SNS COLLEGE OF ENGINEERING
(Autonomous)
DEPARTMENT OF CSE-IoT ENGINEERING

Artificial Intelligence & Natural Language Processing

Single Agent Pathfinding Problems

Prepared by,
P.Ramya
Assistant Professor/CSE-IoT
SNS College of Engineering

Single Agent Pathfinding Problems

Definition:

- A pathfinding problem involves an agent moving from a given start state to a goal state while minimizing some cost function.
- The environment is typically represented as a graph or grid where nodes correspond to locations, and edges denote possible movements.

Components of Pathfinding Problems:

•**Initial State**: The agent's starting position.

•**Goal State**: The target destination.

•**Actions**: Possible movements (e.g., left, right, up, down in a grid).

•**Transition Model**: Defines the effect of each action.

•**Path Cost**: A function that assigns a cost to different paths, such as distance, time, or energy.

Search Strategies for Pathfinding:

- **Uninformed Search Algorithms**:
  - **Breadth-First Search (BFS)**: Expands the shallowest node first, optimal for unweighted graphs.
  - **Depth-First Search (DFS)**: Explores one path fully before backtracking, but may not be optimal.
  - **Uniform Cost Search (UCS)**: Expands the node with the lowest path cost, ensuring an optimal solution.
- **Informed Search Algorithms**:
  - **Greedy Best-First Search**: Uses a heuristic function to estimate the cost to the goal.
  - ***A* Search Algorithm*:** Combines UCS and heuristic information for optimal pathfinding.

Real-World Applications:

- **Navigation Systems** (Google Maps, GPS).
- **Robotics** (Autonomous drones, warehouse robots).
- **Game AI** (NPC movement in video games).

This section of AI focuses on **heuristic-based approaches** to make search more efficient, especially in large environments.


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