**特征说明**

该数据集所选特征共561个，包含通过手机传感器和陀螺传感器获得的*X*、*Y*和*Z*三轴身体加速度（字符“bodyACC”表示）、重力加速度（字符“GRavityAcc”表示）及角速度（字符“Angle”表示）。变量（特征）名称中时间域信号（前缀“*t*”表示）以50Hz的恒定速率捕获。然后，使用中值滤波器和3阶低通Butterworth滤波器进行滤波，带通频率为20Hz，以消除噪声。同样，加速度信号使用另一个带通频率为0.3Hz的低通Butterworth滤波器分离为身体加速度信号和重力加速度。随后，通过时间推导出身体线性加速度和角速度以获得Jerk信号（字符“Jerk”表示）。此外，使用欧几里得范数计算三维信号的大小（字符“Mag”表示）。最后，对其中一些信号应用快速傅里叶变换（FFT），得到部分特征（字符“*f*”表示频域信号）。这些信号中估计的数字特征如下：

1、mean（）：均值，字符“Mean”表示；

2、std（）：标准偏差，字符“STD”表示；

3、mad（）：中位数绝对偏差，字符“Mad”表示；

4、max（）：数组中最大的值，字符“Max”表示；

5、min（）：数组中最小的值，字符“Min”表示；

6、sma（）：信号幅度区域，字符“SMA”表示；

7、energy（）：能量测量。平方和除以值的数量，字符“Energy”表示；

8、iqr（）：四分位间距，字符“IQR”表示；

9、entropy（）：信号熵，字符“ropy”表示；

10、arCoeff（）：Burg阶数等于4的自回归系数，字符“ARCoeff”表示；

11、correlation（）：两个信号之间的相关系数，字符“Correlation”表示；

12、maxInds（）：具有最大幅度的频率分量的索引，字符“MaxInds”表示；

13、meanFreq（）：频率分量的加权平均值，以获得平均频率，字符“MeanFreq”表示；

14、skewness（）：频域信号的偏斜度，字符“Skewness”表示；

15、kurtosis（）：频，字符“Kurtosis”表示。

16、bandsEnergy( )：每个窗口的FFT的64个bin中的频率间隔的能量

17、angle( ): 两个向量之间的角度。

通过对信号窗口样本中的信号进行平均获得附加向量，这些向量用于angle()变量：

gravityMean

tBodyAccMean

tBodyAccJerkMean

tBodyGyroMean

tBodyGyroJerkMean

**注：更多信息参考下面英文原始介绍。**

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