
HURISTIC STUDY

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Heuristic value function introduction

Custom function: conservative style

This function returns the value of $1.5 * \text{my number of move} - \text{opponent's number of move}$, which values saving more moves for active players more.

Custom function 2: progressive style

This function returns the value of $\text{my number of move} - 1.5 * \text{opponent's number of move}$, which values making opponents less moves more, more attacking, but easy to lose possible moves for player itself, which resulting less efficient than AB_Improved agents.

Custom function 3: changing style

This function returns the ratio of $\text{my number of move} / \text{opponent's number of move}$ (0.1 is added to avoid zero), which changes the style of playing according to situation. When the opponents have very limited moves, especially 0 moves, this function return much larger value. When the difference of moves is the same, the agent tends to choose the one which makes the opponent less moves, e.g. between $8/6$ & $7/5$, $7/5$ is chosen. However, when the difference of moves is larger, the larger difference one is chosen, e.g. between $7/4$ & $7/3$, $7/3$ is chosen. This property makes this heuristic a better choice.

The result of tournament is pasted below, the 3 agents outperformed AB_Improved in win rate, and in most cases. However, when play against AB agent, the result is actually similar, but the custom function 3 mostly outperform others, thus custom function 3 are recommended. Based on the test we can see AB agent can almost always outperform MM agent, which means the search depth is quit important.

Playing Matches

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	8	2	10	0	10	0	10	0
2	MM_Open	8	2	9	1	9	1	9	1
3	MM_Center	10	0	10	0	10	0	10	0
4	MM_Improved	7	3	9	1	9	1	10	0
5	AB_Open	5	5	4	6	5	5	8	2
6	AB_Center	6	4	6	4	4	6	6	4
7	AB_Improved	5	5	5	5	5	5	4	6

Win Rate:	70.0%	75.7%	74.3%	81.4%
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Playing Matches

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	10	0	10	0	10	0	10	0
2	MM_Open	9	1	8	2	8	2	7	3
3	MM_Center	10	0	9	1	9	1	10	0
4	MM_Improved	7	3	10	0	6	4	9	1
5	AB_Open	5	5	5	5	6	4	8	2
6	AB_Center	7	3	6	4	5	5	5	5
7	AB_Improved	5	5	2	8	6	4	6	4

Win Rate:	75.7%	71.4%	71.4%	78.6%
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Playing Matches

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	10	0	10	0	10	0	10	0
2	MM_Open	8	2	9	1	7	3	7	3
3	MM_Center	10	0	10	0	10	0	9	1
4	MM_Improved	8	2	8	2	9	1	9	1
5	AB_Open	6	4	6	4	3	7	7	3
6	AB_Center	7	3	7	3	6	4	5	5
7	AB_Improved	5	5	5	5	6	4	6	4

Win Rate:		77.1%		78.6%		72.9%		75.7%	