

# Assignment 5: Probabilistic Occupancy Grid Generation from Lidar Data

Mar. 11<sup>th</sup>, 2021

## Objectives

- To understand how to use lidar data to generate occupancy probabilities
- Apply logodds updates based on given Bresenham raytracing outputs
- Convert a logodds grid to a probabilistic occupancy grid

You are provided with lidar measurement data (Measurements.txt), as well as a Python 3 Jupyter Notebook which contains the required supplementary code (thanks to Paul Balzer). Your task is to complete each TODO section of the notebook in order to generate a probabilistic occupancy grid, as well as answer the given written questions.

## Resources and Instructions

There are 3 TODO sections to complete in the given Jupyter notebook:

1. Write code to convert lidar data in spherical coordinates to Cartesian coordinates in the function `ibeo2XYZ()`.
2. Perform the logodds update for the ``grid`` global variable in `insertPointcloudBRESENHAM()`. Make sure to complete both TODOs in this section.
3. Convert the logodds grid to a probabilistic occupancy grid.

In addition, there are two written questions you must answer:

1. What are the computational advantages of using logodds when generating our occupancy grid?
2. Is the angle  $\phi$  in our Spherical to Cartesian calculation the same as the polar angle in standard Spherical coordinates? Why?

## Deliverables

HTML output: In the Jupyter Notebook, go to File > Download as > HTML (.html). In addition, include a PDF file of your answers to the two written questions. Submit a ZIP file containing the HTML output and the PDF file.

**Run all code blocks before downloading the HTML.**

Please follow the naming convention for your zip file: `a5_<user_id>.zip` .

## Due Date

11:59 PM, Friday Mar. 19<sup>th</sup>, 2021.

No late submissions will be accepted. There will be no extensions.

## Marking Scheme

Assignments are marked on a 0-5 point scale.

2 points will be given for answering the written questions. The remaining 3 points will be given for completing each TODO section correctly, 1 point each.

## Policies

### Collaboration

You can discuss the problem with peers, but you must design and implement your own solution independently.

### Use of online resources

You may consult online resources for inspiration, but you must develop your own code.