Mobile Sensing: Spring 2015
Exercise: 5

Due on 9th April 2015 by 17:45 PM.

Instructions: All course participants are requested to submit their exercise solutions electronically to the instructors (samuli.hemminki at cs.helsinki.fi and teemu.pulkkinen at cs.helsinki.fi), as well as to the course lecturer (petteri.nurmi at cs.helsinki.fi) by the due date (latest before the exercise session). In all the exercises, do not just give the answer, but also the derivation how you obtained it. Participants are encouraged to write computer programs to derive solutions to some of the given problems.

Ex 1. Load accelerometer data collected during a tram ride.

a) Estimate and eliminate gravity using mean-filtering based methods presented on the lectures: Mizell (30sec), Nericell (10sec)

b) Estimate and eliminate gravity using an opportunistic method, where near-stationary periods are detected by comparing a fixed threshold value [1] with the variance of accelerometer's L2-norm: $\sqrt{x^2 + y^2 + z^2}$

c) For each gravity estimation result, calculate horizontal and vertical projections of linear acceleration.

Ex 2. Load accelerometer data collected during walking [2]

a) Calculate L2-norm of the signal and perform mean filtering using frames of 10 samples.

b) Calculate the number of steps using peak detection with a predefined threshold (you can visually examine the data to find a suitable threshold).

c) Load the walking data used last week for activity recognition. Calculate steps using same method as above in b). How well does it perform? Can you reason why?

Matlab: *findpeaks*, Python: See page *DetectPeaks*

[1] E.g., variance is ≤ 0.002, over 0.75s frame

[2] Note: modified +80% amplitude from original for this exercise