AO* search

AO* Search (Anytime Optimistic A) is a variant of the A* search algorithm, designed to find the optimal path in a graph or tree by efficiently exploring nodes based on their heuristic cost and actual cost. It is called optimistic because it maintains a lower bound estimate of the cost from the current node to the goal node, allowing for more optimistic pruning of the search space. This lower bound estimate helps in guiding the search towards promising regions of the state space.

Key Concepts: (copy)

AO* combines the benefits of A* search with anytime algorithm properties, allowing for iterative improvement on solution quality.

It maintains both optimistic and pessimistic cost estimates to guide the search efficiently.

The algorithm incrementally refines the search space and updates the cost estimates to converge towards the optimal solution.

Advantages

Allows for anytime performance: Provides a solution at any point during the search, improving over time.
Guarantees optimality under certain conditions (admissible heuristic).
Efficiently prunes the search space by focusing on nodes with promising cost estimates.

Working

The evaluation function in AO* looks like this:
f(n) = g(n) + h(n)
f(n) = The actual cost of traversal.
g(n) = the cost from the initial node to the current node.
h(n) = estimated cost from the current node to the goal state.

Complexity

The time complexity of AO* depends on factors such as the branching factor, the quality of the heuristic function, and the termination condition.
In the worst case of an unbounded search space, the number of nodes expanded is exponential in the depth of the solution (the shortest path) d: O(b^d), where b is the branching factor

Application

1.Path planning in robotics and artificial intelligence.
2.Game AI for decision-making and pathfinding.
3.Logistics and transportation route optimization.
4.Automated planning and scheduling problems.

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