Project Title: Pucket: An Innovative Twist on a Classic Game
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Course: AI
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1. Project Overview

- **Project Topic:**
  Pucket is a fast-paced, competitive game where players use a wooden board with holes to launch pucks into their opponent's side. This proposal aims to innovate the traditional Pucket game by introducing additional mechanics, such as power-ups and obstacles, to enhance gameplay.
- **Objective:**
  The main goal of this project is to develop a strategic AI capable of playing Pucket using the Minimax algorithm, accommodating the new elements introduced in the game.

2. Game Description

- **Original Game Background:**
  Pucket is played on a rectangular board with a central divider, where players aim to slide their pucks into their opponent's goal. The game is known for its quick pace and requires both skill and strategy.
- **Innovations Introduced:**
  - **New Elements:** Adding power-ups (e.g., speed boost, shield) that can be activated during gameplay, and obstacles (e.g., bumpers) that change puck trajectories.
  - **Impact on Gameplay:** These innovations will increase the complexity of the game, requiring players to adapt their strategies dynamically.

3. AI Approach and Methodology

- **AI Techniques to be Used:**
  - **Minimax Algorithm:** Modified for the multi-player setting to evaluate optimal moves considering power-ups and obstacles.
  - **Alpha-Beta Pruning:** To enhance efficiency during decision-making.
  - **Reinforcement Learning:** To train the AI through self-play, optimizing strategies over time.
- **Heuristic Design:**
  Heuristics will evaluate game states based on puck positions, power-up availability, and potential obstacles.
- **Complexity Analysis:**
  The time complexity will be analyzed based on the number of pucks and the introduction of power-ups, which may increase the decision space significantly.

4. Game Rules and Mechanics

- **Modified Rules:**
  - Players can activate one power-up per turn.
  - Obstacles will be placed randomly on the board at the start of each game.
- **Winning Conditions:**
  A player wins by successfully getting all their pucks into the opponent's goal first, considering the impact of power-ups and obstacles.
- **Turn Sequence:**
  Players take turns launching pucks, with the ability to use power-ups during their turn.

5. Implementation Plan

- **Programming Language:** Python
- **Libraries and Tools:**
  - Pygame (for GUI)
  - NumPy (for data handling)
  - TensorFlow (for implementing reinforcement learning)
- **Milestones and Timeline:**
  - **Week 1-2:** Game design and rule finalization
  - **Week 3-4:** AI strategy development (Minimax and heuristics)
  - **Week 5-6:** Coding and testing the game mechanics
  - **Week 7:** AI integration and testing
  - **Week 8:** Final testing and report preparation

6. References

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