

Multi-Agent Tic Tac Toe Challenge

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TIC TAC TOE

- ▶ Minimax and Alpha-Beta Algorithm agents thoroughly look through all possible movements to ensure optimal play in Tic Tac Toe. They may, however, be computationally costly. Reinforcement learning agents, on the other hand, are more flexible but necessitate a longer training period since they acquire knowledge by trial and error. Minimax and Alpha-Beta are the best at being optimal, although Reinforcement Learning agents might be more generalizable. The decision is based on how much computational power, optimality, and training time are traded off.

Objectives

- ▶ Q-learning, Minimax Algorithm, and Alpha-Beta Pruning are the three AI agents that we will create for Tic Tac Toe. To find out who is more efficient at winning, these agents will face off against one another several times. Three successive symbols in a row, column, or diagonal are the goal. The best method between adversarial search and reinforcement learning will be determined by comparing their effectiveness using performance indicators.

Objectives

- Our goal in this experiment is to evaluate how well adversarial search algorithms do in solving the Tic Tac Toe game in comparison to reinforcement learning methods. We want to determine the optimal tactic for winning Tic Tac Toe by comparing the performance of Q-learning, Minimax Algorithm, and Alpha-Beta Pruning agents over several gameplay rounds.

Approach

- ▶ We'll look at two methods for solving Tic Tac Toe in this project:
- ▶ First, we'll put Q-Learning—a reinforcement learning method where the agent picks up knowledge through trial and error—into practice.
- ▶ Second, we'll use Alpha-Beta Pruning and the Min-Max Algorithm in Adversarial Search to build agents that can outmaneuver opponents on a strategic level.
- ▶ Python 3 is the foundation of our technology stack because of its adaptability and strong libraries for game and machine learning.

Deliverables

- ▶ User Documentation: Detailed instructions for using Min-Max, Alpha-Beta, and Reinforcement Learning agents to build the game Tic Tac Toe.
- ▶ Python methods: Python (.py files) methods developed for AI agents are implemented.
- ▶ GitHub Repository: Use the provided GitHub repository URL to view the project's Python code and associated files.
- ▶ YouTube Video: A demonstration video that shows how the project is being implemented, complete with slides that provide more details.

Evaluation Methodology

- Among the things included in the project review are
- ▶ Counting the victories that every AI agent has in a series of one-on-one matches in order to determine which agent is the most effective.
 - ▶ Displaying a comparative table with the three agents' Tic Tac Toe moves, scores, and win percentages.
 - ▶ Comparing the agents' performances visually using graphs.
 - ▶ Comparing the effectiveness of the three implemented agents by doing a time and space complexity analysis.