Project Proposal: Snake Game with Rotten Fruit Mechanic

1 Group Information

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Table 1: Group Member Information

2 Problem Statement

The proposed project involves the development of a modified version of the classic Snake game, introducing a new mechanic where fruits, which traditionally extend the snake's length, are subject to a timer. If the snake consumes a fruit that has turned rotten, it will lose length instead of gaining it. This addition introduces a strategic layer, compelling players to prioritize consuming fresh fruits while avoiding rotten ones. The project aims to create a challenging, dynamic gaming experience that encourages quick decision-making and planning.

3 Project Feasibility

Reinforcement Learning is an appropriate approach for this project as it provides the framework necessary for training AI agents to make optimal decisions in real-time, dynamic environments. Specifically, RL will be utilized to develop an intelligent snake that learns to maximize its length by navigating the challenges posed by perishable fruits. The AI will need to balance the risks and rewards of consuming fruits, demonstrating advanced gameplay that adds depth and replayability to the game.

4 Project Milestones

The project will be completed over ten weeks, with key milestones outlined as follows:

1. **Weeks 1-2:** Define game mechanics, finalize game design, and create a basic snake game prototype without the rotten fruit mechanic.
2. **Weeks 3-4:** Implement the fruit decay timer and the rotten fruit mechanic. Introduce basic AI control using simple heuristic rules.
3. **Weeks 5-6:** Develop and integrate a basic RL model for training the snake AI on optimal fruit consumption strategies. Set up and validate the training environment.
4. **Weeks 7-8:** Refine the RL model, conduct extensive testing, and evaluate AI performance under varying game conditions.
5. **Weeks 9-10:** Complete final testing and bug fixing. Finalize game design and polish the game for presentation. Prepare the project report and demonstration materials.

5 Relevant Literature

The following literature provides insights into reinforcement learning strategies and game AI development that are relevant to our project:

1. "Autonomous Agents in Snake Game via Deep Reinforcement Learning." *IEEE Conference Publication — IEEE Xplore*, 1 July 2018, `https://ieeexplore.ieee.org/abstract/document/8460004`.
2. "A Deep Q-Learning Based Approach Applied to the Snake Game." *IEEE Conference Publication — IEEE Xplore*, 22 June 2021, `https://ieeexplore.ieee.org/document/9480232`.
3. "A Multi-Agent Actor-Critic Based Approach Applied to the Snake Game." *IEEE Conference Publication — IEEE Xplore*, 24 July 2023, `https://ieeexplore.ieee.org/document/10241182`.
4. Sarkhi, Sadeq Mohammed Kadhm, and Hakan Koyuncu. "Optimization Strategies for Atari Game Environments: Integrating Snake Optimization Algorithm and Energy Valley Optimization in Reinforcement Learning Models." *AI*, vol. 5, no. 3, July 2024, pp. 1172–91. `https://doi.org/10.3390/ai5030057`.