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FACULTY OF EGINEERING

ARTIFICIAL INTELLIGENCE
LECTURE-12

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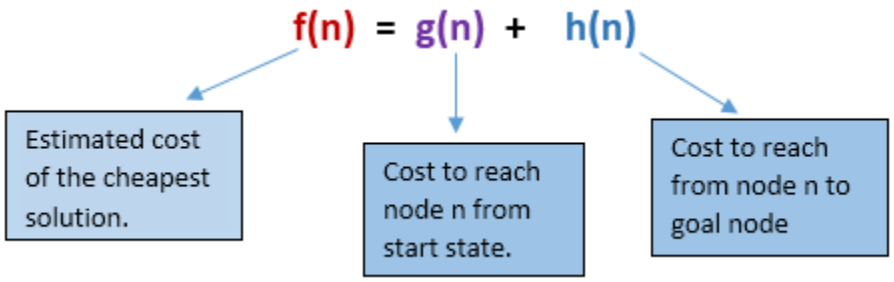
OUTLINE

- A* Search Algorithm
- Algorithm of A* search
- Advantages and Disadvantages
- Hill Climbing Algorithm in Artificial Intelligence
- Features of Hill Climbing
- State-space Diagram for Hill Climbing
- MCQ
- References

A* Search Algorithm

A* search is the most commonly known form of best-first search. It uses heuristic function h(n), and cost to reach the node n from the start state g(n). It has combined features of UCS and greedy best-first search, by which it solve the problem efficiently. A* search algorithm finds the shortest path through the search space using the heuristic function. This search algorithm expands less search tree and provides optimal result faster. A* algorithm is similar to UCS except that it uses g(n)+h(n) instead of g(n).

In A* search algorithm, we use search heuristic as well as the cost to reach the node. Hence we can combine both costs as following, and this sum is called as a fitness number.



Algorithm of A* search

Step1: Place the starting node in the OPEN list.

Step 2: Check if the OPEN list is empty or not, if the list is empty then return failure and stops.

Step 3: Select the node from the OPEN list which has the smallest value of evaluation function (g+h), if node n is goal node then return success and stop, otherwise

Step 4: Expand node n and generate all of its successors, and put n into the closed list. For each successor n', check whether n' is already in the OPEN or CLOSED list, if not then compute evaluation function for n' and place into Open list.

Step 5: Else if node n' is already in OPEN and CLOSED, then it should be attached to the back pointer which reflects the lowest g(n') value.

Step 6: Return to Step 2.

Advantages and Disadvantages

Advantages:

A* search algorithm is the best algorithm than other search algorithms.

A* search algorithm is optimal and complete.

This algorithm can solve very complex problems.

Disadvantages:

It does not always produce the shortest path as it mostly based on heuristics and approximation.

A* search algorithm has some complexity issues.

The main drawback of A* is memory requirement as it keeps all generated nodes in the memory, so it is not practical for various large-scale problems.

Hill Climbing Algorithm in Artificial Intelligence

•Hill climbing algorithm is a local search algorithm which continuously moves in the direction of increasing elevation/value to find the peak of the mountain or best solution to the problem. It terminates when it reaches a peak value where no neighbor has a higher value.

•Hill climbing algorithm is a technique which is used for optimizing the mathematical problems. One of the widely discussed examples of Hill climbing algorithm is Traveling-salesman Problem in which we need to minimize the distance traveled by the salesman.

•It is also called greedy local search as it only looks to its good immediate neighbor state and not beyond that.

•A node of hill climbing algorithm has two components which are state and value.

•Hill Climbing is mostly used when a good heuristic is available.

•In this algorithm, we don't need to maintain and handle the search tree or graph as it only keeps a single current state.

Features of Hill Climbing

•Following are some main features of Hill Climbing Algorithm:

•**Generate and Test variant:** Hill Climbing is the variant of Generate and Test method. The Generate and Test method produce feedback which helps to decide which direction to move in the search space.

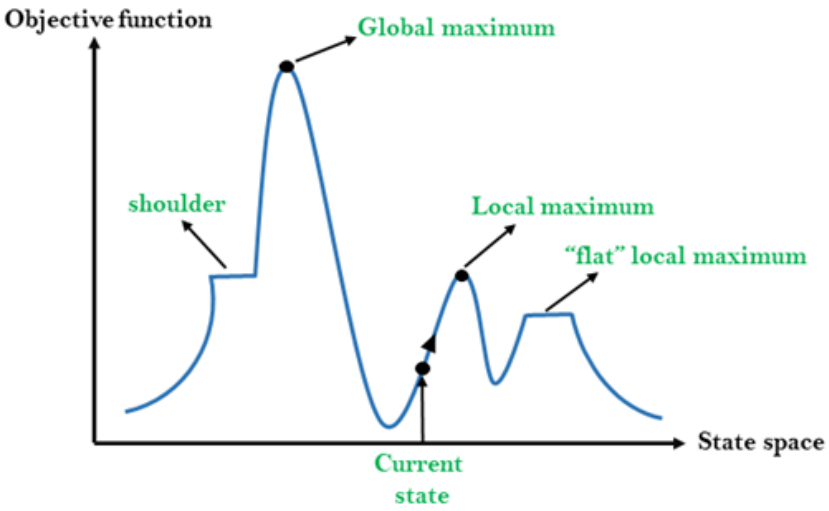
•**Greedy approach:** Hill-climbing algorithm search moves in the direction which optimizes the cost.

•**No backtracking:** It does not backtrack the search space, as it does not remember the previous states.

State-space Diagram for Hill Climbing

•The state-space landscape is a graphical representation of the hill-climbing algorithm which is showing a graph between various states of algorithm and Objective function/Cost.

•On Y-axis we have taken the function which can be an objective function or cost function, and state-space on the x-axis. If the function on Y-axis is cost then, the goal of search is to find the global minimum and local minimum. If the function of Y-axis is Objective function, then the goal of the search is to find the global maximum and local maximum.



MCQ

1. What is the primary interactive method of communication used by humans?

a) reading

b) writing

c) speaking

d) all of the mentioned

2. Elementary linguistic units that are smaller than words are?

a) allophones

b) phonemes

c) syllables

d) all of the mentioned

3. In LISP, the atom that stands for “true” is _____

a) t

b) ml

c) y

d) time

MCQ

4. A mouse device may be _____

a) electro-chemical

b) mechanical

c) optical

d) both mechanical and optical

5. An expert system differs from a database program in that only an expert system _____

a) contains declarative knowledge

b) contains procedural knowledge

c) features the retrieval of stored information

d) expects users to draw their own conclusions

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