

Lab 7: Moving Averages

Objectives:

- Practice Top-Down Program Design, Problem Solving in C
- Work with arrays and functions defined on arrays
- Investigate moving averages and their effect on data

Starting Point:

- *lab7.c*

Process:

Creating a New Folder

Create a new folder named *lab7* in your *cpre185labs* folder on the U: drive. You will want to copy over *ds4rd.exe* to the *lab7* folder.

Problem

When dealing with real-time data sources such as the DualShock 4, it is common to want to smooth out rough data. One way to do that is to apply a moving average to the data. In this lab, we will develop a program that reads from *ds4rd.exe* the x, y, and z values from the gyroscope and computes moving averages on the data in real time.

A moving average of length *n* computes the average of the last *n* inputs. For instance, a moving average of length 2 of (1, 3, 5, 6, 3) is (2, 4, 5.5, 4.5). A moving average of length 3 of the same data would be (3, 4.666, 4.666). Note that the moving average has to accumulate *n* inputs before it can output something.

For this lab, start with the source code linked above. Write a program that reads from *ds4rd.exe* (**document your command line options that you use when running *ds4rd.exe***) and outputs the given x, y, and z gyroscope values followed by the moving averages of x, y, and z. It should also output the maximum and minimum values from the array used to compute the averages, which are calculated in a *maxmin* function. The output should be all on one line and separated by commas.

The length of the moving average shall be given on the command line to your program (code is included in the sample to help you read this input). Once

enough data has been read to output a moving average, a new output should be generated for each input line. Your program should end when the SQUARE button is pressed.

Experiments:

Save your output for three different motions of 5-10 seconds each to a sample data file. You will use the "> file" trick. Then, you will use this data to examine the 2 different moving average lengths. We are asking you to collect the sample data so that you can more easily compare the short vs. the long window lengths.

Motion 1: DualShock 4 lying on the table still. (short window length 20 and long window length 100)

Motion 2: A very fast repetitive rocking motion (short window length 20, and long window length 100)

Motion 3: A slow repetitive motion of your choosing (document it in your report.) (short window length 20, and long window length 100)

Questions:

1. Use a spreadsheet to graph the short and long window lengths. Label the data. You will turn in three graphs, **one for each axis** (X,Y, Z) with the three motions labeled (i.e. one graph will be for the X-axis and only contains the X-axis data for all three motions, one graph will be for the Y-axis and only contains the Y-axis data for all three motions, one graph will be for the Z-axis and only contains the Z-axis data for all three motions.) Compare the short window length data to the longer window length data and the raw data on each. Describe at least 2 things about the graphs that seem to happen when window lengths get longer. Why?
2. What happens in comparing Motion 2's data graph and Motion 3's data graph? Would you be more likely to use a short window length or long window length for each of these? Explain your reasoning.

Turn-In:

Your lab report including answers to the all questions, the graphs above, and all your source code that has been checked by your undergraduate TA.