

CODEBOOK

Below is a description of the variables used in the assignment.

Method of data collection :

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

Complete list of variables :

Below is a complete list of variables of each feature vector, with its position.

The variables from 1 to 561 are normalized and bounded within [-1,1].

The variables 562, 563 and 564 are the group, subjects and activities of the measurement.

Variable position / Variable name

- [1] "tBodyAcc-mean()-X"
- [2] "tBodyAcc-mean()-Y"
- [3] "tBodyAcc-mean()-Z"
- [4] "tBodyAcc-std()-X"
- [5] "tBodyAcc-std()-Y"
- [6] "tBodyAcc-std()-Z"
- [7] "tBodyAcc-mad()-X"
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- [9] "tBodyAcc-mad()-Z"
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- [17] "tBodyAcc-energy()-X"
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- [28] "tBodyAcc-arCoeff()-X,3"
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- [395] "fBodyAccJerk-bandsEnergy()-25,48"
- [396] "fBodyAccJerk-bandsEnergy()-1,8"
- [397] "fBodyAccJerk-bandsEnergy()-9,16"
- [398] "fBodyAccJerk-bandsEnergy()-17,24"
- [399] "fBodyAccJerk-bandsEnergy()-25,32"
- [400] "fBodyAccJerk-bandsEnergy()-33,40"
- [401] "fBodyAccJerk-bandsEnergy()-41,48"
- [402] "fBodyAccJerk-bandsEnergy()-49,56"
- [403] "fBodyAccJerk-bandsEnergy()-57,64"
- [404] "fBodyAccJerk-bandsEnergy()-1,16"
- [405] "fBodyAccJerk-bandsEnergy()-17,32"
- [406] "fBodyAccJerk-bandsEnergy()-33,48"
- [407] "fBodyAccJerk-bandsEnergy()-49,64"
- [408] "fBodyAccJerk-bandsEnergy()-1,24"
- [409] "fBodyAccJerk-bandsEnergy()-25,48"
- [410] "fBodyAccJerk-bandsEnergy()-1,8"
- [411] "fBodyAccJerk-bandsEnergy()-9,16"
- [412] "fBodyAccJerk-bandsEnergy()-17,24"
- [413] "fBodyAccJerk-bandsEnergy()-25,32"
- [414] "fBodyAccJerk-bandsEnergy()-33,40"
- [415] "fBodyAccJerk-bandsEnergy()-41,48"

- [416] "fBodyAccJerk-bandsEnergy()-49,56"
- [417] "fBodyAccJerk-bandsEnergy()-57,64"
- [418] "fBodyAccJerk-bandsEnergy()-1,16"
- [419] "fBodyAccJerk-bandsEnergy()-17,32"
- [420] "fBodyAccJerk-bandsEnergy()-33,48"
- [421] "fBodyAccJerk-bandsEnergy()-49,64"
- [422] "fBodyAccJerk-bandsEnergy()-1,24"
- [423] "fBodyAccJerk-bandsEnergy()-25,48"
- [424] "fBodyGyro-mean()-X"
- [425] "fBodyGyro-mean()-Y"
- [426] "fBodyGyro-mean()-Z"
- [427] "fBodyGyro-std()-X"
- [428] "fBodyGyro-std()-Y"
- [429] "fBodyGyro-std()-Z"
- [430] "fBodyGyro-mad()-X"
- [431] "fBodyGyro-mad()-Y"
- [432] "fBodyGyro-mad()-Z"
- [433] "fBodyGyro-max()-X"
- [434] "fBodyGyro-max()-Y"
- [435] "fBodyGyro-max()-Z"
- [436] "fBodyGyro-min()-X"
- [437] "fBodyGyro-min()-Y"
- [438] "fBodyGyro-min()-Z"
- [439] "fBodyGyro-sma()"
- [440] "fBodyGyro-energy()-X"
- [441] "fBodyGyro-energy()-Y"
- [442] "fBodyGyro-energy()-Z"
- [443] "fBodyGyro-iqr()-X"
- [444] "fBodyGyro-iqr()-Y"
- [445] "fBodyGyro-iqr()-Z"
- [446] "fBodyGyro-entropy()-X"
- [447] "fBodyGyro-entropy()-Y"
- [448] "fBodyGyro-entropy()-Z"
- [449] "fBodyGyro-maxInds-X"
- [450] "fBodyGyro-maxInds-Y"
- [451] "fBodyGyro-maxInds-Z"
- [452] "fBodyGyro-meanFreq()-X"
- [453] "fBodyGyro-meanFreq()-Y"
- [454] "fBodyGyro-meanFreq()-Z"
- [455] "fBodyGyro-skewness()-X"
- [456] "fBodyGyro-kurtosis()-X"
- [457] "fBodyGyro-skewness()-Y"
- [458] "fBodyGyro-kurtosis()-Y"
- [459] "fBodyGyro-skewness()-Z"
- [460] "fBodyGyro-kurtosis()-Z"
- [461] "fBodyGyro-bandsEnergy()-1,8"
- [462] "fBodyGyro-bandsEnergy()-9,16"
- [463] "fBodyGyro-bandsEnergy()-17,24"
- [464] "fBodyGyro-bandsEnergy()-25,32"
- [465] "fBodyGyro-bandsEnergy()-33,40"
- [466] "fBodyGyro-bandsEnergy()-41,48"
- [467] "fBodyGyro-bandsEnergy()-49,56"
- [468] "fBodyGyro-bandsEnergy()-57,64"
- [469] "fBodyGyro-bandsEnergy()-1,16"
- [470] "fBodyGyro-bandsEnergy()-17,32"
- [471] "fBodyGyro-bandsEnergy()-33,48"
- [472] "fBodyGyro-bandsEnergy()-49,64"

- [473] "fBodyGyro-bandsEnergy()-1,24"
- [474] "fBodyGyro-bandsEnergy()-25,48"
- [475] "fBodyGyro-bandsEnergy()-1,8"
- [476] "fBodyGyro-bandsEnergy()-9,16"
- [477] "fBodyGyro-bandsEnergy()-17,24"
- [478] "fBodyGyro-bandsEnergy()-25,32"
- [479] "fBodyGyro-bandsEnergy()-33,40"
- [480] "fBodyGyro-bandsEnergy()-41,48"
- [481] "fBodyGyro-bandsEnergy()-49,56"
- [482] "fBodyGyro-bandsEnergy()-57,64"
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- [484] "fBodyGyro-bandsEnergy()-17,32"
- [485] "fBodyGyro-bandsEnergy()-33,48"
- [486] "fBodyGyro-bandsEnergy()-49,64"
- [487] "fBodyGyro-bandsEnergy()-1,24"
- [488] "fBodyGyro-bandsEnergy()-25,48"
- [489] "fBodyGyro-bandsEnergy()-1,8"
- [490] "fBodyGyro-bandsEnergy()-9,16"
- [491] "fBodyGyro-bandsEnergy()-17,24"
- [492] "fBodyGyro-bandsEnergy()-25,32"
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- [495] "fBodyGyro-bandsEnergy()-49,56"
- [496] "fBodyGyro-bandsEnergy()-57,64"
- [497] "fBodyGyro-bandsEnergy()-1,16"
- [498] "fBodyGyro-bandsEnergy()-17,32"
- [499] "fBodyGyro-bandsEnergy()-33,48"
- [500] "fBodyGyro-bandsEnergy()-49,64"
- [501] "fBodyGyro-bandsEnergy()-1,24"
- [502] "fBodyGyro-bandsEnergy()-25,48"
- [503] "fBodyAccMag-mean()"
- [504] "fBodyAccMag-std()"
- [505] "fBodyAccMag-mad()"
- [506] "fBodyAccMag-max()"
- [507] "fBodyAccMag-min()"
- [508] "fBodyAccMag-sma()"
- [509] "fBodyAccMag-energy()"
- [510] "fBodyAccMag-iqr()"
- [511] "fBodyAccMag-entropy()"
- [512] "fBodyAccMag-maxInds"
- [513] "fBodyAccMag-meanFreq()"
- [514] "fBodyAccMag-skewness()"
- [515] "fBodyAccMag-kurtosis()"
- [516] "fBodyBodyAccJerkMag-mean()"
- [517] "fBodyBodyAccJerkMag-std()"
- [518] "fBodyBodyAccJerkMag-mad()"
- [519] "fBodyBodyAccJerkMag-max()"
- [520] "fBodyBodyAccJerkMag-min()"
- [521] "fBodyBodyAccJerkMag-sma()"
- [522] "fBodyBodyAccJerkMag-energy()"
- [523] "fBodyBodyAccJerkMag-iqr()"
- [524] "fBodyBodyAccJerkMag-entropy()"
- [525] "fBodyBodyAccJerkMag-maxInds"
- [526] "fBodyBodyAccJerkMag-meanFreq()"
- [527] "fBodyBodyAccJerkMag-skewness()"
- [528] "fBodyBodyAccJerkMag-kurtosis()"
- [529] "fBodyBodyGyroMag-mean()"

- [530] "fBodyBodyGyroMag-std()"
- [531] "fBodyBodyGyroMag-mad()"
- [532] "fBodyBodyGyroMag-max()"
- [533] "fBodyBodyGyroMag-min()"
- [534] "fBodyBodyGyroMag-sma()"
- [535] "fBodyBodyGyroMag-energy()"
- [536] "fBodyBodyGyroMag-iqr()"
- [537] "fBodyBodyGyroMag-entropy()"
- [538] "fBodyBodyGyroMag-maxInds"
- [539] "fBodyBodyGyroMag-meanFreq()"
- [540] "fBodyBodyGyroMag-skewness()"
- [541] "fBodyBodyGyroMag-kurtosis()"
- [542] "fBodyBodyGyroJerkMag-mean()"
- [543] "fBodyBodyGyroJerkMag-std()"
- [544] "fBodyBodyGyroJerkMag-mad()"
- [545] "fBodyBodyGyroJerkMag-max()"
- [546] "fBodyBodyGyroJerkMag-min()"
- [547] "fBodyBodyGyroJerkMag-sma()"
- [548] "fBodyBodyGyroJerkMag-energy()"
- [549] "fBodyBodyGyroJerkMag-iqr()"
- [550] "fBodyBodyGyroJerkMag-entropy()"
- [551] "fBodyBodyGyroJerkMag-maxInds"
- [552] "fBodyBodyGyroJerkMag-meanFreq()"
- [553] "fBodyBodyGyroJerkMag-skewness()"
- [554] "fBodyBodyGyroJerkMag-kurtosis()"
- [555] "angle(tBodyAccMean,gravity)"
- [556] "angle(tBodyAccJerkMean,gravityMean)"
- [557] "angle(tBodyGyroMean,gravityMean)"
- [558] "angle(tBodyGyroJerkMean,gravityMean)"
- [559] "angle(X,gravityMean)"
- [560] "angle(Y,gravityMean)"
- [561] "angle(Z,gravityMean)"

- [562] "group"
 - Character – 2 values :
 - TRAIN
 - TEST

The 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.

- [563] "activity"
 - Character – 6 values :
 - LAYING
 - SITTING
 - STANDING
 - WALKING
 - WALKING_DOWNSTAIRS
 - WALKING_UPSTAIRS

- [564] "subject"
 - Numeric

Each of the subject is assigned a number from 1 to 30.