Heuristic Analysis

Three evaluation heuristics

I implemented three evaluation heuristics for a possible move. If a move was to be applied, then for the resulted board state, let D denote the distance between the position of this player and center of the board; let O denote the number of next available legal moves for this player; Let O_a denote the number of next available legal moves for opponent player. The three evaluation heuristics are:

Custom_score = D + O − O_a
Custom_score_2 = O − 1.5×O_a
Custom_score_3 = D − O_a

Performance

Opponent	AB_Improved	AB_Custom_1	AB_Custom_2	AB_Custom_3
Random	1	0.7	1	1
MM_Open	0.6	0.7	0.8	0.5
MM_Center	0.9	0.9	0.8	0.9
MM_Improved	0.8	0.7	0.8	0.7
AB_Open	0.6	0.4	0.4	0.5
AB_Center	0.4	0.5	0.5	0.5
AB_Improved	0.3	0.3	0.5	0.6
Total	0.657	0.600	0.686	0.671

Table 1 Winning rates of agents using alpha-beta-pruning and various heuristics under the tournament of 280 games

Overall, among the three implemented heuristics, agent using the custom_score_2 has the highest winning rate of 0.686 among 70 games it played. This winning rate is higher than 0.657 of AB_improved agent.

Recommendation

I would like to recommend custom_score_2 as the best evaluation function with the following reasons:
1. It has the highest overall winning rates;
2. Agent using it has a stable performance competing with other agents;
3. It has highest time efficiency compared with the rest two custom heuristics.