

AIND-Isolation: Build a Game-Playing Agent

Robin Pilling

Udacity uses an agent called `ID_Improved` as a benchmark for our agent by comparing the strength of an agent using iterative deepening (ID) search with alpha-beta pruning against the strength of different given heuristic functions. The `Student` agent then measures the performance of our custom heuristic functions against the same opponents. Hence, the only difference between `ID_Improved` and our `Student` agent is the heuristic function which is considered for evaluating the game. The `ID_Improved` agent uses the "improved" heuristic from the lecture which was defined as the number of moves of our player minus the number of moves of the opponent player. The "improved" heuristic function yields a higher score the more moves there are left for our player in comparison to the opponent.

After implementing minmax and alphabeta search for the isolation game, four heuristic functions were developed to compare our agent against `ID_Improved` and outperform its performance:

1. Heuristics h1: #own moves - 2* #opponent moves.

The objective of the first evaluation function is similar to the "improved" heuristic but stricter in terms of opponent moves as it weighs them by 2.

2. Heuristics h2: #own moves / #opponent moves

The objective of the second heuristic is to compare the number of our moves relative to our opponent.

3. Heuristics h3: own_center_distance - opp_center_distance

The objective of the third heuristic is to favor the distance to the center and compare our distance from the center to the opponents distance from the center.

4. Heuristics h4: #own moves *own_center_distance - #opp moves *opp_center_distance

The objective of the fourth heuristic is similar to the third heuristic favoring the distance to the center but also taking into consideration the number of own and opponent moves as weighting factor.

Heuristics	h1	h2	h3	h4
ID_Improved	69.29%	67.86%	68.57%	70.00%
Student	70.71%	67.86%	65.71%	69.29%

From the table we can find and conclude that only Heuristics h1 outperforms the “ID_Improved” agent. Using Heuristics h2 or “ID_Improved” to play the game returned the same results where the h2 heuristics yield better results against the Random, MM_Null and MM_Open heuristics (compare with Appendix). Heuristic h3 didn’t perform well by evaluating the performance when staying close to the center and was “far away” in terms of outperforming the “ID_Improved” agent. When adding number of moves to heuristic h3, we find that heuristic h4 yields a good result even not being able to outperform “ID_Improved”.