Sensors, Noise and Walking: Human Activity Analysis

CourSys - Project Topic: Sensors, Noise, and Walking

Plan:

1. Getting data
    a. Sensor Logger
        i. Accelerometer
        ii. Location
        iii. Gyroscope
    b. iOS vs Android
        i. holding two diff branch devices test the result is the same or not
    c. Different positions of the phone
        i. hand
        ii. ankle
        iii. pocket
2. Questions
    a. Can you calculate walking speed (m/s) from just the accelerometer? How accurate can you get? Can you then determine the differences between the subjects as above?
    b. Are the results better depending on where the phone is?
    c. Ankle vs pocket vs hand? Ankle above or below the joint?
    d. Visualize the GPS
3. Noise filtering
    a. consider abt x,y,z?
        i. I can't speak for your phone, but my sensor has some bias and/or drift that makes everything go slightly wrong. I had to make the rule “stand still for a second at the start and end” and use that data to un-bias the readings.
        ii. Maria offers a hint for the best results: it's possible to look at the phone's gyroscope to determine the change in orientation. As the phone moves, there isn't a single one of the x, y, z directions that corresponds to “forward”. If you can rotate the signal to keep “forward” and “down” correct, you'll get better results.
    b. Butterworth filter to deal with noise (Lecture 6)
4. Analysis
    a. x - get the frequency of steps
    b. ANOVA/Post-Hoc/MWU - Check data for normality
    c. ML models - Compare multiple ML models for accuracy
    d. Predict user based on provided accelerometer data

First Meeting task (11/13)

Data collection (Simple data) (For everyone):

- 1mins recording (flat) (50 Hz and 10 Hz each)
- Accelerometer, Location, Gyroscope
- phone on the left hand
- phone on the right hand
- phone strapped to the left ankle (or pocket)
- phone strapped to the right ankle (or pocket)
- at least 8 data for each (remember to edit the title)

Initial filtering and analysis

- Butterworth filter to deal with noise (Lecture 6)
- Fourier transform for frequency of steps
- Check data for normality (ANOVA/Post-Hoc/MWU)
- Compare multiple ML models for accuracy (Lecture 11-12)

Second Meeting task (11/16)

- Fourier transform for frequency of steps
    - IPython Cookbook - 10.1. Analyzing the frequency components of a signal with a Fast Fourier Transform (ipython-books.github.io)
    - Fourier Transforms With scipy.fft: Python Signal Processing – Real Python

Third Meeting task (11/22)

- recording bigger data for ML models
    - 5 mins left pocket (upward, screen face to leg), 50Hz
- Compare multiple ML models for accuracy (Lecture 11-12)
    - GaussianNB()
    - KNeighborsClassifier()
    - SVC()
    - DecisionTreeClassifier()
    - RandomForestClassifier()

Forth Meeting task (11/27)

- Record screen on 5 mins data (Matt)
- Split file
    - Import
    - functions
    - getting data
    - filter/fft
    - machine learning
- Machine Leanring

Fith Meeting task (12/1)

- Machine Learning task (find what we can do)
    - Does a minute of data make ML accurate enough?
- Height?
    - data: (need to find more people)
        - Matt: 6’0 (183 cm)
        - Diego: 5’8
        - Sam: 5’10
    - use the freq to predict the height
    - assumption: Tall guys may have lower freq cuz they have longer legs, which makes each step longer

- Human-Activity-Recognition-using-LSTM
    - https://github.com/shashi9323/Human-Activity-Recognition-using-LSTM
    - Activities
        - Walking (flat, up, down)
        - Running
        -

Fifth meeting task (12/6)

- Fix the ML prediction of the name label (testing)
- digging into **Human-Activity-Recognition-using-LSTM**
- Probably start the report from Wednesday (Pydiot353 Report)

Sixth meeting task (12/8)

- Import all needed data into the human activity recognition
- Then change the parameters to get the best result
    - Walking
    - up/downstairs
- Put more comments
- Make src notebook as summary
    - the screen on/off test
    - read raw
    - butter worth filter
    - Fourier transformer