20 Jun 2018Udacity: Build an Adversarial Game Playing AgentJose Medina

**Advanced Heuristic**

Baseline: #my\_moves - #opponent\_moves heuristic from lecture (should use fair\_matches flag in run\_match.py)

|  |  |  |  |
| --- | --- | --- | --- |
|  | RANDOM Agent | GREEDY Agent | MINIMAX Agent |
| Score (Baseline) | 93.5 | 86.0 | 71.0 |
| 91.5 | 89.0 | 70.0 |
| 95.5 | 83.0 | 71.0 |
| Average | 93.5 | 86 | 70.6666667 |
|  | | | |
| Custom\_Heuristic\_1 | 95.5 | 88.0 | 73.5 |
| 95.0 | 84.0 | 74.0 |
| 94.5 | 84.5 | 81.0 |
| Average | 95 | 85.5 | 76.1666667 |
|  | | | |
| Custom\_Heuristic\_2 | 91.5 | 86.5 | 68.5 |
| 91.0 | 88.0 | 72.5 |
| 93.0 | 87.0 | 79.5 |
| Average | 91.83333333 | 87.16666667 | 73.5 |
|  | | | |
| Custom\_Heuristic\_3 | 94.0 | 86.5 | 71.5 |
| 92.5 | 86.0 | 76.0 |
| 94.5 | 85.0 | 75.5 |
| Average | 93.66666667 | 85.83333333 | 74.3333333 |
|  | | | |
| Custom\_Heuristic\_4 | 93.5 | 84.0 | 73.0 |
| 92.0 | 84.5 | 79.0 |
| 94.0 | 86.0 | 77.0 |
| Average | 93.16666667 | 84.83333333 | 76.3333333 |

* What features of the game does your heuristic incorporate, and why do you think those features matter in evaluating states during search?

custom\_heuristic\_1 :

The heuristic utilized the number of liberates available to each player. The function squares both the number of moves available to the player and the opponent, but multiplies the opponents moves by 1.8 which results in the number of opponents move to have a higher impact when deciding to reduce the number of opponents move. Considering the number of moves available to each player, allows the player to choose moves which will reduce the number of moves possible to the opponent and increase the number of moves the player possess. The consideration of the number of moves is an effective way to ensure victory occurs the player. The squaring of the number of moves available to each player allows for the result to be on a significantly larger scale, up to a factor of two.

custom\_heuristic\_2 :

The heuristic analysis the moves available to each player, where a value of five added to the score for every move the player possess which is also within the opponent moves. This implementation of the heuristic function allows the player to choose moves which will block the opponent's moves and restrict the number of actions the opponent can perform.

custom\_heuristic\_3 :

Similar to custom\_heuristic\_2, the heuristic only adds a single value of five to the score for any move the player possess is also within the opponents moves.

custom\_heuristic\_4 :

The final heuristic places a higher significance on the number of moves available to the player by multiplying it by 18 which results in the player to behave more defensively.

* Analyze the search depth your agent achieves using your custom heuristic. Does search speed matter more or less than accuracy to the performance of your heuristic?

My agent was able to achieve a max search depth close to 2000 within the 150 milliseconds, but with an average search depth of about six to eight. The results indicate that the agent can choose a move within the allocated time provided. Although the agent can determine an action within a depth of six to eight meaning a higher focus can empathize with accuracy, I believe speed is the essential component when using a search engine. When implementing a search engine to an industrial size or real-world applications such as shipping or trajectory calculations require speed to become the most vital component to ensure the best action is selected as soon as possible with the minimal amount of information. Balancing speed and accuracy also depends heavily on the application used and should always be adjusted to ensure the end goals or criteria are met.

(200 games each run of the script)

Score (Baseline) vs MINIMAX

python run\_match.py -f -r 50 -o MINIMAX -p 4

Your agent won 71.0% of matches against Minimax Agent

Your agent won 70.0% of matches against Minimax Agent

Your agent won 71.0% of matches against Minimax Agent

Score (Baseline) vs Greedy

python run\_match.py -f -r 50 -o GREEDY -p 4

Your agent won 86.0% of matches against Greedy Agent

Your agent won 89.0% of matches against Greedy Agent

Your agent won 83.0% of matches against Greedy Agent

Score (Baseline) vs RANDOM

python run\_match.py -f -r 50 -o RANDOM -p 4

Your agent won 93.5% of matches against Random Agent

Your agent won 91.5% of matches against Random Agent

Your agent won 95.5% of matches against Random Agent

Custom Heuristic 1 vs MINIMAX

python run\_match.py -f -r 50 -o MINIMAX -p 4

Your agent won 73.5% of matches against Minimax Agent

Your agent won 74.0% of matches against Minimax Agent

Your agent won 81.0% of matches against Minimax Agent

Custom Heuristic 1 vs Greedy

python run\_match.py -f -r 50 -o GREEDY -p 4

Your agent won 88.0% of matches against Greedy Agent

Your agent won 84.0% of matches against Greedy Agent

Your agent won 84.5% of matches against Greedy Agent

Custom Heuristic 1 vs RANDOM

python run\_match.py -f -r 50 -o RANDOM -p 4

Your agent won 95.5% of matches against Random Agent

Your agent won 95.0% of matches against Random Agent

Your agent won 94.5% of matches against Random Agent

Custom Heuristic 2 vs MINIMAX

python run\_match.py -f -r 50 -o MINIMAX -p 4

Your agent won 68.5% of matches against Minimax Agent

Your agent won 72.5% of matches against Minimax Agent

Your agent won 79.5% of matches against Minimax Agent

Custom Heuristic 2 vs Greedy

python run\_match.py -f -r 50 -o GREEDY -p 4

Your agent won 86.5% of matches against Greedy Agent

Your agent won 88.0% of matches against Greedy Agent

Your agent won 87.0% of matches against Greedy Agent

Custom Heuristic 2 vs RANDOM

python run\_match.py -f -r 50 -o RANDOM -p 4

Your agent won 91.5% of matches against Random Agent

Your agent won 91.0% of matches against Random Agent

Your agent won 93.0% of matches against Random Agent

Custom Heuristic 3 vs MINIMAX

python run\_match.py -f -r 10 -o MINIMAX -p 4

Your agent won 80.0% of matches against Minimax Agent

python run\_match.py -f -r 50 -o MINIMAX -p 4

Your agent won 71.5% of matches against Minimax Agent

Your agent won 76.0% of matches against Minimax Agent

Your agent won 75.5% of matches against Minimax Agent

Custom Heuristic 3 vs Greedy

python run\_match.py -f -r 50 -o GREEDY -p 4

Your agent won 86.5% of matches against Greedy Agent

Your agent won 86.0% of matches against Greedy Agent

Your agent won 85.0% of matches against Greedy Agent

Custom Heuristic 3 vs RANDOM

python run\_match.py -f -r 50 -o RANDOM -p 4

Your agent won 94.0% of matches against Random Agent

Your agent won 92.5% of matches against Random Agent

Your agent won 94.5% of matches against Random Agent

Custom Heuristic 4 vs MINIMAX

python run\_match.py -f -r 50 -o MINIMAX -p 4

Your agent won 73.0% of matches against Minimax Agent

Your agent won 79.0% of matches against Minimax Agent

Your agent won 77.0% of matches against Minimax Agent

Custom Heuristic 4 vs Greedy

python run\_match.py -f -r 50 -o GREEDY -p 4

Your agent won 84.0% of matches against Greedy Agent

Your agent won 84.5% of matches against Greedy Agent

Your agent won 86.0% of matches against Greedy Agent

Custom Heuristic 4 vs RANDOM

python run\_match.py -f -r 50 -o RANDOM -p 4

Your agent won 93.5% of matches against Random Agent

Your agent won 92.0% of matches against Random Agent

Your agent won 94.0% of matches against Random Agent