Gomoku Project

Wentao Ning 11610914

School of Computer Science and Engineering

Southern University of Science and Technology

Email: 11610914@mail.sustc.edu.cn

1. Preliminaries

Gomoku, also written Go-Moku (lit. "five points") is a Japanese board game traditionally played with Go pieces and board (black and white stones on a 19x19 line board). The stones are placed on the intersections of the board, with Black playing first. The winner is the first player to get an unbroken row of five stones, either orthogonally or diagonally. [1]

1.1 Software

This project is written in Python, mainly using editor Sublime Text and IDE PyCharm. The library which was used is only NumPy.

1.2 Algorithm

I used basic search algorithm to complete the value function. Traverse all nodes which is empty and calculation the value if the player put the chess piece here. We calculate the value by assigning different values to different situations such as live_four, die_four, live_three, die_three. Choose the maximum value and put the node into our candidate list.

2. Methodology

In this part, I will describe the representation, architecture and the details of my algorithms.

2.1 Representation

In my project, I used some variables to represent different parts of Gomoku game.

- chessboard: NumPy 2D array
- chess status:
  - COLOR BLACK: black chess
  - COLOR WHITE: white chess
  - COLOR NONE: none chess
- candidate_list: a list whose last element is what we will choose.

2.2 Architecture

Here list all functions in the Python file go test with their usage.

- Given:
  - ***go*:** choose the next position to go.
- Self define:
  - ***value_points*:** traverse all the nodes which are empty and calculate the value of that node.
  - ***max_value_point:*** find the node which has the maximum value.

2.3 Details of Algorithm

I assign different score to different situations. Then traverse every empty node. Assume player put the chess here, find out the horizontal, vertical and orthogonal situations and add up to the total value. Finally, we chose the maximum value.

Now, I will describe in detail how to implement the valuation function.

In the main parts of the game program, the valuation core (valuation function) is a part closely combined with the specific chess knowledge. It can be said that the valuation function determines the chess power of the game program to a great extent. For the importance of the score, you can consider the current game from four directions: horizontal, vertical, left and right oblique. In fact, it is necessary to consider the distribution of subs formed by one of the parties in these four directions, and the evaluation of the current situation after falling in a place where there is no child is mainly to illustrate the importance of this place. Sex, in this, set a simple rule to represent the current chess against the machine and human side scores.

Before evaluating the current situation on the chessboard, I will introduce the commonly used terms in Gomoku:

--- ***live three:*** The situation in which the three children are connected without spacing, and there is a non-chess intersection on each of the extension lines at each end of the three chess, which is closely connected to the three chess.

--- ***Sleeping four:*** Four chess are closely connected with each other. But there is only one crossing point on the extension line available, and the other end is the chess of your enemy.

Then you can get the definitions of the other situations like live four, death three, live two and so on.

	L_2	L_3	L_4	L_5	S_2	S_3	S_4
value	1299	4000	12000	100000	505	1950	5000

As you can see above, L_2 means live two, D_2 means sleeping two and the rest can be done in the same manner.

Search the whole board to find out how many live two, sleeping two and so on, finally each part of the two sides separately sum, get the evaluation of the current situation. Note that the rules here are a summary of the general rules of chess play, and users can add rules and modify the scoring

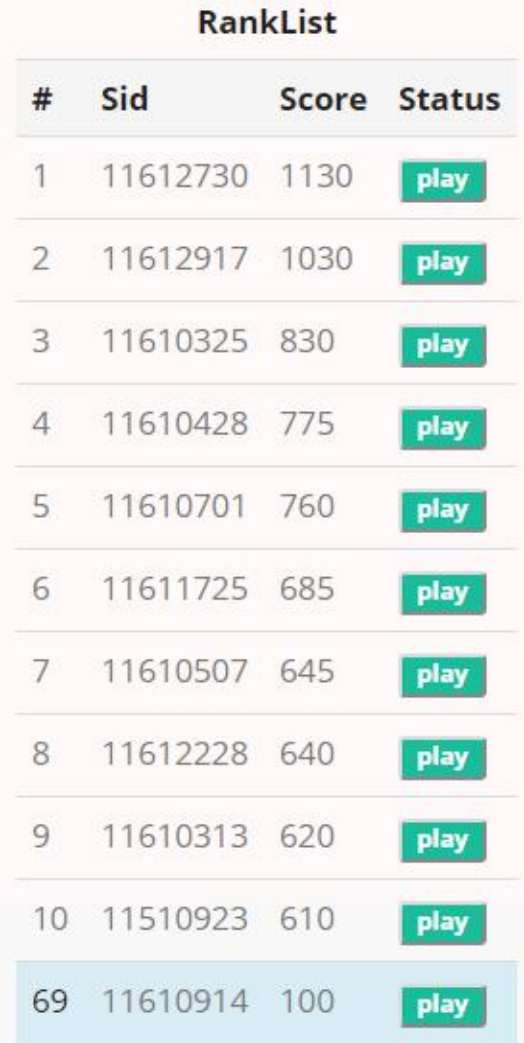
mechanism when they are actually running.

Finally, according to the current situation of the last chess to determine the victory or defeat. It is necessary to judge from four positions that the horizontal, vertical and two lines at 45 degrees and 135 degrees respectively, so as to see whether the last of the four directions falls on one side to form five pieces in a row. If so, it means that the game has been over.

3. Empirical Verification

I have use the code_check.py and code_check_test.py in Sakai. Put them and my file together and run. I find that I can pass the test. Then I upload it to the website, and play with others. In this step, I lose in some rounds and found that there is some problems in my code. I found the problems and fixed them.

In the round-robin game, I got 100 points which is 69th ranking out of 142 people.



RankList

#	Sid	Score	Status
1	11612730	1130	play
2	11612917	1030	play
3	11610325	830	play
4	11610428	775	play
5	11610701	760	play
6	11611725	685	play
7	11610507	645	play
8	11612228	640	play
9	11610313	620	play
10	11510923	610	play
69	11610914	100	play

4. References

[1] "Gomoku - Japanese Board Game", *Web.archive.org*, 2018. [Online]. Available: https://web.archive.org/web/20140326000833/http://www.japan-101.com/culture/gomoku_japanese_board_game.htm. [Accessed: 26- Oct- 2018].