Assignment Activity Recognition

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Background

- Aim: Create an algorithm capable to discriminate between standing still, walking and running
- Challenge: Phones generally have lower processing capabilities, and limited battery life
    - Create as simple algorithm as possible

Method

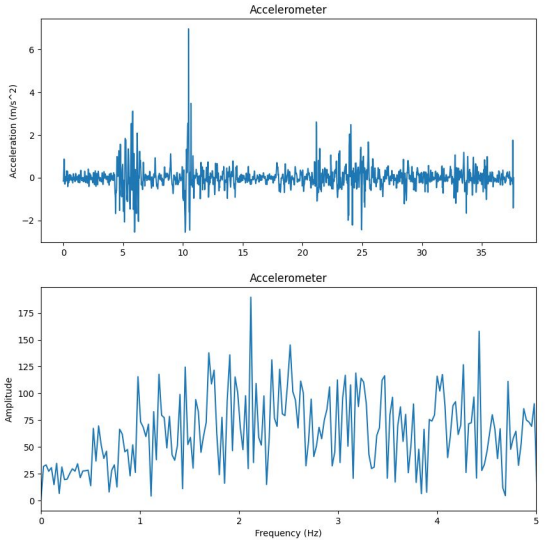
- Initial data collection for the three activities with all possible sensors
- Visual inspection of data for sensor selection and algorithm design
  - Identify patterns unique to each activity
  - Find easy way to algorithmically identify said patterns
- Tune algorithm on collected data
- Evaluate on test sequence containing all three activities and transitions between them

Data collection

- Recorded five logs
  - Standstill where person is using phone but not walking or running
    - Pressing buttons etc. should not lead to missclassification
  - Walking with phone in hand
  - Walking with phone in pocket
  - Running with phone in hand
  - Running with phone in pocket
- Inhand vs. in pocket should assure some robustness
- Total acceleration seemed to give good indication of activity
  - Both frequency and magnitude differed between activities
  - Patterns in Fourier domain where unique between activities

Stand-still

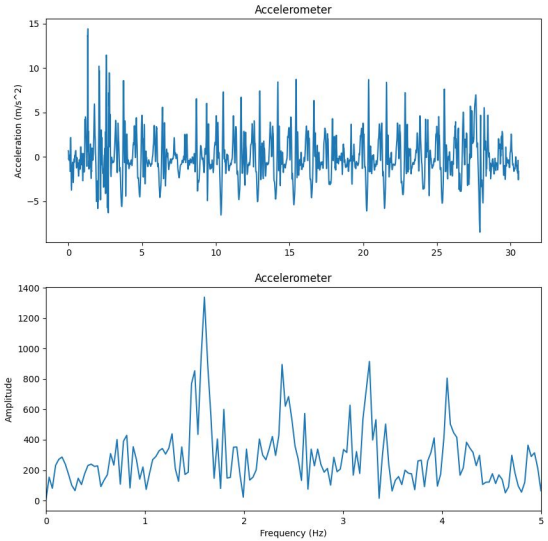
- Top is total acceleration over time
- Bottom is same log in Fourier domain, i.e., magnitude for difference frequencies
- Phone placed in pocket @10 seconds and taken out @23 seconds



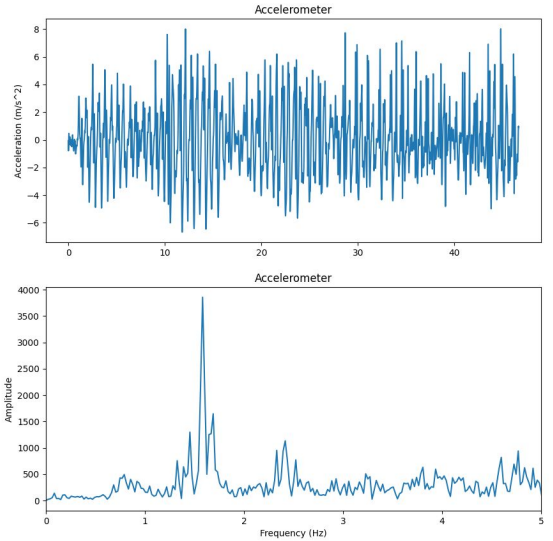
Walking

- Walking gives spike @ 1.5Hz
- Maximum magnitude in Fourier domain much higher than standing still

In pocket



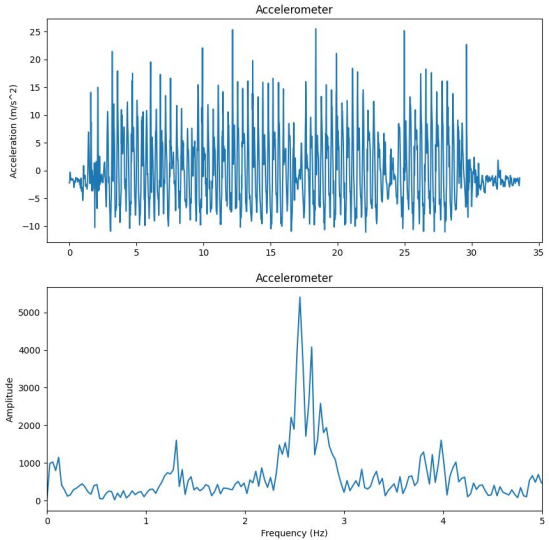
In hand



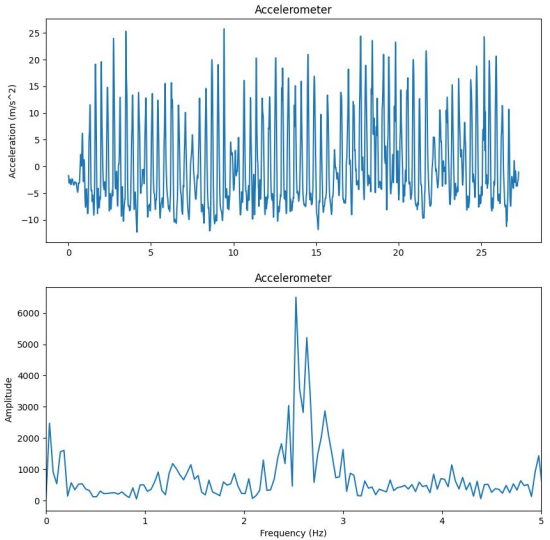
Running

- Running gives spike @ 2.5Hz
- Maximum magnitude in Fourier domain even higher than walking

In pocket



In hand



The algorithm

- Apply fast Fourier transform to window of temporal data
  - If: maximum magnitude < WALKING_THRESHOLD or magnitude peak @ < 1Hz -> standing still
  - else if: maximum magnitude < RUNNING_THRESHOLD or magnitude peak @ < 2Hz -> walking
  - else: running
- Tuning gave:
  - temporal window of 3 seconds
  - WALKING_THRESHOLD = 80
  - RUNNING_THRESHOLD = 700
  - Note that temporal window will change magnitudes, hence these may seem small when looking at plots from previous slides

Testing

Conclusions

- Algorithm successfully identifies activities
- 3 second time window causes some delay when switching between activities
- Moving phone fast in hand could spoof algorithm
    - Putting it in the pocket was interpreted as walking in the test
    - Could be avoided by increasing time window, at cost of switching between activities fast

Data & Code @ github

https://github.com/wljungbergh/activity-recognition