

REPORT

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ASSIGNMENT ADVANCE ALGORITHM IMPLEMENTATION

Explain in your own words, how does D* replan a path by updating the cost?

Ans- D_star has two states Raise and Lower states.

RAISE states transmit path cost increases due to an increased arc value, and **LOWER** states reduce costs and re-direct arrows to compute new optimal paths.

LOWER states are placed on the OPEN list by current path cost value (i.e., cost from the state to the goal), and the RAISE states are placed on the list by previous. unraised path cost value.

We check the neighbor of given node and if neighbor node is a dynamic obstacle the cost from the adjacent node to the dynamic node is modified.

Using this k_min is found using Raise and lower states and we do it till we have less value of k_min than the path cost found.

Why does D* can replan faster than A* or Dijkstra?

Ans- Unlike A* it avoids high computational cost of backtracking. It is more efficient in dynamic environment re-planner in expansive and complex environments.

It uses **$F = h + g$**

Where h is not heuristic, its path cost.

And k is the smallest value of h

$$K(\min) = (h_{\text{new}}, h_{\text{old}})$$

In A* we need repeated searches in this case of dynamic obstacles which will eventually increase the cost and is not very efficient.

For A*

$$F = g + h \text{ (here we use heuristic cost)}$$

For Dijkstra

$$F = g$$

What is the key differences between regular RRT* and informed RRT*?

Ans- When RRT* is used to find optimal solution asymptotically from initial state to every state in planning domain by rewiring, it becomes inefficient and also inconsistent due to single query nature.

To minimize the path length, the subset of states that can improve solution in prolate hyper-spheroid. We increase this efficiency by sampling in this hyper-spheroid. This is used by informed RRT* where sampling is done inside ellipsoid from start to goal. It converges the final solution cost by finding difficult passages as ellipsoid grows smaller in range between current and goal pose.

By showing and comparing the results of RRT* and informed RRT*, what is the advantages of using the latter?

Ans-

Advantage of using informed RRT* is it minimize the path length, the subset of states that can improve solution in prolate hyper-spheroid. We increase this efficiency by sampling in this hyper-spheroid. This is used by informed RRT* where sampling is done inside ellipsoid from start to goal. It converges the final solution

cost by finding difficult passages as ellipsoid grows smaller in range between current and goal pose.