**Homework 05b**

This homework involves doing some fairly simple analysis of sensor data. Although you could probably use Excel to solve this problem, please try to write a Python program to compute the solution.

I believe these are good sources for Python tutorials are:

# Starting out – Free online book-- Python for Everybody by Charles Severance

<https://books.trinket.io/pfe/index.html>

Scientific Computing – scipy.org

<https://scipy.org/>

I haven’t had time to go through these in detail. If anyone has any other suggestions, please share it with me and the class.

**Please submit your Python code along with your answers.**

1. The file LIDAR\_100ms\_Wander.csv contains the values, in centimeters, measured every 100 ms of range facing down the longest corridor at 85 Prescott Street. From this data, determine:
   1. What is the probability of obtaining a suspiciously out of range measurement?

(The stated maximum range of the sensor is 40m). (2 points)

Probability of out of range measurement: 2.12%

* 1. What is the probability of obtaining a suspiciously minimum range measurement?

(The minimum range is 5 centimeters.) (2 points)

Probability of suspiciously minimum range measurement: 4.00%

Probability of suspiciously minimum range measurement when counting 5 as error: 5.94%

* 1. Sort out those measurements that relate to the wall at the end of the hallway. What are the statistics (mean and standard deviation) of the “actual” range measurements?

(2 points)

Wall mean is 3216.19cm and stddev is 12.62cm

* 1. From the data there are a few places where an “object” moves in the environment.
     1. How many “objects” are detected? (1 point)

Number of objects, naive approach: 44

Number of objects, no minimum reads: 13

Number of objects, no noise: 6

* + 1. What is the maximum velocity of an object? (1 point)

Max object velocity: 144.59 cm/s

* + 1. Looking at the times at which objects appear, and the amount of time they are in view, what is the probability that a given measurement is an object and not the wall? (2 points)

Naive object probability: 30.25%

No min reading objects probability: 26.49%

Clean readings objects probability: 24.48%

1. What is the pseudo-distribution (mixture distribution) for this range data? (Hint. Use the EM algorithm, which we will discuss in Lecture 6. Use the four un-truncated distributions we will discuss in class. Use the mean computed in 1.d above for z\*. Lump all out- of- range measurements in the 40 meter bin)? (5 points)

Pseudo distribution PF parameters.

Min reads: 0.05944673317376322

Wall: 0.6614186963935308

Obj: 0.25794456396429527

Max: 0.02118893466745144

Noise: 1.0718009593264667e-06

Sigma: 12.601524070339105

Lambda: 0.0007994875126744481

Please look at the python notebook, it contains the notes and explanations for all the answers above. I recommend you have a setup with jupyter for python 3.