

Trustworthy Artificial Intelligence

Assignment IV : BFS

1. The Environment

Create a 19×19 grid with the following features:

Obstacles (20%): Impassable walls the agent cannot enter.

Dirty Tiles (20%): The agent's cleaning targets.

Sticky Mud (10%): Special terrain tiles that are costly to traverse.

Standard Tiles: Normal, clean tiles.

You will need to test your agent on two grid types: a "Scattered Grid" (dirt is mostly isolated) and a "Clustered Grid" (dirt is grouped in patches).

2. The Agent's Logic

Implement a single agent (Agent A) with the following characteristics:

Core Algorithm: The agent must use BFS to find the most energy-efficient path to the nearest dirty tile.

Starting Point: The agent always begins at (0, 0).

Goal: After cleaning a tile, it immediately re-evaluates and searches for the next nearest dirty tile from its new position.

3. The Challenge: Constraints & Costs

This is not a simple pathfinding problem. Your agent's BFS implementation must account for the following rules:

Energy Budget: The agent starts with 200 energy units. The simulation ends when it runs out of energy or cleans all the dirt.

Movement Costs:

Moving Horizontally or Vertically costs 1.0 energy.

Moving Diagonally costs 1.5 energy.

Terrain Costs:

Moving onto a Sticky Mud tile costs an additional +2 energy. For example, moving diagonally into a mud tile would cost $1.5 + 2.0 = 3.5$ energy.

4. Experiment & Analysis

You will run your agent on both the Scattered and Clustered grids and report on its performance.

Performance Metrics:

Tiles Cleaned: Total number of tiles cleaned before the energy ran out.

Energy Efficiency: Calculated as $(\text{Total Tiles Cleaned} / \text{Total Energy Used})$.

Coverage: The percentage of total dirt that was cleaned.