

RRT*FN (FIXED NODES) – A NOVEL PATH PLANNING ALGORITHM WITH EFFECTIVE MEMORY UTILIZATION

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INTRODUCTION.

Generation of obstacle-free path for a robot is an essential problem of robotics. The robot motion planning problem becomes a harder challenge in higher dimensional configuration spaces, which is prevalent in robotics. Initial approaches to the motion planning problem involved cell decomposition based methods, potential fields and visibility graphs.

Most popular sampling-based planners are Probabilistic Roadmaps (PRMs) and Rapidly-Exploring Random Trees (RRTs). Both RRT and PRM are probabilistically complete, i.e. they converge to the optimal solution as the number of solutions approaches infinity. RRT and PRM randomly sample points from the state space and connect them to create a graph. Their primary difference is the way they create the graph connecting the sampled points. RRT does not use a metric to measure the optimality of the trajectory between the initial state and the other nodes. It tries to find a feasible solution as quickly as possible. RRT* is a probabilistically optimal variant of RRT* which takes into account the metric of the problem space.

RESULTS AND DISCUSSION.

In this work, we present a modified version of the RRT* motion planning algorithm, which limits the memory required for storing the tree. We run the RRT* algorithm until the tree has grown to a predefined number of nodes and afterwards we remove a weak node whenever a high performance node is added. A simple two-dimensional navigation problem is used to show the operation of the algorithm. The algorithm was also applied to a high-dimensional redundant robot manipulation problem to show the efficacy. The results show that our algorithm outperforms RRT and comes close to RRT* with respect to the optimality of returned path, while needing much less number of nodes stored in the tree.

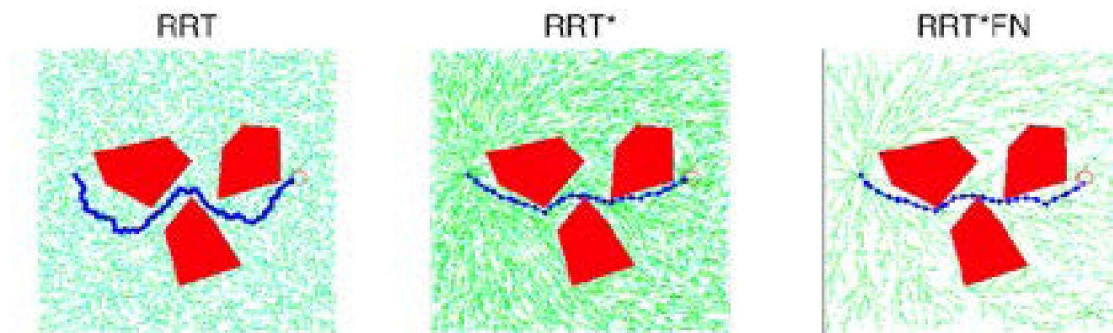


Figure 1. RRT, RRT*, RRT*FN generated paths for a 2D mobile non-holonomic robot.