Comparative Analysis of Reinforcement Learning and Floodfill Algorithm for Optimal Pathfinding in a Maze

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The aim of the project is to compare Reinforcement Learning and the classical Floodfill algorithm for optimal pathfinding in a maze. The problem is based on the conditions often found in Maze Running competitions — including predefined maze sizes, turning constraints, mechanical limitations, and time restrictions for reaching the goal.

The research consists of two main stages: theoretical and practical parts. The theoretical part reviews the main approaches of Reinforcement Learning, such as Q-learning and its variations, as well as the working principle of the Floodfill algorithm and its advantages for pathfinding tasks. In the practical part, these algorithms are tested on various simulated maze scenarios, followed by analysis of the results based on several criteria: efficiency, accuracy, computational resource consumption, adaptability, and real-time responsiveness.

The goal of the study is to determine which approach is superior for different types of mazes and scenarios — for simple structures, Floodfill may offer fast and resource-efficient solutions, while in complex, dynamic, or unknown environments, the adaptive capabilities of Reinforcement Learning may become preferable.

Technologies used: The project employs Python programming language, Reinforcement Learning libraries (TensorFlow, PyTorch), as well as maze generators and simulation platforms for modeling.

References

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