

## Final Project

*Handed Out: March 15<sup>th</sup>, 2020**Due: 11:59pm, April 22<sup>nd</sup>, 2020*

Final Exam: April 23rd 2:40pm. Submission due April 22nd 11:59pm.

## 1 Project Topics

The project philosophy is as follows: I have created the required data for two project ideas. You will not collect any new data, but just work on the provided data. You will be writing a program in any language I can read (C/C++, Java, python, matlab) that solves the specific aim for the project topic of your choice. I have reduced the project topics to just two ideas. Select one of the following:

- Sound based AoA triangulation
- Sound based fingerprinting

## 2 Sound based AoA Triangulation

### 2.1 Aim:

You have to create an algorithm that takes as input sounds recorded by three different microphone arrays (6 mics per array arranged in a circular fashion) and estimates the location of the sound source. The sound is spoken by a person somewhere around these three microphone arrays (see Figure 1). You will be provided the exact distance between the microphone arrays (see Figure 2) and their configuration (inside the data zip file). You will not have the exact source sound signal. You will also be given the ground truth location for a few “training” files to check your algorithm. The data is provided in the accompanying finalProjects.zip file.

### 2.2 What to submit:

1. Your code
2. The estimated location of the human speaker for all the provided test sound files.
3. 5 slide presentation describing your algorithm

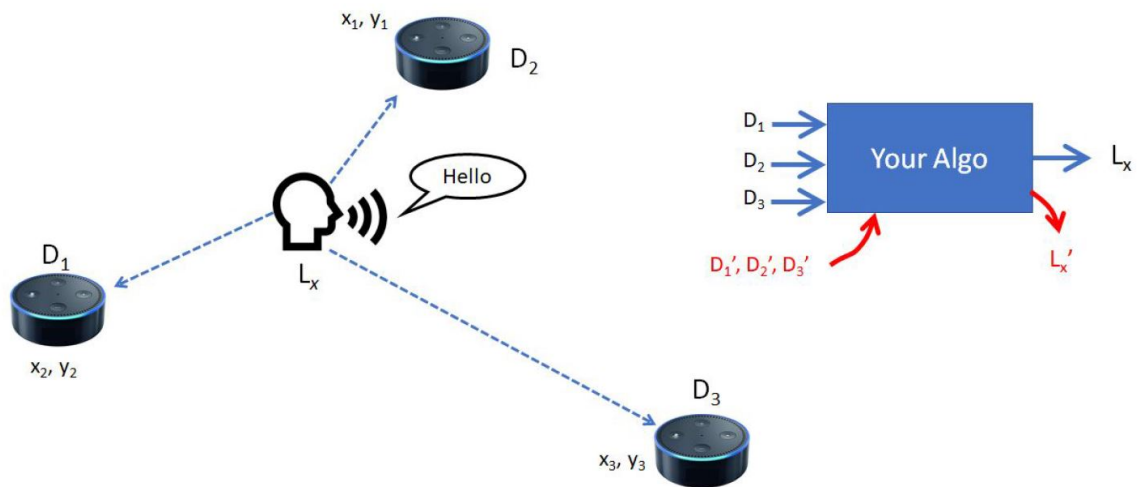


Figure 1: AoA triangulation project idea

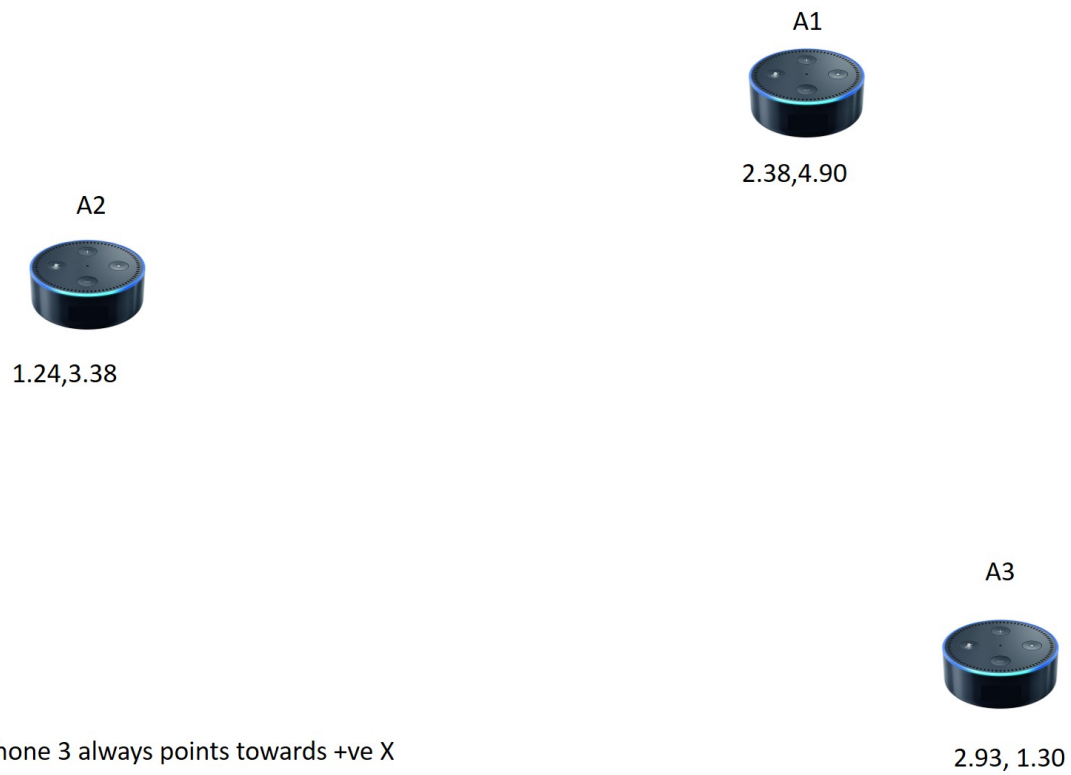


Figure 2: Exact coordinates for three devices used to collect data.

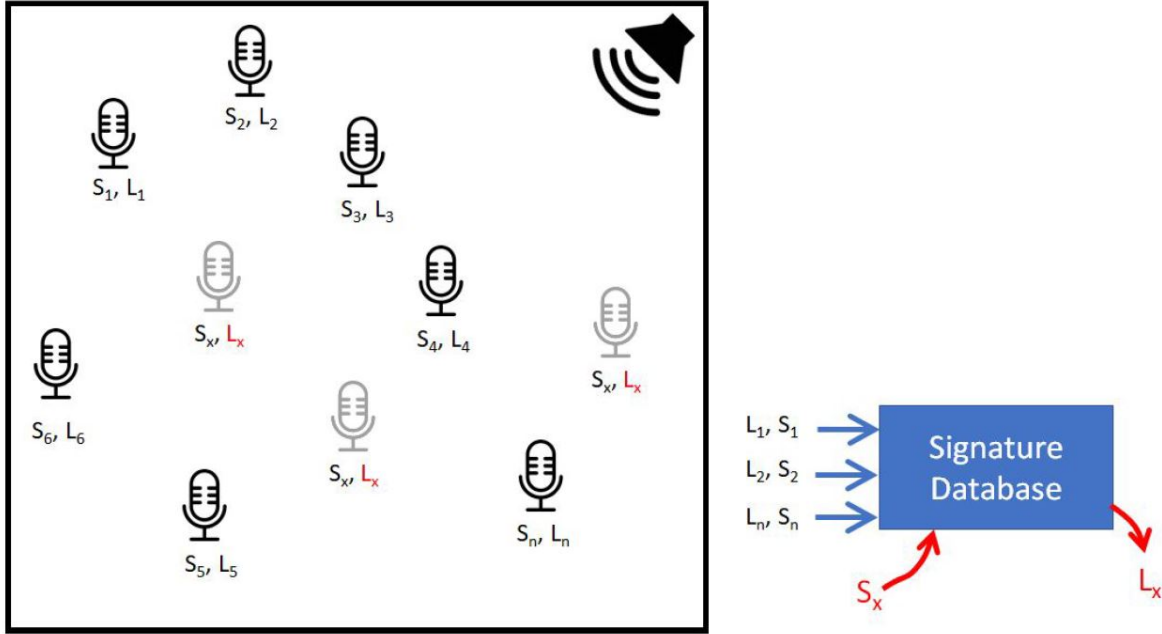


Figure 3: AoA triangulation

### 2.3 On the exam day:

1. You will be provided a new set  $D'1, D'2, D'3$  and your algorithm must estimate the location  $L'_x$
2. Your algorithm should work on the provided data file and produce an output within a maximum of one minute.

## 3 Sound based Fingerprinting

### 3.1 Aim:

There is a single sound source inside a room. It is sending periodic audible beeps and you have a microphone that can record these beeps. Design an algorithm that can take as input a set of sounds ( $S_1, S_2, \dots, S_n$ ) collected from various known locations ( $L_1, L_2, \dots, L_n$ ) and produces a database of signatures (see Figure 3). Then, when given the sound heard ( $S_x$ ) at an unknown location, your algorithm should output the corresponding location ( $L_x$ ) by consulting the previously created database.

### 3.2 What to submit:

1. Your code
2. The estimated location of the mic for all the provided test sound files.

3. 5 slide presentation describing your algorithm

### **3.3 On the exam day:**

1. You will be provided a new sound file and your algorithm must estimate the location  $L_x$
2. Your algorithm should work on the provided data file and produce an output within a maximum of one minute.