

# Heuristic analysis

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## 1. Introduction

I think that I have to decide to choose a position where I wins for the isolation game. To win the game, I will build a strategies. This game are two players(i.e. Zero-sum game), adversarial search, perfect information, and turn-based. Evaluation function returns estimate value to meet the game states.

## 2. Modeling Evaluation Function

### 1. Custom\_score

- a. This evaluation function learned lecture that outputs a score equal to the difference in the number of moves available to the two players. I study this function called "AB\_Improved". So, I can improve to add empirical weights of opponent player. This weight is my experience. I repeated several times about this weight of function repeatedly. I think that is to search tree better than "AB\_improved".

**b. `return float(abs(own_moves) - 1.5*abs(opp_moves))`**

### 2. Custom\_score2

- a. This evaluation function that I earned idea from Euclidean distance. This is not consider direction but I want to find the distance between two points.

b. 
$$d(p, q) = \sqrt{(p - q)^2 + (p - q)^2}$$

- c. This heuristic is performer than AB\_Improved. But this function's problem is a lot of deviation in the search process.

**d. `return float(math.sqrt((x2 - x1)**2 + (y2 - y1)**2))`**

### 3. Custom\_score3

- a. This evaluation function that handle in between my moves and opponent moves of centrality.

**b. `return float((h - own_y)**2 + (w - opp_x)**2) + float((h - opp_y)**2 + (w - own_x)**2)`**

## 3. Conclusion

I did develop and improve heuristic evaluation functions. Custom\_1 performed the best between other function of 10 times running. AB\_Custom\_1 is 70.0%, AB\_Custom\_2 69.0%,

AB\_Improved 68.3% and AB\_Custom\_3 66.6%. I will study this heuristics and game agent to improve after term 1.

I recommend “AB\_Custom\_1” of heuristic function. Because this function is lower deviation and higher win rate. This function is more searching tree nodes and empirical method. How many left moves?. But add weights to find more searching and good solution(position). I will try to combine AB\_custom\_1 and AB\_custom\_3.

Match #	Opponent	AB_Improved		AB_Custom		AB_Custom_2		AB_Custom_3	
		Won	Lost	Won	Lost	Won	Lost	Won	Lost
1	Random	10	0	9	1	10	0	10	0
2	MM_Open	7	3	7	3	7	3	7	3
3	MM_Center	9	1	10	0	7	3	9	1
4	MM_Improved	6	4	8	2	7	3	7	3
5	AB_Open	5	5	6	4	5	5	5	5
6	AB_Center	6	4	6	4	4	6	5	5
7	AB_Improved	6	4	4	6	4	6	2	8
		49	21	50	20	44	26	45	25
	Win Rate:	0.700		0.714		0.629		0.643	
1	Random	10	0	10	0	9	1	10	0
2	MM_Open	6	4	9	1	7	3	7	3
3	MM_Center	8	2	9	1	7	3	9	1
4	MM_Improved	6	4	7	3	6	4	7	3
5	AB_Open	6	4	5	5	6	4	6	4
6	AB_Center	7	3	7	3	5	5	7	3
7	AB_Improved	4	6	7	3	5	5	4	6
		47	23	54	16	45	25	50	20
	Win Rate:	0.671		0.771		0.643		0.714	
1	Random	10	0	9	1	9	1	9	1
2	MM_Open	7	3	6	4	7	3	7	3
3	MM_Center	8	2	10	0	9	1	9	1
4	MM_Improved	8	2	8	2	8	2	8	2
5	AB_Open	3	7	6	4	5	5	4	6
6	AB_Center	8	2	5	5	4	6	3	7
7	AB_Improved	5	5	5	5	7	3	4	6
		49	21	49	21	49	21	44	26
	Win Rate:	0.700		0.700		0.700		0.629	
1	Random	9	1	9	1	10	0	10	0
2	MM_Open	9	1	8	2	9	1	7	3
3	MM_Center	10	0	8	2	10	0	9	1
4	MM_Improved	7	3	8	2	7	3	8	2
5	AB_Open	4	6	5	5	5	5	5	5
6	AB_Center	6	4	5	5	6	4	6	4
7	AB_Improved	3	7	5	5	3	7	3	7
		48	22	48	22	50	20	48	22
	Win Rate:	0.686		0.686		0.714		0.686	
1	Random	7	3	9	1	8	2	8	2

2	MM_Open	6	4	9	1	9	1	8	2
3	MM_Center	9	1	8	2	10	0	9	1
4	MM_Improved	6	4	7	3	7	3	7	3
5	AB_Open	5	5	6	4	6	4	7	3
6	AB_Center	5	5	7	3	6	4	5	5
7	AB_Improved	5	5	5	5	5	5	5	5
		43	27	51	19	51	19	49	21
	Win Rate:	0.614		0.729		0.729		0.700	
1	Random	9	1	10	0	9	1	9	1
2	MM_Open	9	1	8	2	8	2	8	2
3	MM_Center	9	1	8	2	10	0	9	1
4	MM_Improved	8	2	8	2	6	4	4	6
5	AB_Open	4	6	4	6	5	5	4	6
6	AB_Center	5	5	5	5	5	5	6	4
7	AB_Improved	5	5	5	5	6	4	4	6
		49	21	48	22	49	21	44	26
	Win Rate:	0.700		0.686		0.700		0.629	
1	Random	10	0	10	0	9	1	9	1
2	MM_Open	5	5	8	2	8	2	8	2
3	MM_Center	7	3	10	0	9	1	8	2
4	MM_Improved	7	3	7	3	7	3	4	6
5	AB_Open	8	2	5	5	6	4	5	5
6	AB_Center	4	6	4	6	5	5	5	5
7	AB_Improved	5	5	3	7	3	7	6	4
		46	24	47	23	47	23	45	25
	Win Rate:	0.657		0.671		0.671		0.643	
1	Random	10	0	10	0	9	1	8	2
2	MM_Open	8	2	8	2	10	0	7	3
3	MM_Center	9	1	10	0	9	1	10	0
4	MM_Improved	8	2	7	3	9	1	8	2
5	AB_Open	7	3	5	5	5	5	6	4
6	AB_Center	4	6	6	4	7	3	5	5
7	AB_Improved	4	6	5	5	8	2	3	7
		50	20	51	19	57	13	47	23
	Win Rate:	0.714		0.729		0.814		0.671	
1	Random	10	0	9	1	9	1	10	0
2	MM_Open	7	3	7	3	7	3	9	1
3	MM_Center	9	1	9	1	9	1	8	2
4	MM_Improved	8	2	6	4	7	3	6	4
5	AB_Open	4	6	5	5	5	5	3	7
6	AB_Center	6	4	3	7	5	5	3	7
7	AB_Improved	6	4	6	4	4	6	6	4
		50	20	45	25	46	24	45	25
	Win Rate:	0.714		0.643		0.657		0.643	
1	Random	10	0	9	1	10	0	9	1
2	MM_Open	7	3	6	4	8	2	6	4
3	MM_Center	8	2	10	0	9	1	10	0

4	MM_Improved	6	4	5	5	6	4	7	3
5	AB_Open	7	3	7	3	4	6	7	3
6	AB_Center	5	5	7	3	3	7	4	6
7	AB_Improved	4	6	4	6	5	5	6	4
		47	23	48	22	45	25	49	21
	Win Rate:	0.671		0.686		0.643		0.700	