Dynamic Maze Puzzle Navigation Using Deep Reinforcement Learning

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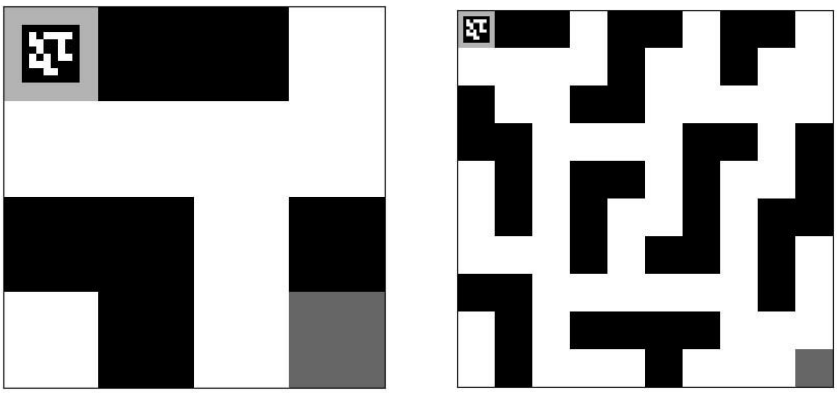

The implementation of deep reinforcement learning in mobile robotics offers a great solution for the development of autonomous mobile robots to efficiently complete tasks and transport objects. Reinforcement learning continues to show impressive potential in robotics applications through self-learning and biological plausibility. Despite its advancements, challenges remain in applying these machine learning techniques in dynamic environments. This thesis explores the performance of Deep Q-Networks (DQN), using images as an input, for mobile robot navigation in dynamic maze puzzles and aims to contribute to advancements in deep reinforcement learning applications for simulated and real-life robotic systems. This project is a step towards implementation in a hardware-based system.

The proposed approach uses a DQN algorithm with experience replay and an epsilon-greedy annealing schedule. Experiments are conducted to train DQN agents in static and dynamic maze environments, and various reward functions and training strategies are explored to optimize learning outcomes. The results indicate that adequate exploration, well-designed reward functions, and diverse training data significantly impacted both training performance and game play outcomes. The findings prove that DQN approaches are plausible solutions to stochastic outcomes, but expanding upon the proposed method and more research is needed to improve this methodology. This study highlights the need for further efforts in improving deep reinforcement learning applications in dynamic environments.

A Master's Thesis Defense in Mechanical Engineering
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Friday August 23rd, 2024, 11:10AM
Building 192, Room 121 (Robotics Lab)

Zoom Meeting Link: https://calpoly.zoom.us/j/6680161737
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