Introduction

Run_analysis.R script modifies and cleans data required for the course project of "Getting and Cleaning Data" course on Coursera.

Pre_Processing

The following files are read in by the script run_analysis.R.
features.txt X_test.txt y_test.txt X_train.txt y_train.txt subject_test.txt subject_train.txt

1. . Read the files X_test.txt,y_test.txt,X_train.txt,y_train.txt,subject_test.txt,subject_train.txt into R data frames:
   "datax2_temp","datay2_temp","datax1_temp","datay1_temp","datas2_temp","datas1_temp" respectively.
2. Bind the raw data test and train together into data_x,data_y,data_S
3. Read the features into a file called features_set
4. Provide Column names to the data_X file from the features set
5. Provide sensible column names to the data_Y and data_S data sets.
6. Exctract only the required features of mean and std deviation (grep) and put into the means and stds data frames and combine into 1 frame dataX
7. We merge the test and train data into dataout_1
8. We merge the subject data into data_subject

Transformations:

a. We use melt to get the file to get the data in lines for the subject and activities
b. We use dcast to take averages of each subjects measures in the variable of means and std deviations into a data frame called data_final _set

Description of Features

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 tGravityAccMagtBodyAccJerkMag tBodyGyroMag tBodyGyroJerkMag fBodyAcc-XYZ fBodyAccJerk-XYZ fBodyGyro-XYZ fBodyAccMagfBodyAccJerkMag 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 inarray sma(): Signal magnitude area energy(): Energy measure. Sum of the squares divided by thenumber 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
This file contains two columns V1: Lists the sequence number ranging from 1 to 561 V2: Lists the variables found in files X_test and X_train files
These files contain one variable indicating the ID of the subject ranging from 1 to 30
The y_test and y_train files contain the activity ids pertaining to the observations in X_test and X_train files respectively.

THE DESCRIPTION OF THE VARIABLES ARE

The values of these activity ids range 1-6 representing the following:
1 WALKING 2 WALKING_UPSTAIRS 3 WALKING_DOWNSTAIRS 4 SITTING 5 STANDING 6 LAYING
The fixed width (10) numeric data columns contained in the files X_test and X_train files are:
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 8 tBodyAcc-mad()-Y 9 tBodyAcc-mad()-Z 10 tBodyAcc-max()-X 11 tBodyAcc-max()-Y 12 tBodyAcc-max()-Z 13
tBodyAcc-min()-X 14 tBodyAcc-min()-Y 15 tBodyAcc-min()-Z 16 tBodyAcc-sma() 17 tBodyAcc-energy()-X 18 tBodyAcc-energy()-Y
19 tBodyAcc-energy()-Z 20 tBodyAcc-iqr()-X 21 tBodyAcc-iqr()-Y 22 tBodyAcc-iqr()-Z 23 tBodyAcc-entropy()-X 24 tBodyAccentropy()-
Y 25 tBodyAcc-entropy()-Z 26 tBodyAcc-arCoeff()-X,1 27 tBodyAcc-arCoeff()-X,2 28 tBodyAcc-arCoeff()-X,3 29 tBodyAccarCoeff()-
X,4 30 tBodyAcc-arCoeff()-Y,1 31 tBodyAcc-arCoeff()-Y,2 32 tBodyAcc-arCoeff()-Y,3 33 tBodyAcc-arCoeff()-Y,4 34
tBodyAcc-arCoeff()-Z,1 35 tBodyAcc-arCoeff()-Z,2 36 tBodyAcc-arCoeff()-Z,3 37 tBodyAcc-arCoeff()-Z,4 38 tBodyAcc-correlation()-
X,Y 39 tBodyAcc-correlation()-X,Z 40 tBodyAcc-correlation()-Y,Z 41 tGravityAcc-mean()-X 42 tGravityAcc-mean()-Y 43 tGravityAccmean()-
Z 44 tGravityAcc-std()-X 45 tGravityAcc-std()-Y 46 tGravityAcc-std()-Z 47 tGravityAcc-mad()-X 48 tGravityAcc-mad()-Y 49
tGravityAcc-mad()-Z 50 tGravityAcc-max()-X 51 tGravityAcc-max()-Y 52 tGravityAcc-max()-Z 53 tGravityAcc-min()-X 54 tGravityAccmin()-
Y 55 tGravityAcc-min()-Z 56 tGravityAcc-sma() 57 tGravityAcc-energy()-X 58 tGravityAcc-energy()-Y 59 tGravityAcc-energy()-Z
60 tGravityAcc-iqr()-X 61 tGravityAcc-iqr()-Y 62 tGravityAcc-iqr()-Z 63 tGravityAcc-entropy()-X 64 tGravityAcc-entropy()-Y 65
tGravityAcc-entropy()-Z 66 tGravityAcc-arCoeff()-X,1 67 tGravityAcc-arCoeff()-X,2 68 tGravityAcc-arCoeff()-X,3 69 tGravityAccarCoeff()-
X,4 70 tGravityAcc-arCoeff()-Y,1 71 tGravityAcc-arCoeff()-Y,2 72 tGravityAcc-arCoeff()-Y,3 73 tGravityAcc-arCoeff()-Y,4 74
tGravityAcc-arCoeff()-Z,1 75 tGravityAcc-arCoeff()-Z,2 76 tGravityAcc-arCoeff()-Z,3 77 tGravityAcc-arCoeff()-Z,4 78 tGravityAcccorrelation()-
X,Y 79 tGravityAcc-correlation()-X,Z 80 tGravityAcc-correlation()-Y,Z 81 tBodyAccJerk-mean()-X 82 tBodyAccJerkmean()-
Y 83 tBodyAccJerk-mean()-Z 84 tBodyAccJerk-std()-X 85 tBodyAccJerk-std()-Y 86 tBodyAccJerk-std()-Z 87 tBodyAccJerkmad()-
X 88 tBodyAccJerk-mad()-Y 89 tBodyAccJerk-mad()-Z 90 tBodyAccJerk-max()-X 91 tBodyAccJerk-max()-Y 92 tBodyAccJerkmax()-
Z 93 tBodyAccJerk-min()-X 94 tBodyAccJerk-min()-Y 95 tBodyAccJerk-min()-Z 96 tBodyAccJerk-sma() 97 tBodyAccJerkenergy()-

X 98 tBodyAccJerk-energy()-Y 99 tBodyAccJerk-energy()-Z 100 tBodyAccJerk-iqr()-X 101 tBodyAccJerk-iqr()-Y 102
tBodyAccJerk-iqr()-Z 103 tBodyAccJerk-entropy()-X 104 tBodyAccJerk-entropy()-Y 105 tBodyAccJerk-entropy()-Z 106 tBodyAccJerkarCoeff()-
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Z,1 115 tBodyAccJerk-arCoeff()-Z,2 116 tBodyAccJerk-arCoeff()-Z,3 117 tBodyAccJerk-arCoeff()-Z,4 118 tBodyAccJerkcorrelation()-
X,Y 119 tBodyAccJerk-correlation()-X,Z 120 tBodyAccJerk-correlation()-Y,Z 121 tBodyGyro-mean()-X 122 tBodyGyromean()-
Y 123 tBodyGyro-mean()-Z 124 tBodyGyro-std()-X 125 tBodyGyro-std()-Y 126 tBodyGyro-std()-Z 127 tBodyGyro-mad()-X 128
tBodyGyro-mad()-Y 129 tBodyGyro-mad()-Z 130 tBodyGyro-max()-X 131 tBodyGyro-max()-Y 132 tBodyGyro-max()-Z 133 tBodyGyromin()-
X 134 tBodyGyro-min()-Y 135 tBodyGyro-min()-Z 136 tBodyGyro-sma() 137 tBodyGyro-energy()-X 138 tBodyGyro-energy()-Y
139 tBodyGyro-energy()-Z 140 tBodyGyro-iqr()-X 141 tBodyGyro-iqr()-Y 142 tBodyGyro-iqr()-Z 143 tBodyGyro-entropy()-X 144
tBodyGyro-entropy()-Y 145 tBodyGyro-entropy()-Z 146 tBodyGyro-arCoeff()-X,1 147 tBodyGyro-arCoeff()-X,2 148 tBodyGyroarCoeff()-
X,3 149 tBodyGyro-arCoeff()-X,4 150 tBodyGyro-arCoeff()-Y,1 151 tBodyGyro-arCoeff()-Y,2 152 tBodyGyro-arCoeff()-Y,3
153 tBodyGyro-arCoeff()-Y,4 154 tBodyGyro-arCoeff()-Z,1 155 tBodyGyro-arCoeff()-Z,2 156 tBodyGyro-arCoeff()-Z,3 157 tBodyGyro
arCoeff()-Z,4 158 tBodyGyro-correlation()-X,Y 159 tBodyGyro-correlation()-X,Z 160 tBodyGyro-correlation()-Y,Z 161 tBodyGyroJerkmean()-
X 162 tBodyGyroJerk-mean()-Y 163 tBodyGyroJerk-mean()-Z 164 tBodyGyroJerk-std()-X 165 tBodyGyroJerk-std()-Y 166
tBodyGyroJerk-std()-Z 167 tBodyGyroJerk-mad()-X 168 tBodyGyroJerk-mad()-Y 169 tBodyGyroJerk-mad()-Z 170 tBodyGyroJerkmax()-
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tBodyGyroJerk-entropy()-Y 185 tBodyGyroJerk-entropy()-Z 186 tBodyGyroJerk-arCoeff()-X,1 187 tBodyGyroJerk-arCoeff()-X,2 188
tBodyGyroJerk-arCoeff()-X,3 189 tBodyGyroJerk-arCoeff()-X,4 190 tBodyGyroJerk-arCoeff()-Y,1 191 tBodyGyroJerk-arCoeff()-Y,2
192 tBodyGyroJerk-arCoeff()-Y,3 193 tBodyGyroJerk-arCoeff()-Y,4 194 tBodyGyroJerk-arCoeff()-Z,1 195 tBodyGyroJerk-arCoeff()-Z,2
196 tBodyGyroJerk-arCoeff()-Z,3 197 tBodyGyroJerk-arCoeff()-Z,4 198 tBodyGyroJerk-correlation()-X,Y 199 tBodyGyroJerkcorrelation()-
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239 tBodyAccJerkMag-arCoeff()4 240 tBodyGyroMag-mean() 241 tBodyGyroMag-std() 242 tBodyGyroMag-mad() 243
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304 fBodyAcc-bandsEnergy()-9,16 305 fBodyAcc-bandsEnergy()-17,24 306 fBodyAcc-bandsEnergy()-25,32 307 fBodyAccbandsEnergy()-
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377 fBodyAccJerk-kurtosis()-X 378 fBodyAccJerk-skewness()-Y 379 fBodyAccJerk-kurtosis()-Y 380
fBodyAccJerk-skewness()-Z 381
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fBodyGyro-mad()-Z 433 fBodyGyromax()-
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

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fBodyGyro-maxInds-X 450 fBodyGyro-maxInds-Y 451 fBodyGyro-maxInds-Z 452 fBodyGyro-meanFreq()-X 453 fBodyGyromeanFreq()-
Y 454 fBodyGyro-meanFreq()-Z 455 fBodyGyro-skewness()-X 456 fBodyGyro-kurtosis()-X 457 fBodyGyro-skewness()-Y
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fBodyGyro-bandsEnergy()-9,16 463 fBodyGyro-bandsEnergy()-17,24 464 fBodyGyro-bandsEnergy()-25,32 465 fBodyGyrobandsEnergy()-
33,40 466 fBodyGyro-bandsEnergy()-41,48 467 fBodyGyro-bandsEnergy()-49,56 468 fBodyGyrobandsEnergy()-
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509 fBodyAccMag-energy() 510 fBodyAccMag-iqr() 511 fBodyAccMag-entropy() 512 fBodyAccMag-maxInds 513 fBodyAccMagmeanFreq()
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 fBodyBodyGyroMagstd()
531 fBodyBodyGyroMag-mad() 532 fBodyBodyGyroMag-max() 533 fBodyBodyGyroMag-min() 534 fBodyBodyGyroMag-sma()
535 fBodyBodyGyroMag-energy() 536 fBodyBodyGyroMag-iqr() 537 fBodyBodyGyroMag-entropy() 538 fBodyBodyGyroMag-maxInds
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fBodyBodyGyroJerkMag-mean() 543 fBodyBodyGyroJerkMag-std() 544 fBodyBodyGyroJerkMag-mad() 545 fBodyBodyGyroJerkMagmax()
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)