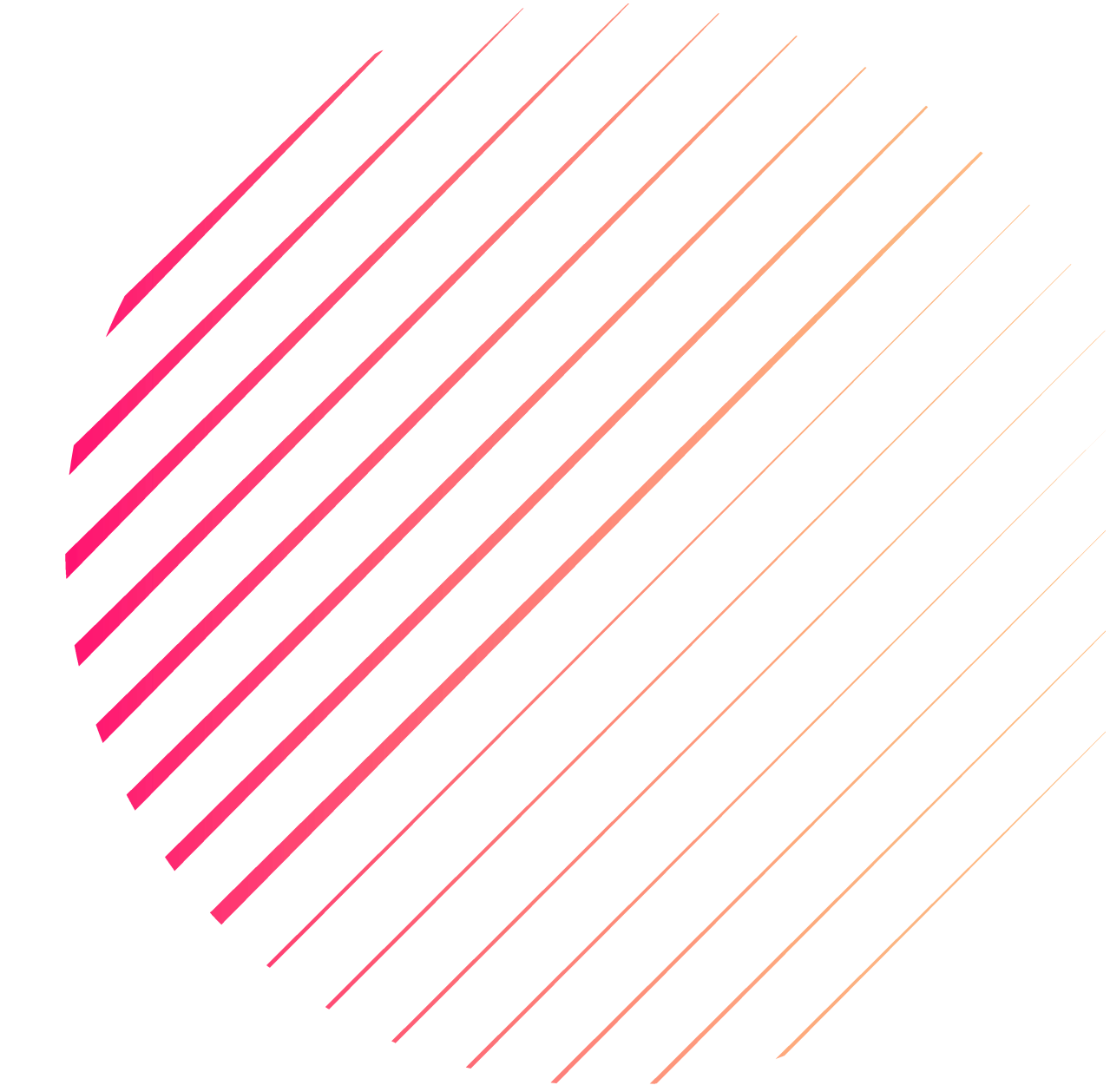
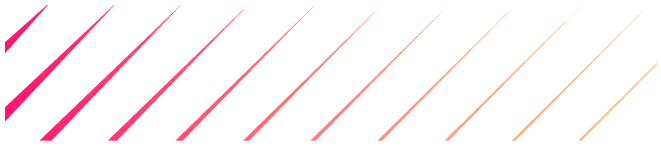
Evaluation Methodology





Evaluation Methodology

To evaluate the performance of the implemented search algorithms, a systematic and consistent evaluation methodology was followed. All algorithms were tested under identical conditions to ensure fairness and accuracy in comparison.

Test Environment

The same grid configurations were used for all algorithms.

Each grid contained:

- A fixed start position.
- A fixed goal position.
- Obstacles placed at predefined locations.
- Cells with varying traversal costs.

The grid size and cost distribution remained constant during each experiment.

This setup ensures that differences in performance are due solely to the search algorithms and not environmental variations.

Performance Metrics

The algorithms were evaluated based on the following criteria:

1.Path Optimality

Determines whether the algorithm finds the minimum-cost path from the start to the goal.

2.Total Path Cost

Measures the accumulated traversal cost of the final solution path.

3.Number of Expanded Nodes

Indicates the computational effort required by the algorithm and reflects its efficiency.

4.Memory Usage

Estimated by tracking the number of stored nodes in data structures such as queues, stacks, and priority queues.

5.Completeness

Evaluates whether the algorithm is guaranteed to find a solution if one exists.

Experimental Procedure

The following steps were applied for each search algorithm:

- Initialize the grid environment and define the start and goal states.
- Run the selected search algorithm implemented in Python.
- Track performance metrics such as path cost and expanded nodes during execution.
- Store the results for analysis.
- 5. Repeat the experiment for all algorithms using the same environment.

Comparison Strategy

- Uninformed search algorithms were compared against informed search algorithms.
- Special attention was given to cost-sensitive algorithms such as Uniform-Cost Search and A*.
- * The impact of heuristic guidance was analyzed by comparing A* with uninformed approaches.

Evaluation Objective

The main objective of this evaluation is to demonstrate:

- The limitations of uninformed search algorithms in cost-based environments.
- The effectiveness of heuristic-based algorithms, particularly A*, in reducing search space while maintaining optimality.