

Custom Heuristic Functions

I have chosen to use three custom heuristic functions. All of the heuristics leverage the foundation of maximizing the number of moves available to us, while minimizing the number of moves available to our opponents. However, in addition, each of these three heuristics tries to explore how we can expand this to improve performance even further.

The first heuristic function (h1) attempts to assign preference to moves that keep us closer to the center, rather than moving toward the edges. This is because in Isolation, being close to the edge tends to be a disadvantage. To do this, the heuristic takes the difference between moves available to us and to our opponents, and divides it by the distance from the center of the board. Therefore, the larger the distance from the center, the more diminished the outcome will become.

The second heuristic function (h2) attempts to keep our player moving toward the opponent. This is an aggressive attempt to keep moving toward the opponent and, hopefully, push the opponent toward a board edge or an 'island' on the board. To do this, the difference between over available to us and to our opponents is divided by the distance between us and our opponent. The smaller that distance is, the larger the resulting value is going to be.

The third heuristic function (h3) takes the opposite approach, and tries to keep our player as far away from the opponent as possible. It computes the distance between us and our opponent, and then multiplies it by the foundation (move delta).

All of the heuristics were evaluated using tournament.py script. Below is the summary of the results (20 runs were performed).

Agent Performance Results

Here is a brief summary of the results. All of the heuristics outperformed the id_improved, but only slightly. ID_Improved performance came at about 80, with other heuristics' scores being between 81 and 82. Overall, the heuristics focused on moving toward our opponent (h2) delivered the highest score of 81.75 (the average of 12 runs). Staying as close to the center as possible performed well also; staying as far away from the opponent as possible was the least successful of the three.

Ultimately, heuristic h2 (aggressively going toward the opponent) is chosen as the custom_score function in the code. The other two heuristic functions remain listed as h1 and h3.

heuristic h2 "push toward the opponent":

ID_Improved	85.00%, Student	80.71%
ID_Improved	73.57%, Student	82.14%
ID_Improved	80.71%, Student	82.86%
ID_Improved	82.14%, Student	77.86%
ID_Improved	79.29%, Student	80.00%
ID_Improved	78.57%, Student	75.00%
ID_Improved	77.86%, Student	82.86%
ID_Improved	77.14%, Student	80.71%
ID_Improved	85.71%, Student	78.57%
ID_Improved	84.29%, Student	84.29%
ID_Improved	77.86%, Student	85.71%
ID_Improved	77.14%, Student	81.43%
ID_Improved	80.00%, Student	76.43%
ID_Improved	80.00%, Student	84.29%
ID_Improved	80.71%, Student	83.57%
ID_Improved	83.57%, Student	80.00%
ID_Improved	76.43%, Student	83.57%
ID_Improved	80.71%, Student	85.71%
ID_Improved	81.43%, Student	82.86%
ID_Improved	81.43%, Student	86.43%

80.178, 81.75: 1.572

heuristic h1 ("cover near center"):

ID_Improved	75.00%, Student	82.14%
ID_Improved	85.00%, Student	85.71%
ID_Improved	81.43%, Student	82.14%
ID_Improved	81.43%, Student	79.29%
ID_Improved	78.57%, Student	85.71%
ID_Improved	76.43%, Student	82.14%
ID_Improved	77.86%, Student	82.14%
ID_Improved	77.86%, Student	75.71%
ID_Improved	78.57%, Student	80.71%
ID_Improved	81.43%, Student	76.43%
ID_Improved	77.14%, Student	82.14%
ID_Improved	72.14%, Student	82.86%
ID_Improved	81.43%, Student	81.43%
ID_Improved	78.57%, Student	82.86%
ID_Improved	79.29%, Student	83.57%
ID_Improved	80.71%, Student	83.57%
ID_Improved	85.71%, Student	76.43%
ID_Improved	79.29%, Student	80.00%
ID_Improved	75.00%, Student	78.57%
ID_Improved	85.00%, Student	81.43%

79.393, 81.249: 1.856

heuristic h3 (distance from opponent):

ID_Improved	81.43%, Student	78.57%
ID_Improved	81.43%, Student	79.29%
ID_Improved	75.71%, Student	80.00%
ID_Improved	82.86%, Student	78.57%
ID_Improved	80.71%, Student	81.43%
ID_Improved	78.57%, Student	81.43%
ID_Improved	80.71%, Student	78.57%
ID_Improved	77.86%, Student	82.14%
ID_Improved	79.29%, Student	78.57%
ID_Improved	80.71%, Student	75.71%
ID_Improved	80.71%, Student	81.43%
ID_Improved	82.14%, Student	82.86%
ID_Improved	79.29%, Student	84.29%
ID_Improved	75.71%, Student	85.00%
ID_Improved	83.57%, Student	80.00%
ID_Improved	75.71%, Student	82.86%
ID_Improved	82.86%, Student	87.14%
ID_Improved	85.71%, Student	82.86%
ID_Improved	81.43%, Student	86.43%
ID_Improved	82.86%, Student	80.71%

80.4635, 81.393: 0.9295