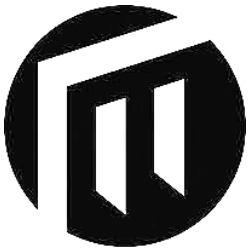

DA274A: Internet of Things and People

Motion Sensing

Lab 2

Shahram Jalaliniya

November 2017

Lab 2: Motion sensing

The goal of this lab is to use a sensor unit to capture and record hand motion. The sensing unit has accelerometer and gyro sensors and is able to communicate the sensor data (6 values) through bluetooth connection. The data should be saved as a .csv file locally on your computer. You will pre-process and process the in lab 3 which is about hand gesture recognition. In this lab, we will work with the data from the sensor unit. The collected data will be used as training and test datasets for classification in the next lab.

Step1: Capture hand motion data

1- Turn the sensing unit on using the small switch on top of the box
2- The sensor should start blinking if not make sure the sensor is charged otherwise use microUSB cable to charge it
3- Pair the sensor with your computer/laptop. Find the name of the Bluetooth module on the label attached to the sensor (G1/G2/…). You should use “1234” as pincode.
4- Now open Arduino IDE and select the Bluetooth USB port in the port list. Open serial port and adjust the baud rate to 9600. You should be able to see the data when you move the sensor.
5- Perform up/down/right/left gestures 3 times and copy the data from the serial port.

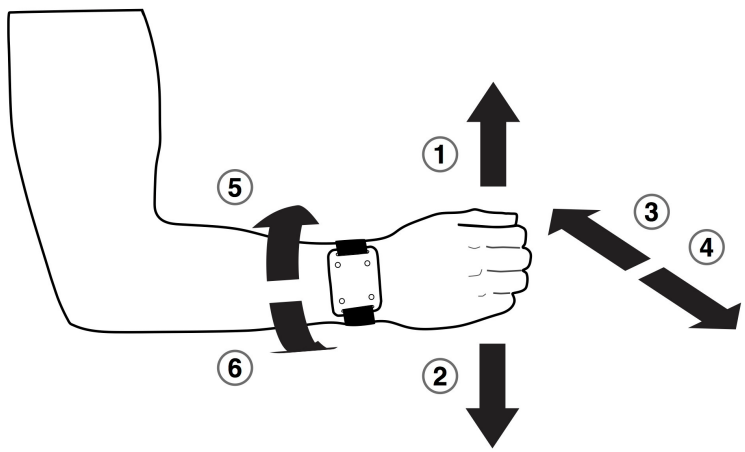

Figure 1: The hand gestures

Step2: Visualize hand motion data

1- Open MS Excel and create a new sheet
2- Paste the copied data from the serial port in the new Excel sheet
3- Use Excel diagram (line) to visualize the data
1- **Mandatory task 1:** Which of 6 values change more significantly when you perform each gesture? Write at least one value (AccX,AccY,AccZ,GyrX,GyrY,GyrZ) for each gesture on a paper and give it to one of the teachers present in the Lab.

Step 3: smooth the data in MS Excel

Do you see fluctuations in the data? You will learn some techniques in Lecture 3 for smoothing data. One of the approaches to smooth the data is using a moving average. In a simple moving average, for each variable we take n recent values and use the average of those values instead. Try to smooth the noise in the Excel sheet using a moving average technique with size of n=3, n=5, and n=7. Add a new chart to visualize the smoothed values. What happens when you increase the size of the window?

$$\frac{x_t + x_{t-1} + x_{t-(n-1)}}{n}$$

Step 4: record hand gesture data

2- Download and install the Processing IDE from (www.processing.org)
3- Download and open this processing code: https://www.dropbox.com/sh/9mysrjyp8vdfoba/AAB06bq2lGajoUw7O9VxUHgpa?dl=0

4- Before using the code for recording hand gesture data, you need to change the boolean "trainFile" flag in the beginning of the code to "True" and the "logFile" flag to "False". The "lable" flag (which is misspelled in the code as well) also needs to be adjusted according to the gesture that you are performing (up, down, left, …). When you are using the processing code for collecting the training data, the system notifies start point of each

gesture by a sound notification. It also counts the number of collected data samples. Repeat each gesture 20 times and record the data for each gesture. The code generates a .csv file with the name of the “lable”. Don’t forget to change the “lable” value before recording the data. After recording all gestures, you need to merge all .csv files together and create one training dataset (train_gestures.csv). You also need to create another dataset which is exactly like training dataset but it includes instances from just 5 repetitions of each gesture. We call the second dataset test_gesture.csv.

5- **Mandatory task 2:** When you have a completed training and test datasets show them to one of the teachers present in the Lab.

It is highly recommended to start developing an Android app to receive the acceleration and rotation data from the sensing unit over Bluetooth connection. You will need this app for your project. You can use the below instruction to develop the Android app: https://goo.gl/JcXDrp