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RBE 550 – Motion Planning

RRT & RRT* Algorithms

The main difference between RRT and RRT* is that RRT* improves on RRT by *rewiring* each new node to its neighbors. This is different for two main reasons:

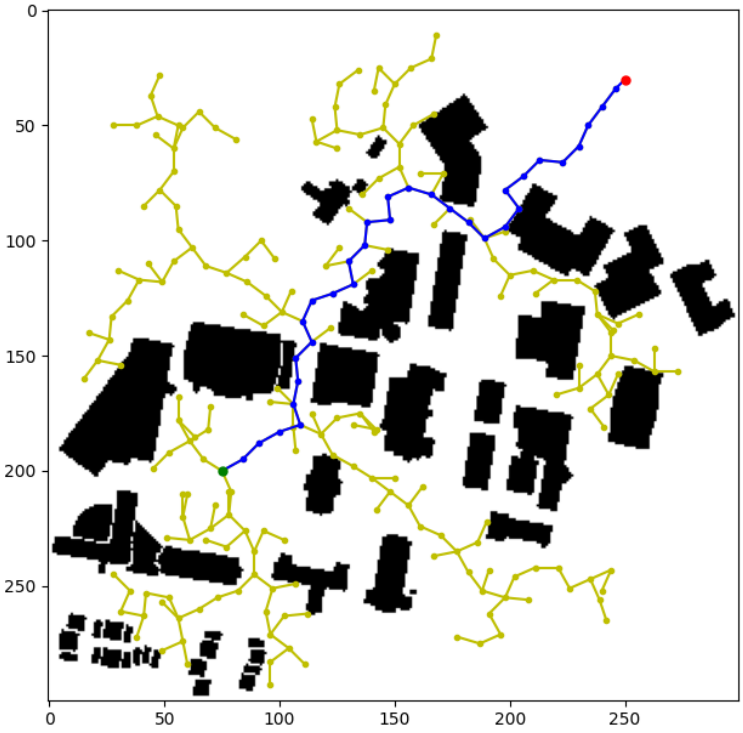
1. RRT stops as soon as **any** feasible path is found.
2. RRT continually explores and adds new nodes to the **nearest** neighbor already in the tree (self.vertices). RRT* checks to see if there are any "**shortcuts**" to make the path to this new node shorter. In this sense, we are *rewiring* each new node to create a new shortest path from our *start* node, within some distance.

RRT* *can* be as efficient as RRT, since it is an *anytime* path planning algorithm. We could theoretically end the RRT* as soon as *any* feasible path is found. As more nodes are added and explored, a more optimal path can be found. The algorithm runs until the threshold is reached, in this case, 1000 nodes.

RRT and RRT* performs worse than PRM, my best PRM trial was bridge sampling with path length **257.88.** My best RRT* trial was **268.04**. However, that PRM trial had 2245 nodes, while RRT* had 1258 nodes. This shows that RRT* has roughly the same performance as PRM, while exploring nearly **half** the number of nodes. The disadvantages are that RRT* doesn't always perform very well. It's performance, of course, relies on the probability that newly explored nodes will *shorten* the already discovered path.

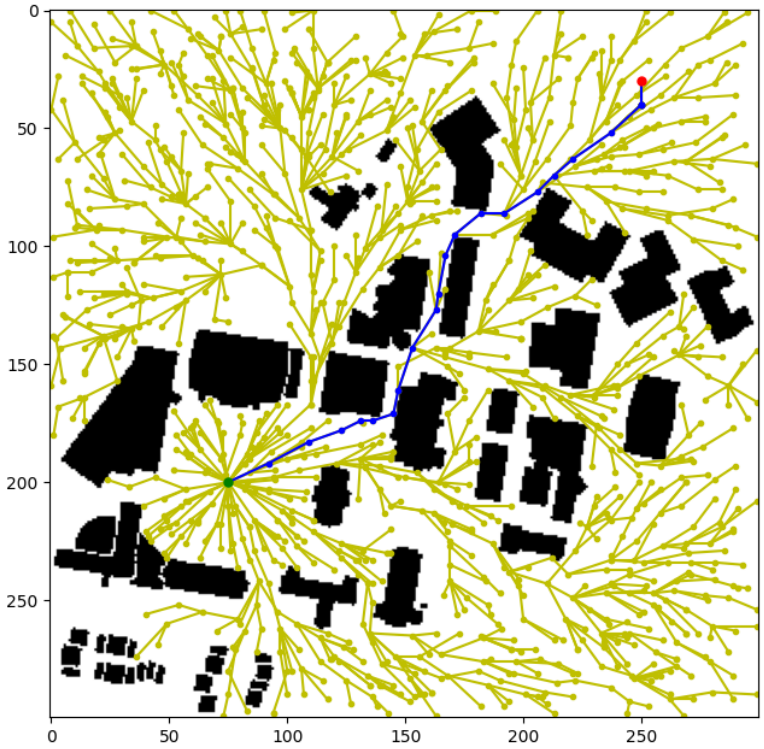
RRT:

226 Nodes to find the path of length **324.73**. Very few nodes explored to find a feasible path.



RRT*:

1258 Nodes to find the path of length **268.84**. This path is much shorter, but explored many more nodes of course. It would be interesting to see if the algorithm would stop exploring in directions *away from the goal*. This would likely reduce the amount of wasted nodes explored.



Different sampling algorithms would result in very different results. This implementation uses random sampling. With Gaussian sampling, we likely would reduce the number of explored nodes, focused about the gaussian distribution about each newly explored node. With bridge sampling, on the other hand, the spaces and nodes around obstacles would be preferred to be explored.