

Bullet-Hell Automation Using A*/D*

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² Course CSCI-B351

Introduction

Pathfinding plays a fundamental role in video games, and many attempts have been made throughout history to use search algorithms to find the most efficient paths.

For our study, we explored two algorithms: A* and D* by implementing a simple bullet-hell style game where these algorithms need to get from one side to be considered complete. We compared the algorithms through success rate across multiple trials.

Objective

We aim to see how two different pathfinding algorithms handle a Bullet-Hell style environment when given the same dodging logic (move in the opposite direction of the closest projectile, the only difference is the pathfinding logic).

Methods

- Data Collection

- We developed a Bullet-Hell style game auto player that randomly chooses A* or D* algorithm as the player and record the number of trials and fail rate.
- The game was created and tested in Unity version 2022.3.36f1 using C#

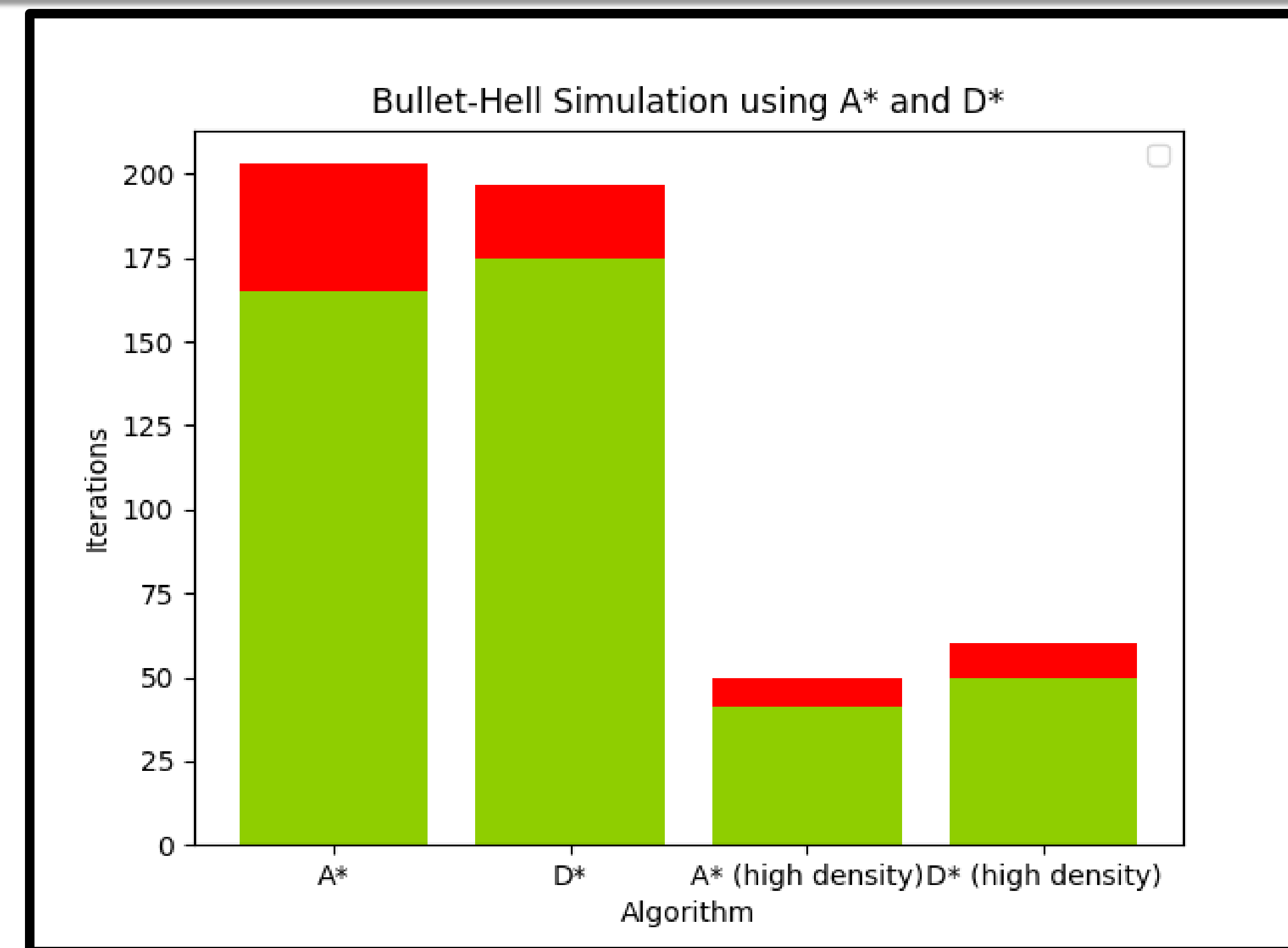
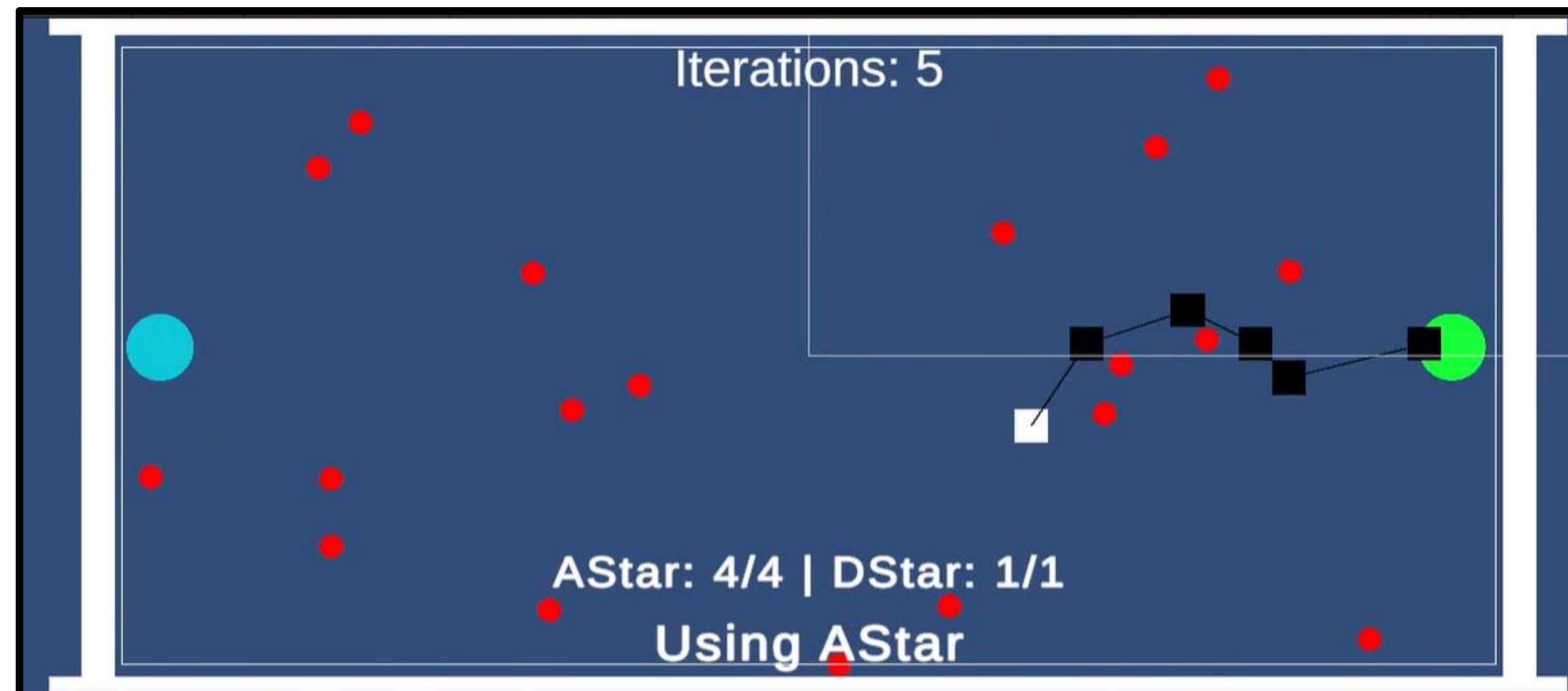
- Data Processing

- Python

- Analysis

- D* had a lower fail rate: 11% and 16.6% for higher and lower projectile density respectively (vs ~18% for A* in both cases)

Results



Legend:

Red: Failures

Green: Success

Discussion and Future Work

• Techniques Used

- A*/D* Pathfinding, algorithm design (dodging logic)

• Key Findings

- D* Seems to have a higher success rate, but had a bigger jump in fail rate at the higher density

• Limitations

- Integration Challenge: Combining pathfinding and dodging logic so the agent could react to nearby projectiles in real time
- Limited test runs per difficulty due to time constraints

• Future Work

- Continue test runs to produce more accurate results
- Include more testing variables/variability such as varied projectile behaviors, projectile size, varying projectile speeds, or also adding static obstacles