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FACULTY OF EGINEERING

ARTIFICIAL INTELLIGENCE
LECTURE-16

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OUTLINE

- Mini-Max Algorithm in Artificial Intelligence
- Pseudo-code for Min-Max Algorithm
- Working of Min-Max Algorithm
- Properties of Mini-Max algorithm
- Limitation of the mini-max Algorithm
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Mini-Max Algorithm in Artificial Intelligence

•Mini-max algorithm is a recursive or backtracking algorithm which is used in decision-making and game theory. It provides an optimal move for the player assuming that opponent is also playing optimally.

•Mini-Max algorithm uses recursion to search through the game-tree.

•Min-Max algorithm is mostly used for game playing in AI. Such as Chess, Checkers, tic-tac-toe, go, and various tow-players game. This Algorithm computes the minimax decision for the current state.

•In this algorithm two players play the game, one is called MAX and other is called MIN.

•Both the players fight it as the opponent player gets the minimum benefit while they get the maximum benefit.

•Both Players of the game are opponent of each other, where MAX will select the maximized value and MIN will select the minimized value.

•The minimax algorithm performs a depth-first search algorithm for the exploration of the complete game tree.

•The minimax algorithm proceeds all the way down to the terminal node of the tree, then backtrack the tree as the recursion.

Pseudo-code for MinMax Algorithm

```
function minimax(node, depth, maximizingPlayer) is

if depth ==0 or node is a terminal node then

return static evaluation of node

if MaximizingPlayer then      // for Maximizer Player

maxEva= -infinity

 for each child of node do

 eva= minimax(child, depth-1, false)

maxEva= max(maxEva,eva)        //gives Maximum of the values

return maxEva

else                          // for Minimizer player

 minEva= +infinity

 for each child of node do

 eva= minimax(child, depth-1, true)

 minEva= min(minEva, eva)         //gives minimum of the values

 return minEva
```

Working of Min-Max Algorithm

➢The working of the minimax algorithm can be easily described using an example. Below we have taken an example of game-tree which is representing the two-player game.

➢In this example, there are two players one is called Maximizer and other is called Minimizer.

➢Maximizer will try to get the Maximum possible score, and Minimizer will try to get the minimum possible score.

➢This algorithm applies DFS, so in this game-tree, we have to go all the way through the leaves to reach the terminal nodes.

➢At the terminal node, the terminal values are given so we will compare those value and backtrack the tree until the initial state occurs. Following are the main steps involved in solving the two-player game tree:

Properties of Mini-Max algorithm

Complete- Min-Max algorithm is Complete. It will definitely find a solution (if exist), in the finite search tree.

Optimal- Min-Max algorithm is optimal if both opponents are playing optimally.

Time complexity- As it performs DFS for the game-tree, so the time complexity of Min-Max algorithm is O(bm), where b is branching factor of the game-tree, and m is the maximum depth of the tree.

Space Complexity- Space complexity of Mini-max algorithm is also similar to DFS which is O(bm).

Limitation of the mini-max Algorithm

•The main drawback of the mini-max algorithm is that it gets really slow for complex games such as Chess, go, etc. This type of games has a huge branching factor, and the player has lots of choices to decide. This limitation of the mini-max algorithm can be improved from **alpha-beta pruning** which we have discussed in the next topic.

MCQ

1. Which instruments are used for perceiving and acting upon the environment?

a) Sensors and Actuators

b) Sensors

c) Perceiver

d) None of the mentioned

2. What is meant by agent's percept sequence?

a) Used to perceive the environment

b) Complete history of actuator

c) Complete history of perceived things

d) None of the mentioned

3. How many types of agents are there in artificial intelligence?

a) 1

b) 2

c) 3

d) 4

MCQ

4. What is the rule of simple reflex agent?

a) Simple-action rule

b) Condition-action rule

c) Simple & Condition-action rule

d) None of the mentioned

5. What are the composition for agents in artificial intelligence?

a) Program

b) Architecture

c) Both Program & Architecture

d) None of the mentioned

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