Monte Carlo Tree Search with Konane

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Introduction

Our main goal is to implement Monte Carlo Tree Search (MCTS) with Konane, an ancient Hawaiian board game, and compare the performance of different simulations. We aim to identify the most effective MCTS by comparing purely random simulations with Alpha-beta pruning and Alpha-beta with Principal Variation Search or Transposition Tables.

Project Breakdown

1. Implement MCTS with random simulation and a default "c" value(ex. c=$\sqrt{2}$). Let the current MCTS and Alpha-Beta Pruning complete one hundred games and count the win rate.
   - Assigned to: Leo
2. Add Alpha-beta pruning with different depths as a simulation type. Finding the optimal depth and let the current MCTS and Alpha-Beta Pruning complete one hundred games and count the win rate.
   - Assigned to: Kimi
3. Compare the two sets of statistics to determine the best MCTS. Following that, experiment with varying "c" values to identify the optimal balance between exploration and exploitation.
   - Assigned to: Leo
4. Select a range of values for "c" and increment the value for each step of "c" (e.g., 0.01). The optimal MCTS with varying "c" values, discovered in the previous session, will compete against Alpha-Beta in 100 simulations. Ultimately, the best value for "c" is determined by a linear graph.
   - Assigned to: Kimi
5. Write a summary of all we did. The summary contains introduction, hypothesis, how we implement each step, results and conclusion.
   - Assigned to: Leo Kimi

Hypothesis

We expect that using Alpha-beta pruning will yield a more effective MCTS compared to purely random simulations and just Alpha-beta pruning. This is because these methods should provide more accurate evaluations of game states, leading to better decisions during game play.

Final Product

Our final product will be a fully implemented MCTS for the Konane. Also, we will analyze the performance of the different MCTS approaches, as well as a demonstration of the most effective MCTS in action. After this, we will have a written based on our findings and the ideal "c" value.

Conclusion

Our project is to try to find an effective MCTS approach for Konane by implementing MCTS with different simulations and exploring different values for the exploration-exploitation constant "c". By dividing tasks between us and focusing on our hypothesis, we will investigate the optimal MCTS approach for this game.