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June 18, 2017

HEURISTIC ANALYSIS

Heuristic Functions

The following three evaluation functions are implemented.

- aggressive_score (AB_Custom_2)

- runaway_score (AB_Custom_3)

- improved_center_score (AB_Custom)

Overall AB_Improved (improved_score) performs best among the opponents. "improved_score" does not, however, have a good way to decide which move is better when the number of legal moves for the player is the same as the opponent's. Therefore, it should work better if location base evaluation is added when the number of legal moves is the same or similar.

First attempt, aggressive_score, is to address it by adding factor to improved_score, which AB_Improved uses. In aggressive_score, it calculates the score as (player_moves - 1.5 * opponent_moves). So, it weights on aggressive move rather than defensive move. It works as good as AB_Improved but not better than that.

Second attempt, runaway_score, is to evaluate the location value by the distance from the opponent location instead of the remaining legal moves. This does not work as good as AB_Improved but it performs as good as AB_Center, which evaluates the location value by the distance from the center of the board.

Finally, improved_runaway_score combines AB_Improved (improved_score) with runaway_score. These evaluations would work better together as runaway_score can help out when the number of legal moves is the same or similar. While it combines them, it uses factor and calculates the score as (factory*improved + runaway). To determine the proper factor, factor is set to 1.0, 1.3, 1.5, 2.0. It appeared it performs better with factor=1.3 against AB_Improved.

Summary

The following table shows the tournament results among the opponents and the above three heuristic functions. This is one of several test results produced by tournament.py. Generally speaking, all of the above heuristic functions perform better than the opponents except AB_Improved.

AB_Custom (improved_runaway_score) and AB_Custom_2 (aggressive_score) perform better than AB_Custom_3 (runaway_score). Their win rates are 70 - 75% overall while AB_Custom_3 (runaway_score) win rate is 65 - 68%. AB_Custom (improved_runaway_core) and AB_Custom_2 (aggressive_score) perform almost the same but AB_Custom (improved_runaway_score) works better against AB_Improved (improved_score). Also, AB_Custom_2 (aggressive_score) sometimes

get lower win rate against AB_Center. So, AB_Custom (improved_runaway_score) is more stable and it's recommended.

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		improved		improved_runaway		aggressive		runaway	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	19	1	19	1	19	1	18	2
2	MM_Open	16	4	14	6	14	6	15	5
3	MM_Center	17	3	17	3	19	1	17	3
4	MM_Improved	16	4	14	6	16	4	10	10
5	AB_Open	10	10	13	7	12	8	12	8
6	AB_Center	14	6	11	9	10	10	10	10
7	AB_Improved	11	9	14	6	12	8	12	8
	Win Rate:		73.6%		72.9%		72.9%		67.1%