

Building An Isolation Game Playing Agent

Udacity AI Nanodegree Project Report

Aim is to develop an adversarial search agent to play the game "Isolation". Isolation is a deterministic, two-player game of perfect information in which the players alternate turns moving a single piece from one cell to another on a board. Whenever either player occupies a cell, that cell becomes blocked for the remainder of the game. The first player with no remaining legal moves loses, and the opponent is declared the winner.

This project uses a version of Isolation where each agent is restricted to L-shaped movements (like a knight in chess) on a rectangular grid (like a chess or checkerboard). The agents can move to any open cell on the board that is 2-rows and 1-column or 2-columns and 1-row away from their current position on the board. Movements are blocked at the edges of the board (the board does not wrap around), however, the player can "jump" blocked or occupied spaces (just like a knight in chess).

Additionally, agents will have a fixed time limit each turn to search for the best move and respond. If the time limit expires during a player's turn, that player forfeits the match, and the opponent wins.

Objectives of this project:

- 1)Implement MinMax Search Algorithm to search the game tree.
- 2)Implement Alpha-Beta Pruning algorithm to improve the performance of the MinMax game tree.
- 3)Implement Iterative Depth Search along with Alpha-Beta algorithm to return the best move within the stipulated time limit.
- 4)Develop different Heuristic evaluation functions which perform comparably or better than provided heuristic evaluation functions.

	AB_Improved	AB_Custom	AB_Custom_2	AB_Custom_3
T1 Win Rate:	64.3%	61.4%	62.9%	61.4%
T2 Win Rate:	58.6%	67.1%	61.4%	57.1%
T3 Win Rate:	61.4%	60.0%	68.6%	60.0%
T4 Win Rate:	62.9%	70.0%	64.3%	57.1%
T5 Win Rate:	57.1%	60.0%	60.0%	60.0%
T6 Win Rate:	67.1%	68.6%	70.0%	60.0%
T7 Win Rate:	58.6%	58.6%	64.3%	58.6%
T8 Win Rate:	62.9%	58.6%	68.6%	57.1%
T9 Win Rate:	68.6%	70.0%	64.3%	60.0%
T10Win Rate:	51.4%	64.3%	71.4%	67.1%
Mean:	61.29	63.86	65.58	59.24
STDEV:	5.07	4.71	3.83	4

1)Custom Score Heuristic: $\text{Num of own_moves} - 2 * (\text{Num of opp moves})$

2)Custom2 Score Heuristic: $\text{Weighted Own moves Score} - \text{Weighted Opp moves score}$

Note: Positions near to center of board weighs more compared to positions near to edges of board.

3)Custom3 Heuristic: $\text{Num of own moves one ply ahead} - \text{Num of opp moves one ply ahead}$

Above Table lists the winning rates along with Statistics from 10 tournaments.

From the above results, Custom2 Score Heuristic out performs the given AB Improved Heuristic.