Udacity – AIND - Advanced Game Playing Heuristic Analysis

By: Cheryl Miller

INTRODUCTION

This project implements an agent to play the game of Isolation using moves like those of a knight piece in the game of Chess. It implements the Minimax, Alpha-Beta Pruning and Iterative Deeping search algorithms. In addition, it implements 3 heuristic functions whose goal is to beat the benchmark ID_Improved agent. The benchmark agent uses a mobility 'improved score' heuristic presented in class lectures which computes the number of legal moves the player has vs the number of legal moves the opponent has and returns the difference.

HEURISTIC FUNCTIONS IMPLEMENTED

ON EDGE HEURISTIC

This heuristic computes a weighed value base on the following formula:

- The 'improved' score calculated as for the ID_Improved agent * 50% weight
- Less one * 20% weight if the primary player's current position is an edge position, else zero
- Plus one * 30% weight if the opponent's current position is an edge position, else zero

The reasoning behind this heuristic is the fuller the board get, if a player gets restricted to an edge position, the fewer move options are available and higher the likelihood of losing. If primary player is in this position, we devalue the score more, however, if the opponent is in this position, we value it more.

ON EDGE – OFFENSE

This heuristic is similar to above, except the weights are 50%, 20% and 20% respectively, plus an added bonus /penalty of the number of legal moves the 2 players have in common. This bonus carries a 10% weight. If the primary player is the active player, this is a bonus and added to the total, if the opponent is the active player, this is a penalty and subtracted from the total.

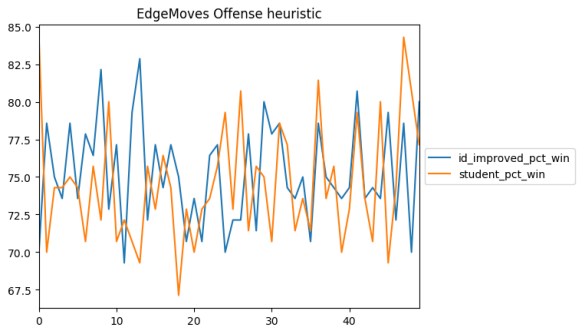
The reasoning behind this heuristic is similar to the On Edge heuristic, with an offense such that more weight is given to moves that the primary player can block from the opponent, and less weight is given to moves where the opponent can block the primary player.

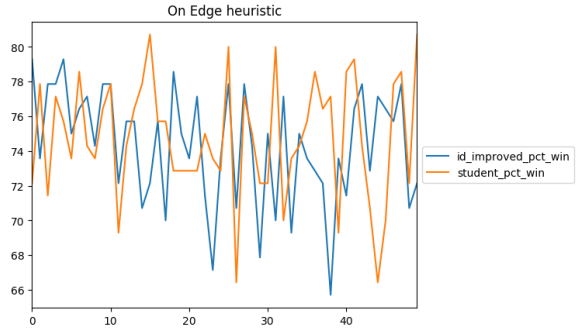
EDGE MOVES – OFFENSE

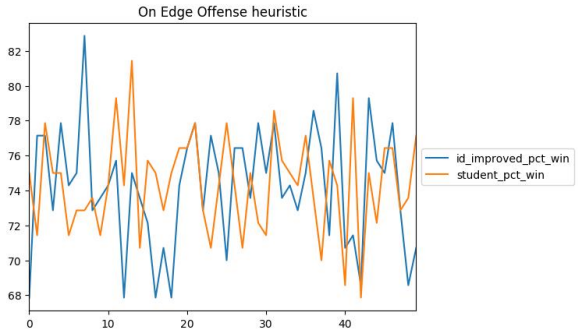
This heuristic is again, similar to the previous two heuristics except that instead of checking if the current position is on an edge, it checks for the legal moves would be on an edge, and subtracts a penalty for each primary player's legal moves is an edge. It adds a bonus for each opponent's legal moves is an edge.

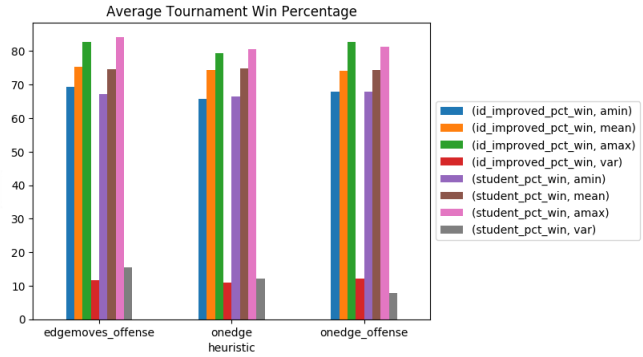
ANALYSIS

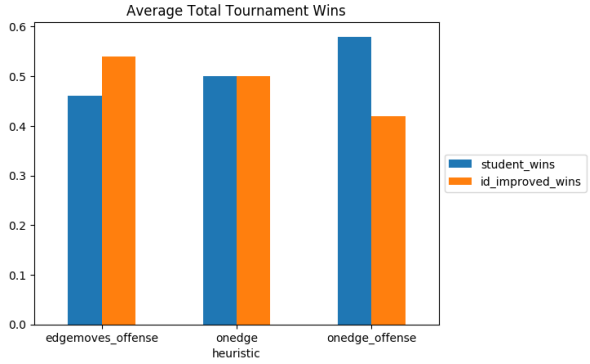
50 tournament tests were run against each heuristic. Since each heuristic builds on the mobility based 'improved score' used by the ID_Improved agent, all 3 did similarly to the ID_Improved agent, but as the following charts show, the win rates for all three as well as the ID_Improved agent have a great deal of variance from run to run. The win percentages range from mid 60% to mid 85%, with an average about 75% and typical variance around 10 points. The total agent wins against the ID_Improved agent range from a 40% loss to about a 57% win ratio.











RECOMMENDATION

Based on the 3 heuristics evaluated, the best performing was the On Edge – Offense heuristic. It had the highest overall average win rate and the least variance.