The Unbeatable Pong

WID3009 Artificial Intelligence Game Programming (Mini Project)

The Team

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The Pong (1)

Games have long been seen as an ideal test-bed for the study of AI. Until recently, most of the academic work in the area focused on traditional board games and card games, the challenge being to beat expert human players. Following **the release of Pong in the early 1970s**,the last few decades have seen a phenomenal increase in the quality, diversity and pervasiveness of video games. **The value of the worldwide computer and video games market is estimated to be $USD25bn annually**, and is predicted to grow rapidly over the next decade.

The Pong (2)

The earliest real artificial intelligence in gaming was the computer opponent in “Pong” or variations. The computer paddle would do its best to block the ball from scoring by hitting it back at the user. Determining where to move the paddle was accomplished by a simple equation that would calculate at exactly what height the ball would cross the goal line and move the paddle to that spot as fast as allowed. Depending on the difficulty setting, the computer might not move fast enough to get to the spot or may just move to the wrong spot with some probability. For a **long time no video game AI was not much more intelligent the “Pong” AI**. This was **because the games were relatively simple and most often played with a second player instead of a computer opponent**.

Problem Definition

The traditional supervised Machine Learning approach need to be trained with an input and a “correct answer” called target. The system will then try to learn how to predict targets based on these unseen inputs. In this case, we don’t know what is the best action to take to each stage of the game.

We are interested to explore how **reinforcement learning** could potentially train an agent to learn what actions to maximize the reward in the game.

Related Work

Our work related to Reinforcement Learning (RL) applied in some board games like Go game or strategy game like StarCraft. These games are same with Pong game by requiring agent to interact with environment that keeps changing and then carries out suitable actions.

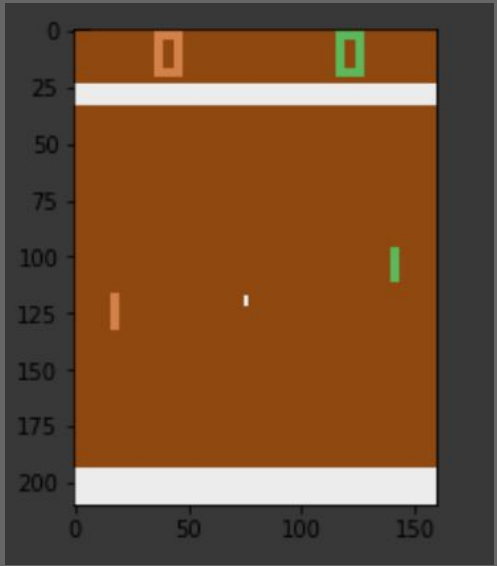
We also reviewed relevant research on applying RL in Pong game. It is important to set difference between two frames as input and produce a predicted action based on input. Then each action can be judged by punishing or rewarding the agent for undesired and desired behavior.

Related Work

Learning Neural Neural Network with Backpropagation: typically considered a supervised learning method classic method large knowledge base exists

Neural Network with Evolutionary Algorithm a typical neural network that employs evolutionary algorithms to optimize itself offers a more efficient tuning of the numerous parameters in a neural network

Environment & Simulation

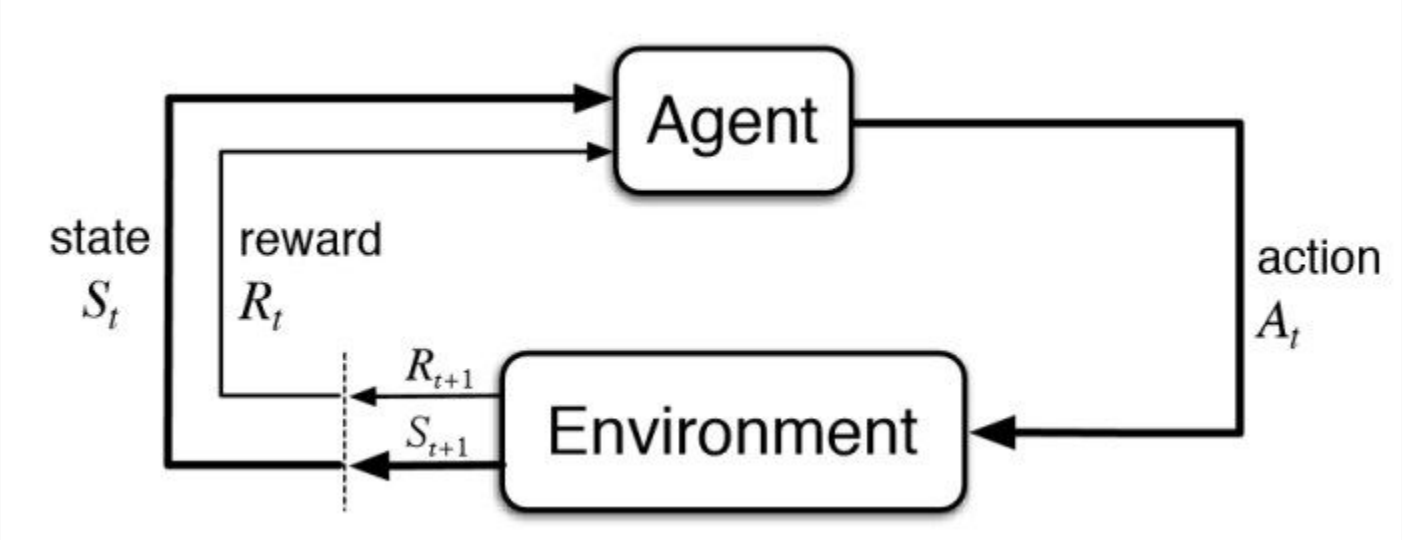


The Pong environment is a simple environment where the objective is to hit the ball with green paddle and get score if orange paddle failed to catch the ball.

There are in total 6 actions in the simulator:

- action 0 and 1 do nothing to the paddle
- action 2 and 4 make the green paddle goes up
- action 3 and 5 make the green paddle goes down

Proposed Approach



Possible Experiment

Train model will different number of epochs:

- 100
- 500
- 1000

Result at epoch 10

Result at epoch 1000

Conclusion

- Increasing the number of generation will cause a significant change in the intelligence of AI
- The agent using a reinforced learning to get reward can be learnt faster because it is free from the overhead needed to maintain generations