Artificial Intelligence

Lab2 Report

Using Minimax Algorithm to Make Connect 4 AI Agent

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**Introduction**

Connect 4 is a two-player game in which the players first choose a color and then take turns dropping their colored discs from the top into a grid. The pieces fall straight down, occupying the next available space within the column. The objective of the game is to connect-four of one’s own discs of the same color next to each other vertically, horizontally, or diagonally. The two players keep playing until the board is full. The winner is the player having greater number of connected-fours.

1-Data structure , algorithms and assumption used:

• 2D numpy array for State Representation.

• Dictionary for gameboards to keep track of the parent nodes.

• 1D array for Possible Moves Representation.

* 1. MiniMax Algorithm (without pruning):

A screen shot of a computer code

Description automatically generated

1.2.MiniMax Algorithm (with pruning):

• Alpha-Beta pruning is a modified version of the minimax algorithm to optimize it.

• Alpha-Beta can be a real game changer, it cannot eliminate the exponent, but it can cuts it to half.

• Alpha-Beta Pruning can -without checking each node of the game tree- compute the correct minimax decision. This involves two threshold parameter Alpha and beta for future expansion, so it is called alpha-beta pruning.

A screen shot of a computer program

Description automatically generated

1.3.Expected MiniMax Algorithm without Alpha-Beta Pruning:

A computer screen shot of text

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1.4.Heuristic:

A screen shot of a computer code

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2-Sample runs & corresponding time & nodes expanded:

A red and yellow circles on a blue background

Description automatically generatedA red and yellow circles on a blue background

Description automatically generated

A screen shot of a computer

Description automatically generated

A screenshot of a computer program

Description automatically generated

Minimax k = 5

Minimax k = 3

A red and yellow circles on a blue background

Description automatically generatedA red and yellow circles on a blue background

Description automatically generated

A screenshot of a computer

Description automatically generatedA screenshot of a computer program

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Alpabeta k = 5

Alpabeta k = 3

A red and yellow circles on a blue background

Description automatically generatedA red and yellow circles on a blue background

Description automatically generated

A screenshot of a computer program

Description automatically generatedA screen shot of a computer

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ExpectiMinimax k=5 ExpectiMinimax k=3

A drawing of a bridge

Description automatically generatedMini max 3

A diagram of a network

Description automatically generatedMinimax 5

A computer screen shot of a network

Description automatically generatedAlphaBeta 5

AlphaBeta A drawing of a bridge

Description automatically generated3

A diagram of a bridge

Description automatically generatedA close-up of a bridge

Description automatically generatedExpectiminimax 3

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