Signals and Systems Final Project Proposal

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Project Overview

For this project, we are taking accelerometer data and using signal processing to do activity recognition. For instance, we want to take accelerometer data and be able to compare it to data from walking or running and determine which activity the data is generated from or most similar to.

At a high level, the signal processing could work like this:
- Take dataset of certain activities (Jogging, Sitting, Walking, Running)
- Split the data into windows
- Extract features from each of the windows. Our first pass will be to use the FFT to estimate the fundamental frequency of each window
- Train a separate model for each activity to determine if a sequence of window-features could be best described by the model. We've found that Hidden Markov Models could satisfy this framing.

Our minimum deliverable is to generate a signal processor that takes data from online of some variety of activities and classifies the activity based on signal processing techniques. This will be displayed in a presentation as well as a blog post. Next steps for this would involve collecting our own data and processing that.

Given the scope of the project, data signal processing will happen offline. No processing will happen on the data-collecting devices, like the Pebble Smartwatch or Android Smartphone.

Timeline

1. Get data from online
2. Research how to process data
   a. Activity Tracking (Walking, Running, Up the Stairs, Down the Stairs) http://nbviewer.ipython.org/github/StartupML/koan/blob/master/DSP_HMM.ipynb
   b. The paper "Activity Tracking Using Cellphone Acceleromter Data" has 529 citations...
3. Spell out assumptions of data collection and initial intuitions that would guide our use of particular signal processing techniques.
4. First Pass at code

5. Create first part of the blog post - experimenting with different signal processing techniques for activity recognition of dataset obtained online
6. Collect data from a wearable (Pebble smartwatch or phone (Android device))
   a. Accelerometer data collection on an Android device can be done using [REVO's Android data collection app](#), written by Chris Lee, Olin '15.
7. Test with code and recalibrate
8. Create second part of the blog post - re-using this code for data that we've collected on our own.
9. Take data for a different activity outside of the online sources.
10. Test new activity with code and recalibrate
11. Write third (and final) part of the blog post - expand on the data that we collected and prove that our implementation works for other types of data