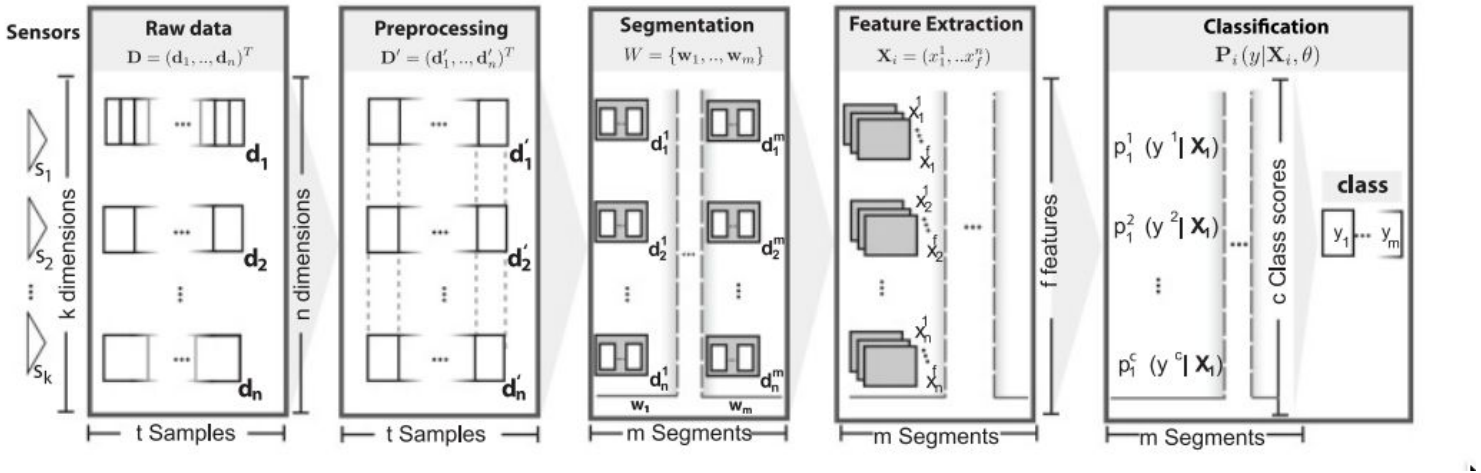
Activity 1:
Sensor Data Analysis

CS 4605/7470 Mobile and Ubiquitous Computing

AIM : practical experience
Bulling's Activity Recognition Chain (ARC)



Bulling, Andreas, Ulf Blanke, and Bernt Schiele. "A tutorial on human activity recognition using body-worn inertial sensors." *ACM Computing Surveys (CSUR)* 46.3 (2014): 33.

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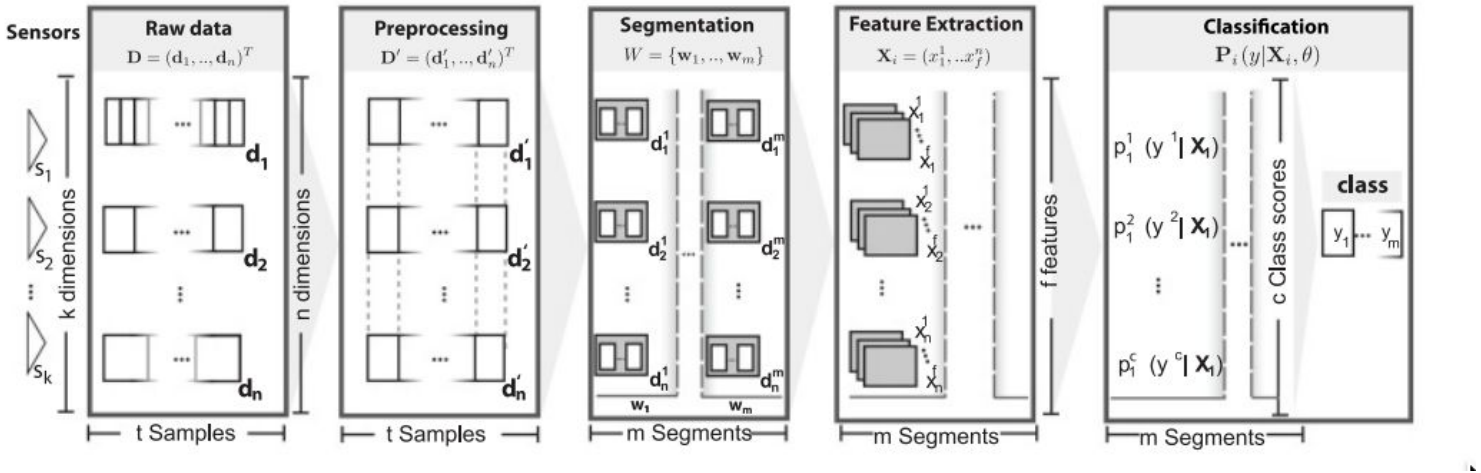

REDUCE : Noise

INCREASE : Information

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Sensor Data Activity

TASK 1 (15 points): What is the sampling rate

TASK 2 (15 points): Clean your data

TASK 3 (40 points): Step counts - walk

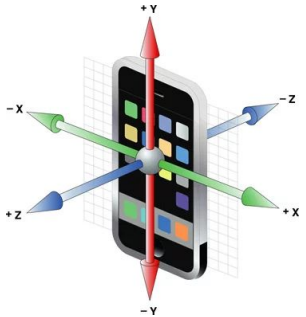
TASK 4 (30 points): Steps counts - climb

Task 5: Bonus (10 points): Who's step?

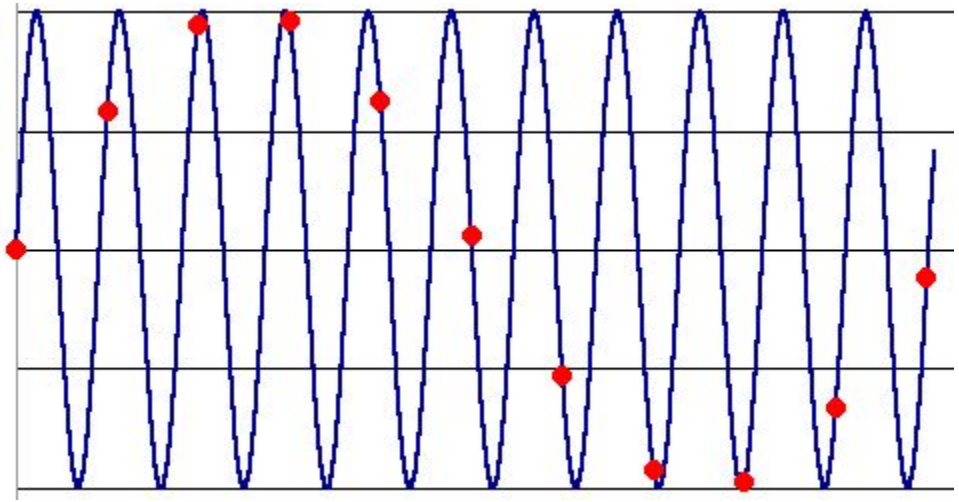
TASK 1 : Understand your data

1. Understand Sampling rate
2. Sampling Rate: Missing detail vs. wasting energy

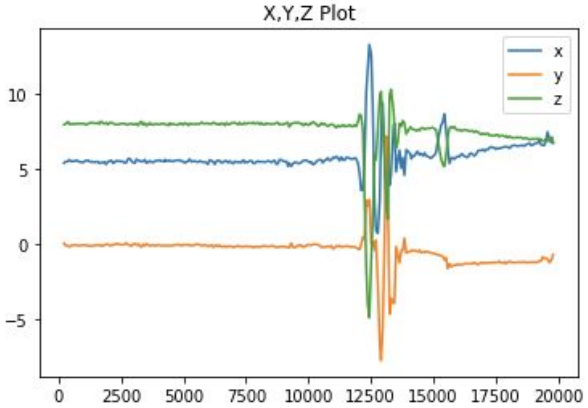
   Hint : **Refer lecture videos**



Sampling Rate and Aliasing



TASK 2 : Clean your data



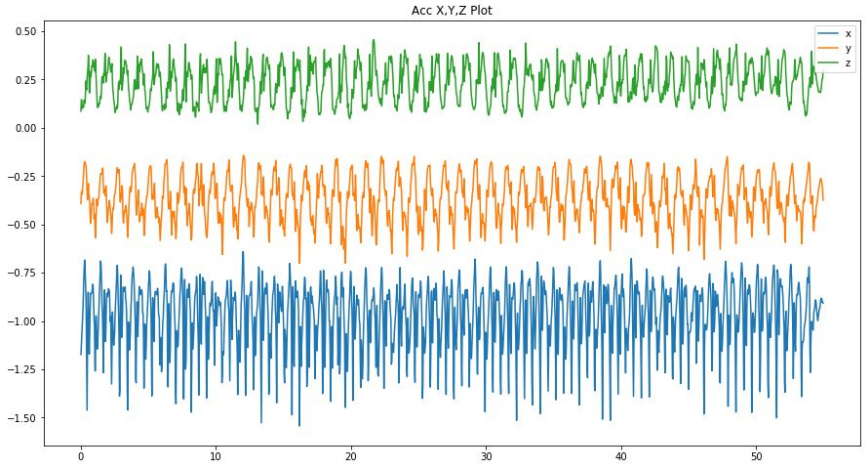
Walk 100 steps

1. Start recording Put phone in pocket
2. **Wait for 3 seconds**
3. Walk 100 steps
4. **Wait for 3 seconds**
5. Take phone out of pocket and stop recording

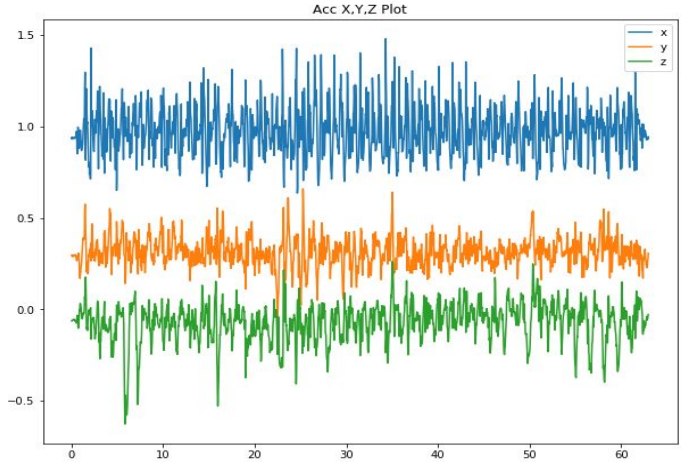
Let’s get started !
Task 1 and 2

TASK 3 : Step counts - walk

Walking Data 1



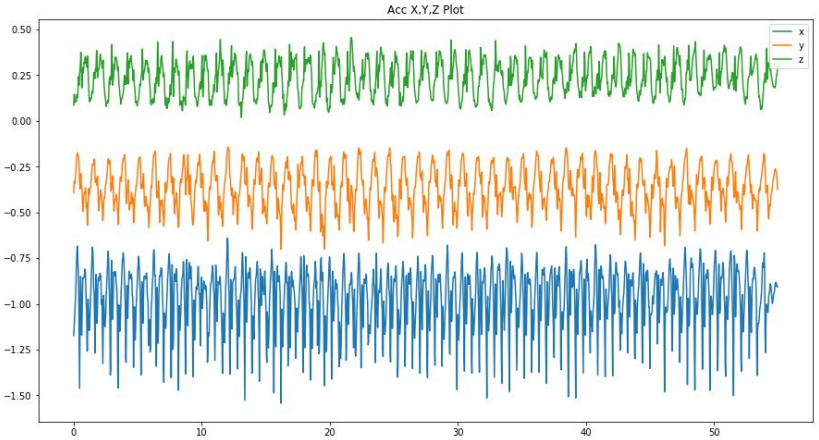
Walking Data 2

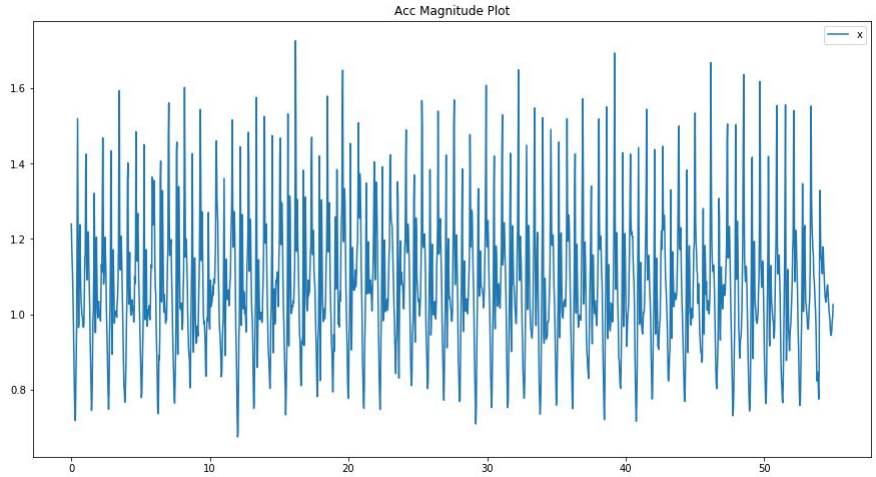


TASK 3 : Step counts - walk

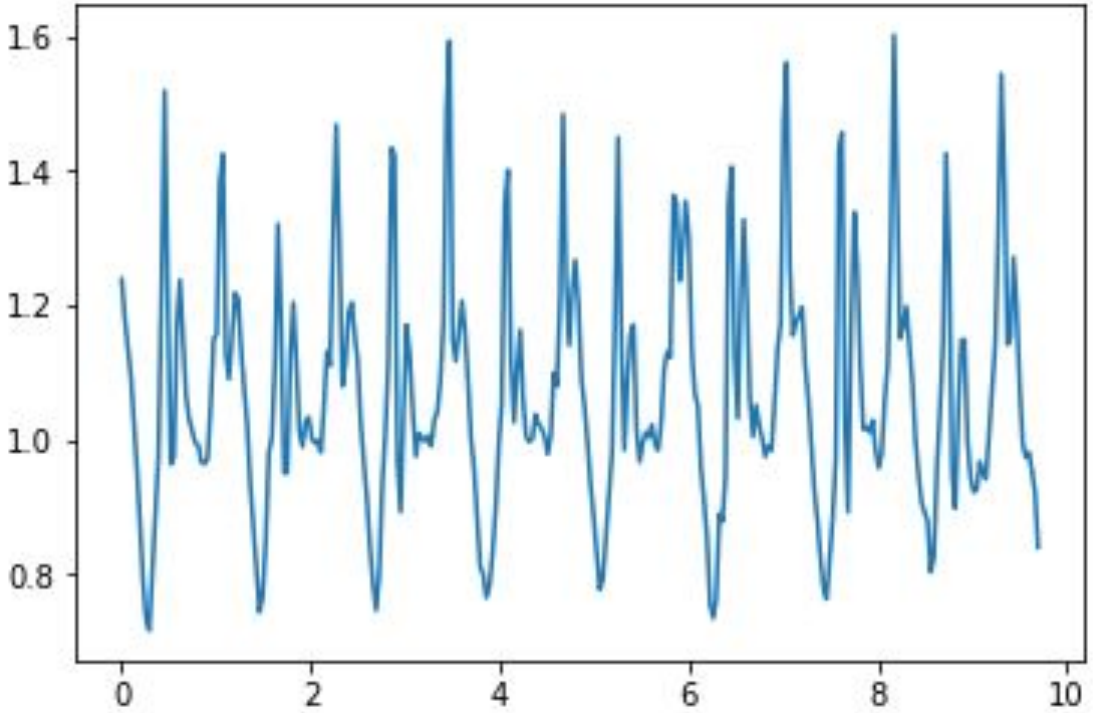
What can we do to reduce sensitivity due to orientation or phone placement?

TASK 3 : Step counts - walk



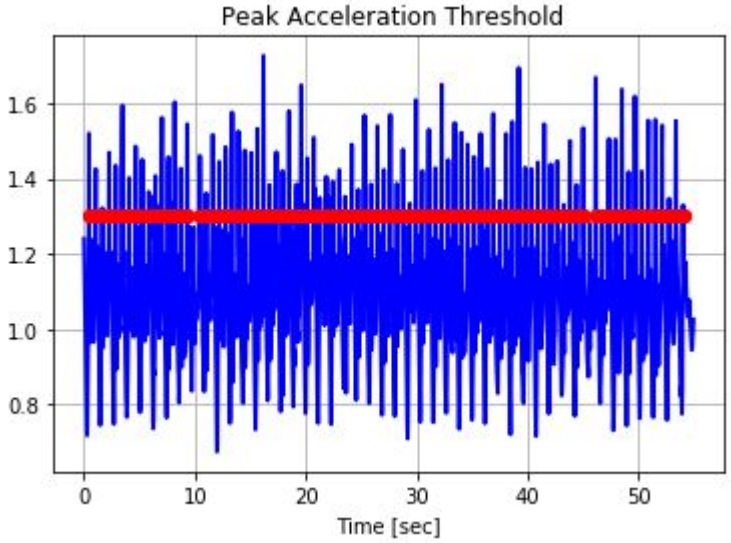


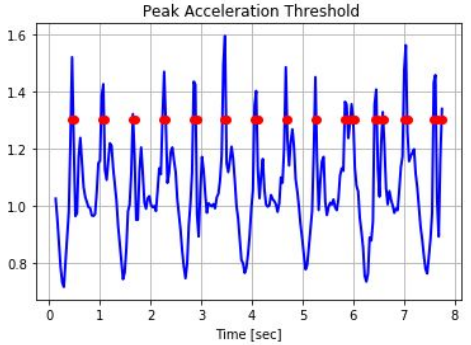
TASK 3 : Step counts - walk

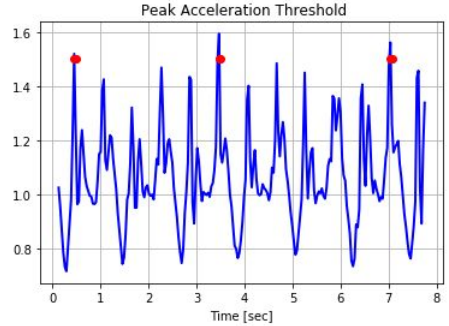


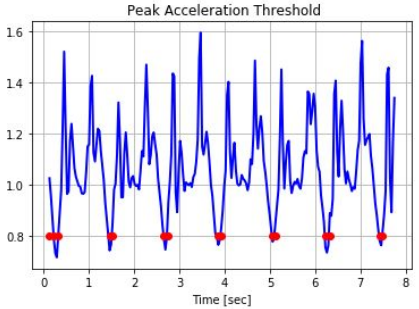
TASK 3 : Step counts - walk

Set Threshold



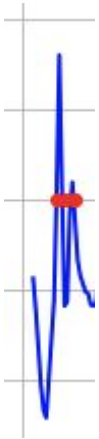






TASK 3 : Step counts - walk

FUNDAMENTAL UNIT HAS 2 Peaks



What will happen if we keep our threshold low by chance?

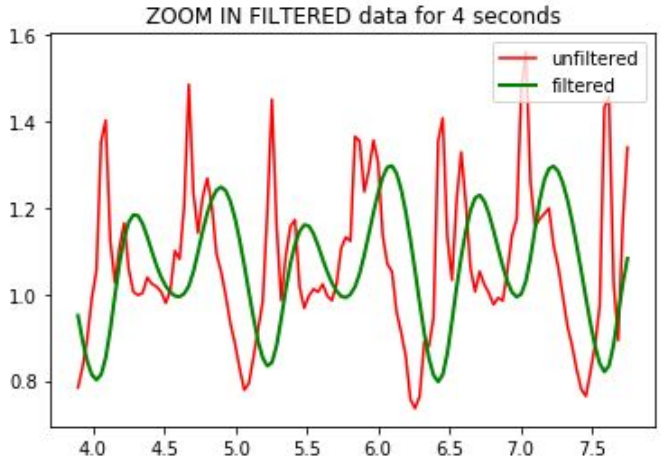
Hint : overestimation

REDUCE : Noise

INCREASE : Information

TASK 3 : Step counts - walk

Wouldn’t it be nice if rather than having two peaks I could have just one peak ?

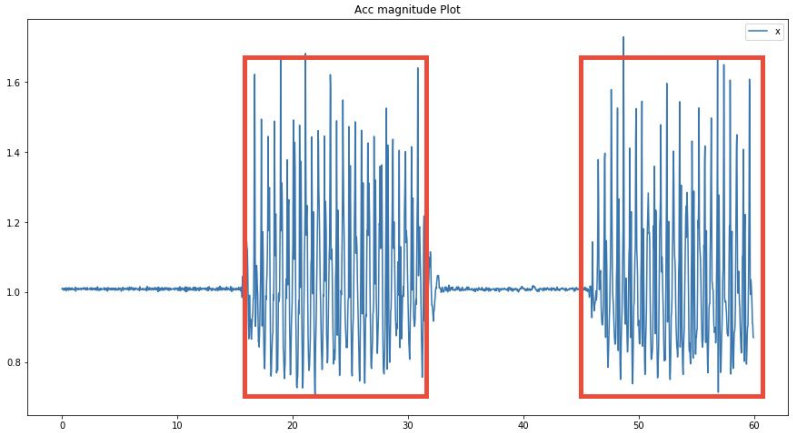


HINT : **FILTERING**
Implement moving average

Make your step counting algorithms with all this information!

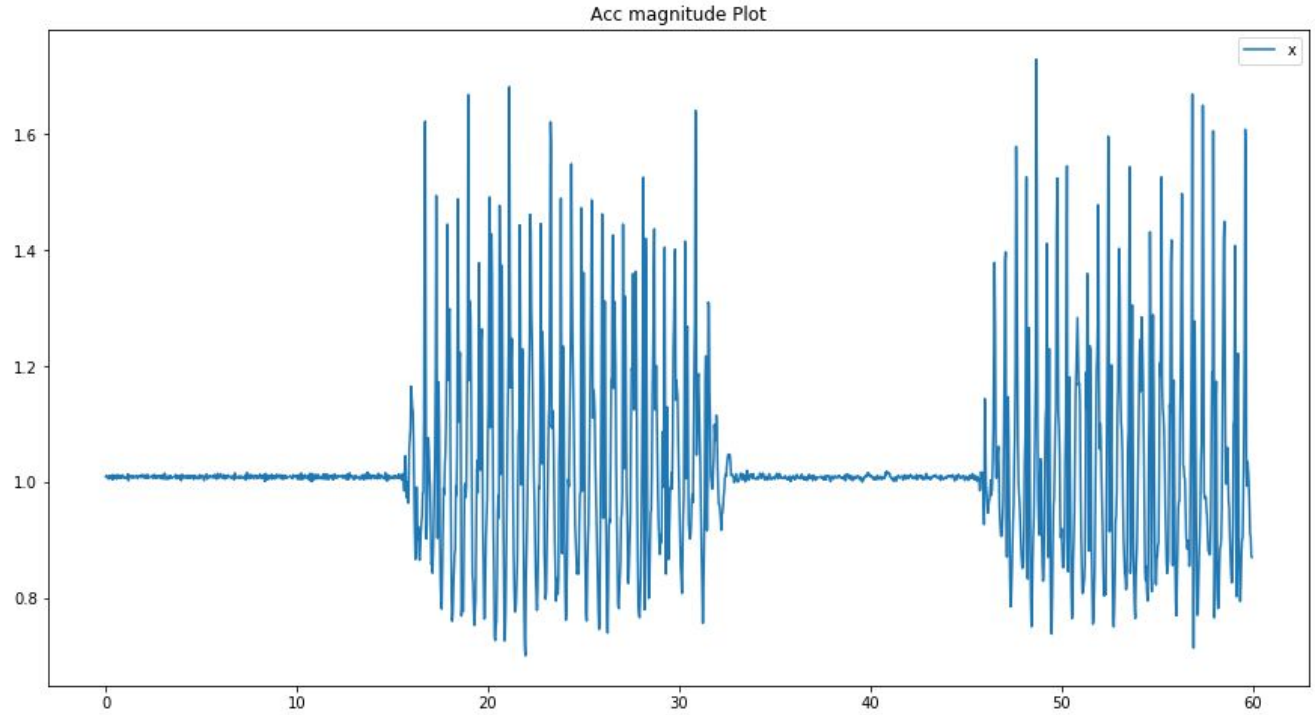
TASK 4 : Segmentation

climb-walk-climb-walk

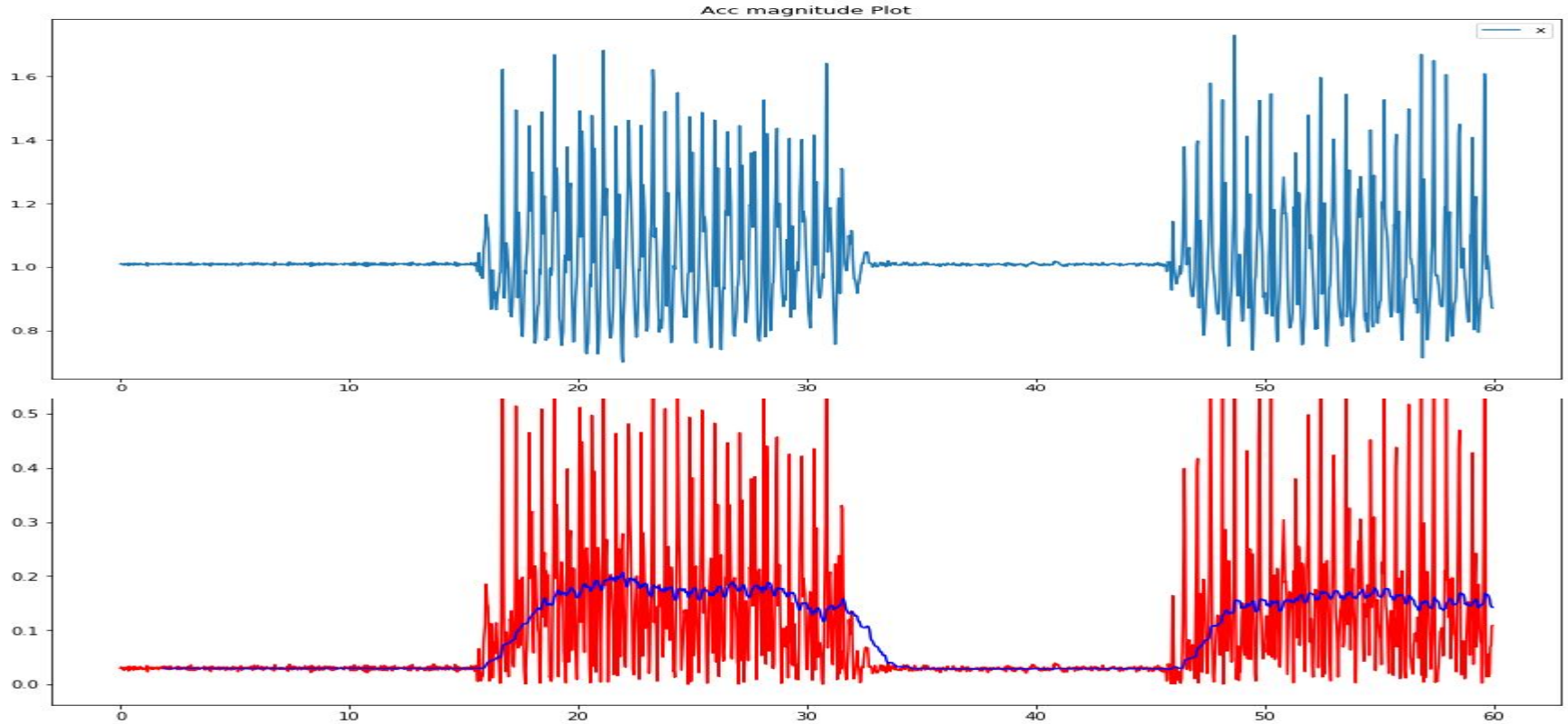


stop-walk-stop-walk

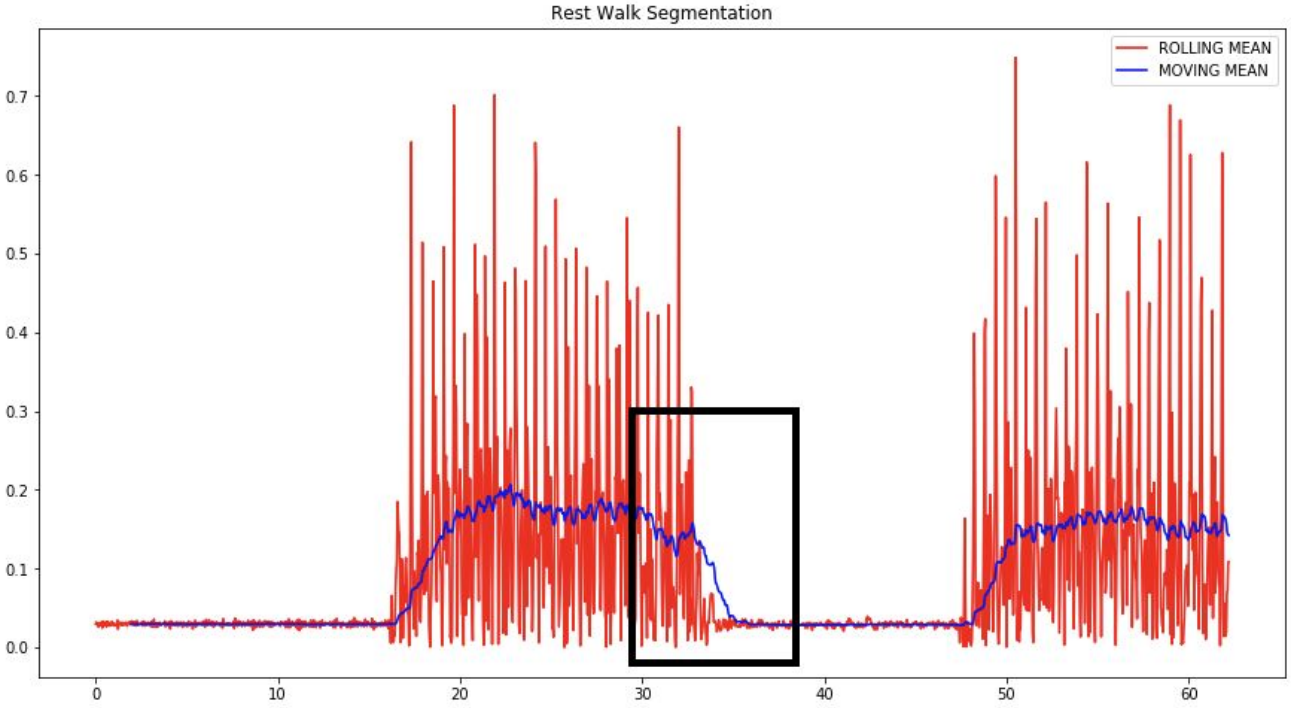
Can we segment walking from rest?



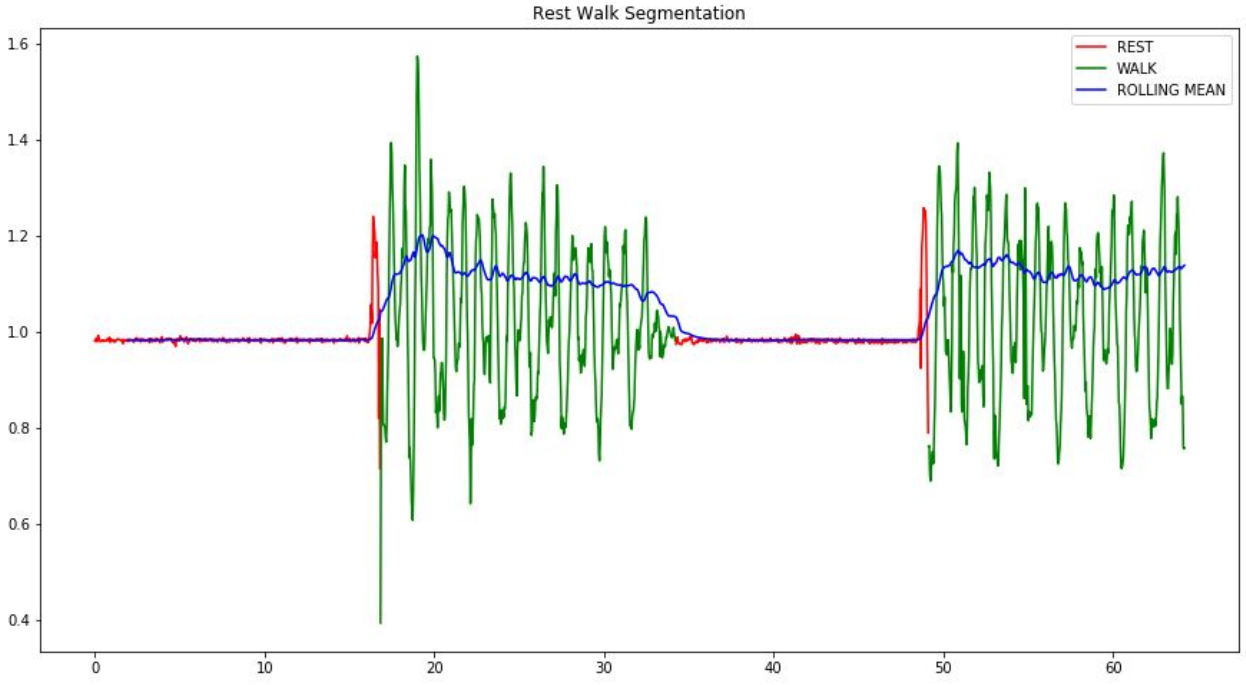
Moving Average



Why is this trailing? **Hint : window size**



Segmented data



Select right window size

Select right threshold to distinguish walking from climbing

TASK 5 : Gait Analysis