro\_meanFreq\_Z  
fBodyAccMag\_mean

fBodyAccMag\_std  
fBodyAccMag\_meanFreq  
fBodyBodyAccJerkMag\_mean  
fBodyBodyAccJerkMag\_std  
fBodyBodyAccJerkMag\_meanFreq

fBodyBodyGyroMag\_mean  
fBodyBodyGyroMag\_std  
fBodyBodyGyroMag\_meanFreq  
fBodyBodyGyroJerkMag\_mean  
fBodyBodyGyroJerkMag\_std

fBodyBodyGyroJerkMag\_meanFreq

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'

| tGravityAcc\_mean\_X | Mean of the gravity acceleration along the accelerometer X axis. | g |

| tGravityAcc\_mean\_Y | Mean of the gravity acceleration along the accelerometer Y axis. | g |

| tGravityAcc\_mean\_Z | Mean of the gravity acceleration along the accelerometer Z axis. | g |

| tGravityAcc\_std\_X | Standard deviation of the gravity acceleration along the accelerometer X axis. | g |

| tGravityAcc\_std\_Y | Standard deviation of the gravity acceleration along the accelerometer Y axis. | g |

| tGravityAcc\_std\_Z | Standard deviation of the gravity acceleration along the accelerometer Z axis. | g |

| tBodyAccJerk\_mean\_X | Mean of the body linear acceleration along the accelerometer X axis. | g/s |

| tBodyAccJerk\_mean\_Y | Mean of the body linear acceleration along the accelerometer Y axis. | g/s |

| tBodyAccJerk\_mean\_Z | Mean of the body linear acceleration along the accelerometer Z axis. | g/s |

| tBodyAccJerk\_std\_X | Standard deviation of the body linear acceleration along the accelerometer X axis. | g/s |

| tBodyAccJerk\_std\_Y | Standard deviation of the body linear acceleration along the accelerometer Y axis. | g/s |

| tBodyAccJerk\_std\_Z | Standard deviation of the body linear acceleration along the accelerometer Z axis. | g/s |

| tBodyGyro\_mean\_X | Mean of the body rotation about the gyroscope X axis. | rad/s |

| tBodyGyro\_mean\_Y | Mean of the body rotation about the gyroscope Y axis. | rad/s |

| tBodyGyro\_mean\_Z | Mean of the body rotation about the gyroscope Z axis. | rad/s |

| tBodyGyro\_std\_X | Standard deviation of the body rotation about the gyroscope X axis. | rad/s |

| tBodyGyro\_std\_Y | Standard deviation of the body rotation about the gyroscope Y axis. | rad/s |

| tBodyGyro\_std\_Z | Standard deviation of the body rotation about the gyroscope Z axis. | rad/s |

| tBodyGyroJerk\_mean\_X | Mean of the body angular velocity about the gyroscope X axis. | rad/s<sup>2</sup> |

| tBodyGyroJerk\_mean\_Y | Mean of the body angular velocity about the gyroscope Y axis. | rad/s<sup>2</sup> |

| tBodyGyroJerk\_mean\_Z | Mean of the body angular velocity about the gyroscope Z axis. | rad/s<sup>2</sup> |

| tBodyGyroJerk\_std\_X | Standard deviation of the body angular velocity about the gyroscope X axis. | rad/s<sup>2</sup> |

| tBodyGyroJerk\_std\_Y | Standard deviation of the body angular velocity about the gyroscope Y axis. | rad/s<sup>2</sup> |

| tBodyGyroJerk\_std\_Z | Standard deviation of the body angular velocity about the gyroscope Z axis. | rad/s<sup>2</sup> |

| tBodyAccMag\_mean | Mean of the magnitude of the body acceleration. | g/s |

| tBodyAccMag\_std | Standard deviation of the magnitude of the body acceleration. | g |

| tGravityAccMag\_mean | Mean of the magnitude of the gravity acceleration. | g |

| tGravityAccMag\_std | Standard deviation of the magnitude of the gravity acceleration. | g |

| tBodyAccJerkMag\_mean | Mean of the magnitude of the body linear acceleration. | g/s |

| tBodyAccJerkMag\_std | Standard deviation of the magnitude of the body linear acceleration. | g/s |

| tBodyGyroMag\_mean | Mean of the magnitude of the body rotation. | rad/s |

| tBodyGyroMag\_std | Standard deviation of the magnitude of the body rotation. | rad/s |

| tBodyGyroJerkMag\_mean | Mean of the magnitude of the body angular velocity. | rad/s<sup>2</sup> |

| tBodyGyroJerkMag\_std | Standard deviation of the magnitude of the body angular velocity. | rad/s<sup>2</sup> |