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AI Catch The Ball Game

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Introduction:

The aim of this project is to develop a simple game where an Artificial Intelligence (AI) controls a basket using Deep Q-Learning (DQN) to catch a falling ball. The AI is trained to become more efficient at catching the ball through iteration and learning from experience.

Tools and Technologies Used:

- Pygame: Used for rendering the game's real-time graphics.
- Gymnasium: Manages the game logic as a reinforcement learning environment.
- Stable Baselines3 (DQN): Used to train the AI through a neural network that learns by trial and error.
- Python: The programming language used to control all processes and build the game.

Game Concept:

The basket moves horizontally to catch a randomly falling ball. The AI learns to control the basket by attempting 3 different actions (move left, move right, or stay still). The AI is rewarded when it catches the ball and penalized when it misses, helping it improve its performance over time.

How it Works:

In each step, the game state is updated based on the AI’s decision. Rewards and penalties are calculated depending on whether the AI successfully catches the ball. Over time and multiple iterations, the AI learns how to predict the best movement of the basket based on the ball's position.

Training:

A DQN model was used to train the AI. The training process involves:
- Initially, the AI explores different random movements.
- Over time, it becomes more efficient and reduces random moves in favor of more effective strategies.

Challenges:

One of the main challenges was tuning the exploration rate for the AI to learn efficiently. Additionally, the training process took a significant amount of time for the AI to acquire the necessary skills.

Results:

After several training rounds, the AI successfully learned how to catch the ball efficiently, making intelligent decisions based on the current game state.