

1. Introduction of the topic.

Gobang is very popular all over the world. The members of our group are very interested in this game so we are trying to make a player vs. AI version of it. Since we have gained some knowledge of Artificial intelligence, we want to use the knowledge we learned in this course to build this game. Thus, our group decided to design a Gobang game that includes a Gobang agent and a simple GUI.

2. Motivation of the topic.

As one of the most ancient board games, Gobang is still a fascinating game to play after over a century. Usually this game requires 2 people to play, however the technology has progressed along the time, 2 players are no longer necessary. Artificial intelligence is now smarter than some of the human players, thus we are planning on training an Artificial intelligence specifically for Gobang games.

3. Description of method(s) from artificial intelligence used.

Minimax algorithm

We need to evaluate what move should the AI execute in the next round in order to gain the most value(advantage), thus we use the Minimax algorithm to evaluate the positions on the chessboard to make the best move.

Alpha-beta Pruning

When we are using the Minimax algorithm, the traversal of a node grows exponentially. It took a lot of time, in order to reduce the time cost of each round, we need to use Alpha-beta pruning to optimize algorithms.

Depth First Search

The basic algorithm that our agent uses.

4. **The result(s) or outcome(s) achieved (both positive and negative results, if applicable).**

Positive result: Our agent always followed Game Tree Search, Minimax algorithm, Alpha-beta Pruning, Negative Maximum Method to get the best position; It knows weigh the pros and cons of attack and defense.

Negative result: Every step took too much time, even the agent has already got 4 in a row, it will still take around 20 seconds to think, If the two sides make more than 10 steps, the calculation time will be very long. We plan to consider using a greedy algorithm to solve this problem in the future.

5. **Discussion of the implications of the work.**

It can train an individual's ability of calculation and prediction. Since chess is a game of thoughts and knowledge, the more one plays, the more he learns from the game, the faster one can calculate what kind of decision will bring himself the greatest value which ultimately will win him the game. With this AI program, people do not have to look for someone to play with, he can simply challenge the AI. In the future modification of this program, we plan to make the AI learn how humans make decisions when facing different situations, which will eventually make the AI smarter and smarter, eventually it will become better at playing chess, while the player can also learn from the AI and improve their skill level.

6. Directions for future work.

Improvements on algorithms: modify the greedy algorithm if possible, since the greedy algorithm is a double-edged sword, it might pick its next step that seems most reasonable(maximum benefit). However, if we can make the greedy algorithm to predict steps that the players could have made, then it can learn from it and calculate more steps to find its next few choices of chess placement in order to gain the maximum value out of its decision.

Improvements on learning: AI will be learning how human players make decisions, and calculate its beneficial rate. If it is the right move to make at the moment, the AI will learn from it and apply it to future games when facing similar situations; If it is not the right move, the AI will still learn it, but then it will store it until a proper counter-move has been demonstrated.

7. “User manual” describing how to run your implementation.

- (1) Run the Python file named “gobang_AI.py”
- (2) A chessboard(19*19) will show up after running the Python file. The User is black and the agent is white.
- (3) Left click to drop the black stone on the chessboard, a row of exactly five stones to be counted as a win
- (4) After one side wins, left click to quit

GUI:



