

Homework 1 - Comparing Bug1 and Bug2 algorithms

Assigned - Oct 16, 2023, Due - Oct 30, 2023

As part of this homework, you will be implementing both Bug 1 and Bug 2 algorithms in the Matlab-based simulation environment provided with the homework files. Your submission is expected to be a detailed report, describing (briefly) the structure and design of your implementation, as well as various algorithmic components that you have implemented in the meantime. More importantly, your report should include results on how the algorithm performs, provide both positive and negative example environments with different complexities together with comparisons of the two algorithms in both cases. You should investigate different aspects of algorithms such as the dependence of its performance on environment structure. Your report should not include any code, except maybe small code snippets to support your descriptions if really necessary. Overall, your report should be structured like a good technical report or paper and be submitted as a PDF file together with your Matlab source files and any supporting media files such as videos. Please do not collaborate with your classmates except exchanging ideas and other inspirational materials.

Note that the simulation environment provided with the homework implements a simple limited range sensor. You may modify the simulation as you need, but you must make sure that your navigation algorithm uses only the provided sensor information and nothing more. You are welcome to use the three arenas provided as examples in the source, but you are required to build and use your own arenas for your report as well.

As a guideline, I expect your report to include at least the following components:

- Brief description of both Bug 1 and Bug 2 algorithms without going into unnecessary detail duplicating what is already available in the textbook and lecture slides
- A clear description of how you used the range sensor to implement various components such as touch sensing and boundary following
- An in depth, comparative study of both algorithms in a variety of different environments, providing examples on soundness and completeness as well as your implementations.
- Descriptions of any important issues you may have encountered during the implementation of the algorithm
- Discussions on any aspects of either the algorithm or your implementations.

Once again, please make sure that your report is well organized into meaningful sections, with figures and captions properly references from within the text and an adequate number of citations to relevant resources from the literature.

Bonus component (+20pts):

The Matlab implementation provided by the homework implements a brute force mechanism for computing the distance to the closest obstacle for a given angle with `read_sensor.m`. Sensor data can be computed much more efficiently with a variant of the Star algorithm described in the textbook for visibility graphs. The idea is to go through a list all obstacle vertices ordered by their angle, and compute the distance to the closest edge as a sensor angle covers the entire angle range. You are welcome to implement this much more efficient version, which will substantially speed up your experiments. Make sure that your sensor implementation is correct before using it for your experiments though.

Submission

Submitted solutions must be typeset in LaTeX and MUST include your name and student ID. You should submit the following files on METU Class before the submission deadline: *lastname-firstname-report.pdf*, *lastname-firstname-sources.zip* with the ZIP file containing both the sources and the figures for

your report as well as your implementation code and any other supporting material you might have. Your report should include your derivations, simulation results in the form of plots and detailed discussion on your findings and should be structured as a well-structured academic report or paper. **Late submissions will not be accepted.**