Isolation Heuristic Analysis

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for Udacity

Abstract

This document analyses the performance of 3 heuristics used for Isolation game playing agent.

Introduction

Three heuristics used for the analysis is described below.

1. Inverse Distance Heuristic

This heuristic measures the measures the distance to each free cell and use the inverse (calculated by subtracting player position from board size) as the score. Heuristic uses the sum of distance to neighbors as the final value.

Note: Distance between two cells is maximum of row displacement or column displacement.

2. Free Neighbors Heuristic

This heuristic measures occupancy of the neighboring cells. For each free neighbor (within [-3, +3] range) score of 1 is added; except for the cells depicted by figure 1 which has the score of -1. Score of -1 is given because these cells take 4 moves to reach from the current position. Difference between two players are used as heuristic value
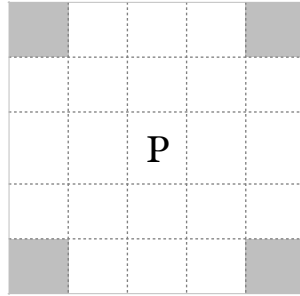
Figure 1: Hard to reach cells

3. Improved Open Moves Heuristic

This improves open moves heuristic by giving a -0.5 weight for the hard to reach cells given in Figure 1.

Performance Analysis

Heuristic	Run 1		Run 2		Run 3		Average
	ID	STD	ID	STD	ID	STD	Difference
Inverse Distance	66.43%	69.29%	68.57%	65.00%	64.29%	62.86%	-0.71%
Free Neighbors	63.57%	70.00%	63.57%	68.57%	67.86%	72.14%	5.23%
Improved Open Moves	65.00%	70.00%	65.71%	70.71%	64.29%	70.71%	5.47%

Table 1: Performance analysis

1. Inverse Distance Heuristic

Inverse distance heuristic performed less than the ID Improved by a small average margin. Inverse distance heuristic traverse through all the cells in the board. Therefore it consumes time that should have been used for evaluate more depth in game tree.

2. Free Neighbors Heuristic

Free neighbors performed better than ID Improved. This heuristic evaluates only neighboring cells; hence consumes less time. But, this heuristic enables player to move into regions with more open space, which gives better performance when spaces split-up during the end game.

3. Improved Open Moves Heuristic

This heuristic assigns a negative weight for 4 neighboring cells that takes at least 4 moves to reach. Therefore, this heuristic encourages agent to move into spaces with cells agent could utilize, but with less cells which only opponent could utilize. Also, this heuristic evaluate only 8 board positions, which makes the calculation fast.

Conclusion

This analysis selects **Improved Open Moves Heuristic** as the best heuristic due to the better performance in statistical analysis and the speed gain by evaluating less cells.