Smart Device Data

With the advent of Internet of Things (IoT) and mobile devices, a key question is, "how much can we learn about a user by the data from smart devices?" Our project helps to answer this question by developing a method to predict short-range displacements of hand gestures using smart devices. Using acceleration data, we seek to build a better algorithm than current existing methods, such as double integration.

Statement of Purpose

The current method of using double integrations of acceleration data to apply simple Newtonian models is very inaccurate. The goal is to use the accelerometer data to identify the distance travelled. This is especially hard since the orientation is not possible to determine, since there is no gyroscope.

Preliminary Tests

We first attempt to measure the accuracy of current existing methods against artificial data with noise. The acceleration in the y direction can be roughly estimated as a sine curve, so we created sine curves (with noise) and measured how double integration and linear regression determined the total distance travelled.

Double integral: average error: 6.5%
Linear regression: average error: 2.5%

Processing Data Pipeline

1. Collect raw Data

   The initial raw data is similar to the figure below.

   Figure: Example of simulated acceleration

   Figure: Data from ten taps, where values of 1000 is equal to 9.8 m/s

Future Work

Fine tuning of the model with more data. We also hope to generalize out work will smart devices that offer more data, such as gyroscope. We are currently looking at using apple watch.