Zombie Runner

AI Project

Report

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Section A

Introduction

The problem involves simulating a survival scenario in a grid-based environment where a user-controlled agent and an AI-controlled agent navigate through a maze-like grid. The grid is populated with obstacles (walls) and dynamic threats (zombies).

The main challenges include that the agents must navigate through a grid that has randomly placed, connected walls forming obstacles, limiting movement and creating potential dead ends. Zombies move randomly within the grid and act as mobile hazards. Both agents must avoid colliding with zombies to minimize penalties. The user-controlled agent and AI-controlled agent aim to reach the finish line at the opposite corner of the grid while minimizing penalties, such as collisions and unnecessary moves. The grid environment changes dynamically due to the random movement of zombies, increasing the complexity of decision-making for both agents.

This problem models real-world scenarios of pathfinding and decision-making under constraints and risks.

Solution

The solution to the problem involves developing a grid-based simulation using Pygame, where both a user-controlled agent and an AI-controlled agent navigate through a maze-like grid environment filled with obstacles and dynamic threats. The primary goal is for the agents to reach a predefined finish line while minimizing penalties, such as point deductions for unnecessary moves or collisions with zombies.

The grid is designed as a fixed-size space divided into cells. Each cell can represent an empty space, a wall, or be occupied by a zombie or an agent. The walls are randomly generated and connected, forming complex paths that require strategic movement. This setup mimics real-world scenarios where navigation is constrained by barriers, adding complexity to the task.

The red agent is the user controlled and the purple agent is AI agent. The total energy in the start of each program is 5000 and with each move 10 points are deducted. On collision with a zombie 100 points are deducted. The AI-controlled agent, employs the A* search algorithm to calculate the optimal path to the finish line. The algorithm uses a heuristic based on Manhattan distance to estimate the cost of reaching the goal and adjusts its calculations to avoid zombie-adjacent cells by assigning higher costs to such positions.

Results

The simulation results reveal that the AI-controlled agent generally outperforms the user-controlled agent in difficult scenarios, such as navigating complex grid layouts with dense obstacles or avoiding clusters of zombies. The AI's use of the A* search algorithm allows it to efficiently calculate optimal paths, even under challenging conditions. However, in simpler situations with fewer obstacles and widely spaced zombies, the user-controlled agent often performs comparably or even better, as human's direct control can lead to more flexible and immediate decision-making. This contrast highlights the AI's strength in handling complexity but also its reliance on computational strategies that may be less efficient in straightforward scenarios.