

Homework#1: Implementing Uniform Cost Search and A* Search Algorithms

Due date: 03/21/2022 23:59 PM

Overview

The goal of this homework assignment is to implement two popular search algorithms, namely Uniform Cost Search and A* Search, using the existing codebase provided in <https://github.com/jostbr/pymaze>. The implementation should be in Python and the resulting code should be submitted along with a detailed report that explains the implementation, demonstrates the algorithms' performance, and provides insights into the strengths and weaknesses of each algorithm.

Task

The specific tasks that you need to accomplish for this homework assignment are as follows:

1. Implement the Uniform Cost Search algorithm by adding a new function to the existing codebase. The function should be named `uniform_cost_search` and should take as input a maze object and return the optimal path from the starting position to the goal position, along with its cost.
2. Implement the A* Search algorithm by adding another new function to the existing codebase. The function should be named `a_star_search` and should take as input a maze object and a heuristic function, and return the optimal path from the starting position to the goal position, along with its cost. **Please use a Euclidian distance for its heuristic function.**
3. Visualize the solutions obtained by both algorithms on 10 randomly generated 20x20 mazes. You should use the visualization functions already provided in the codebase to create a visual representation of each maze and the found paths.
4. Write a detailed report that explains your implementation of the two algorithms, including any modifications or enhancements you made to the existing codebase. Your report should also include a discussion of the strengths and weaknesses of each algorithm and their performance (e.g., the number of steps) on the mazes you used for testing.

Submission

Your submission should include the following:

1. A PDF report that describes your implementation and testing of the two algorithms, including visualizations of the solutions obtained. Your report should be well-structured, clearly written, and should provide sufficient detail for the reader to understand your work.
2. A README file that provides instructions for running your code, including any dependencies or setup required.
3. All the code you wrote for the homework assignment, including any modifications or enhancements you made to the existing codebase.

Grading

Your submission will be graded based on the following criteria:

1. Correctness and completeness of the implementation of the two algorithms.
2. Clarity and quality of the report.
3. Quality of the visualizations.
4. Insight in identifying the strengths and weaknesses of each algorithm and their performance on the test mazes.

Note

You are free to use any external resources or libraries that you think might be helpful for this assignment, as long as you cite them properly in your report and do not violate any academic integrity policies. However, you should not use any pre-existing implementations of the Uniform Cost Search or A* Search algorithms.

Package Requirements

Please use *Matplotlib* == 3.5.4 for running the code base.

If you are running your code on a MAC OS, FFmpeg file errors may occur. Please proceed with the next process after installing the package using homebrew.

<https://www.lainyzine.com/ko/article/how-to-install-ffmpeg-on-mac/>

Visualization Examples

