Sensors, Noise, and Walking

<https://coursys.sfu.ca/2021fa-cmpt-353-d1/pages/ProjectWalking>

1. Getting data ( few days )
2. Sensor Logger
   1. Accelerometer
   2. Location
   3. Gyroscope
3. iOS vs Android
   1. holding two diff branch devices test the result is the same or not
4. Different positions of the phone
   1. hand
   2. ankle
   3. pocket
5. Questions
   1. 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?
   2. Are the results better depending on where the phone is?
   3. Ankle vs pocket vs hand? Ankle above or below the joint?
   4. Visualize the GPS
6. Noise filtering
   1. consider abt x,y,z?
      1. 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.
      2. 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.
   2. Butterworth filter to deal with noise (Lecture 6)
7. Analysis
   1. x - get the frequency of steps
   2. ANOVA/Post-Hoc/MWU - Check data for normality
   3. ML models - Compare multiple ML models for accuracy
   4. 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 left hand
* phone on right hand
* phone strapped to left ankle (or pocket)
* phone strapped to right ankle (or pocket)
* at least 8 datas 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)](https://ipython-books.github.io/101-analyzing-the-frequency-components-of-a-signal-with-a-fast-fourier-transform/)
  + [Fourier Transforms With scipy.fft: Python Signal Processing – Real Python](https://realpython.com/python-scipy-fft/)

Third Meeting task (11/22)

* recording data
  + 5 mins left pocket (upward, screen face to leg)
  + 50Hz

* Check data for normality
  + ANOVA
  + Post-Hoc
  + MWU
* Compare multiple ML models for accuracy (Lecture 11-12)
  + GaussianNB()
  + KNeighborsClassifier()
  + SVC()
  + DecisionTreeClassifier()
  + RandomForestClassifier()