PROBABLISTIC ROADMAP GENERATION WITH A* SEARCH

The code illustrates the PRM method to generate a roadmap for obstacle avoidance (taken circles here). The input file for the code is a CSV that contains information about the centres of the circular obstacles and their diameters. The basic methodology of PRM is that a certain number of random points are sampled from the C-free space and then interconnected by edges if the said edges do not collide with the obstacles.

To this end, to avoid repeated code, several functions were defined to expediate the coding process and make it easier for end users to comprehend.

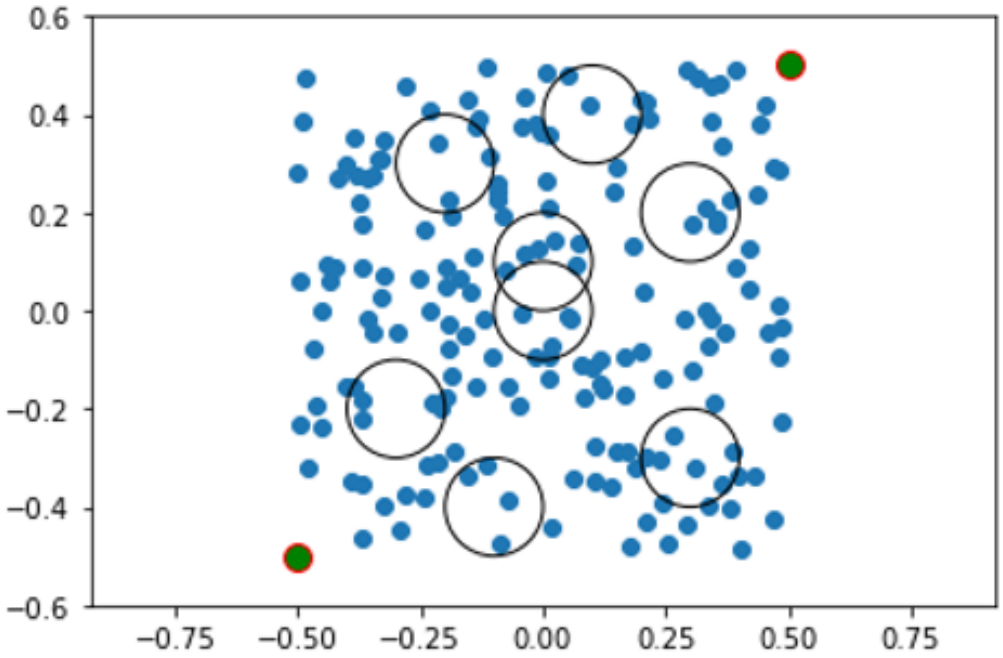
The domain considered is : -0.5<x<0.5 and -0.5<y<0.5

Start node : (-0.5,-0.5)

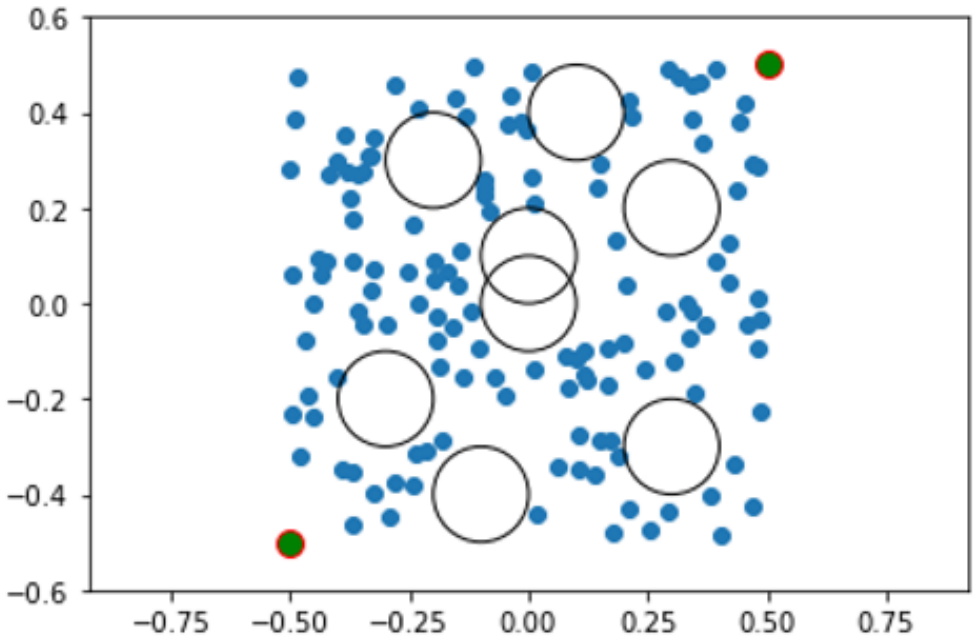
Goal node : (0.5, 0.5)

Following are some of the key results of the motion planning problem considered :

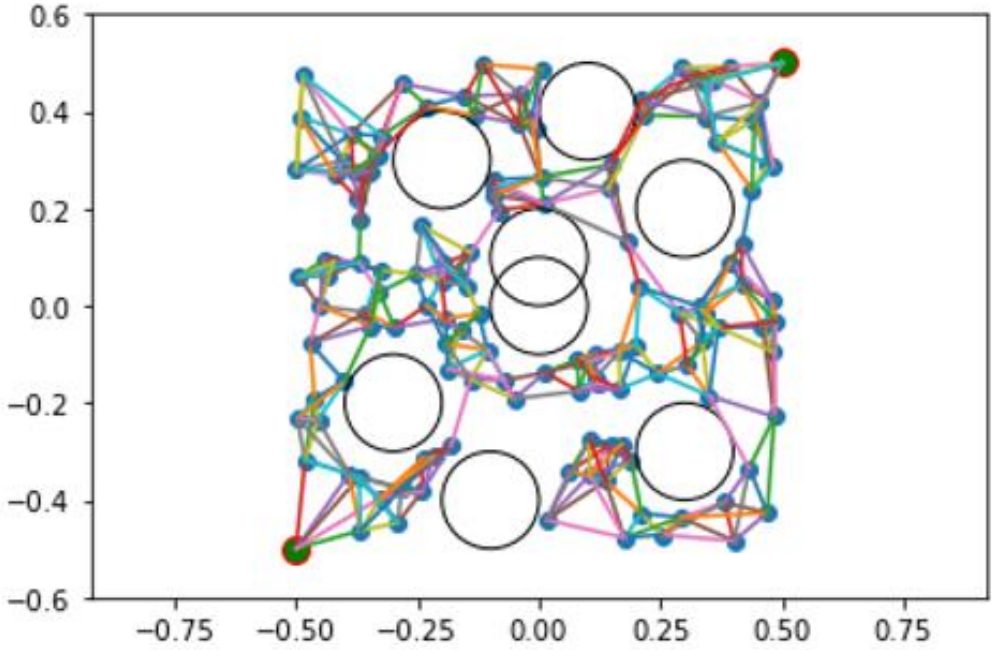
1) SAMPLING : 180 points sampled randomly



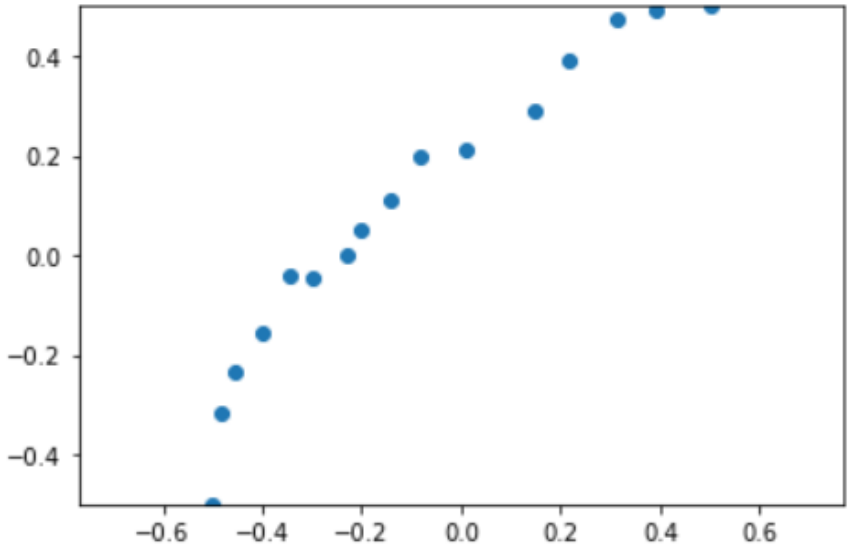
2) FILTERING : Removing points that lie inside obstacle regions



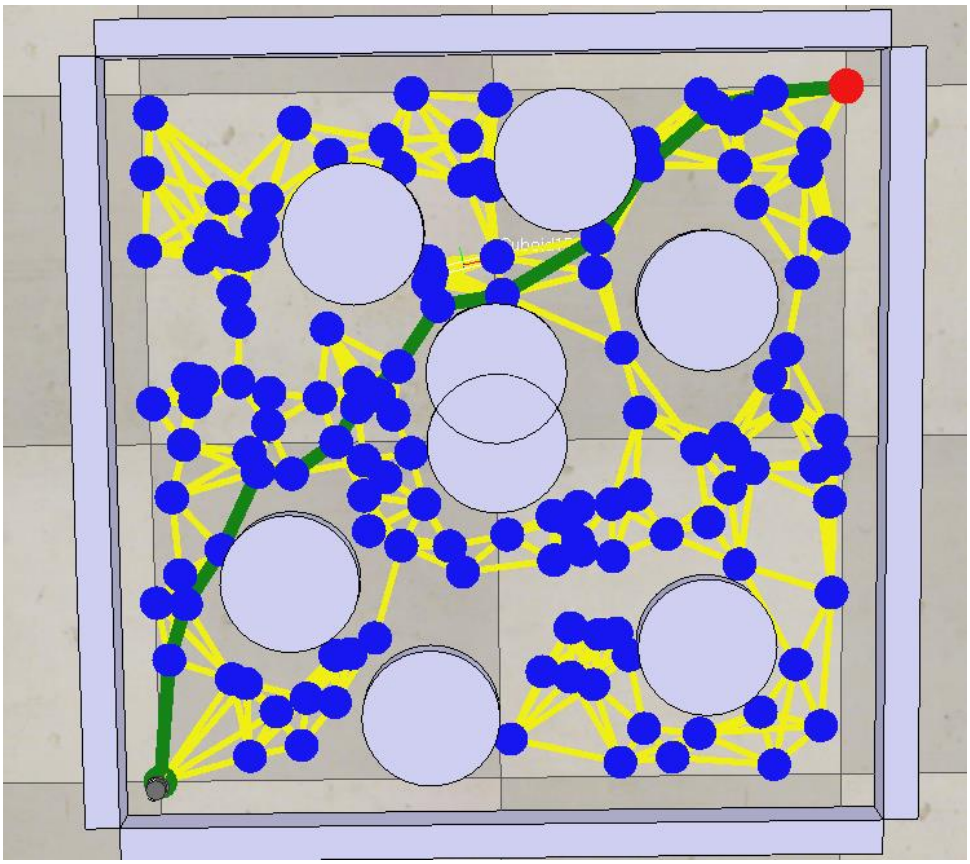
3) ROADMAP : Joining remaining points with edges. 5 nearest neighbors based on the Euclidean distance are considered here.



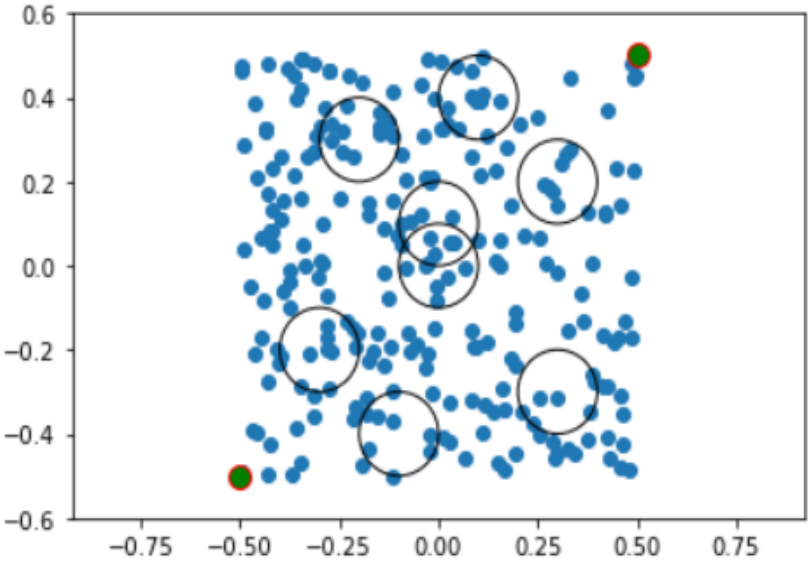
4) A* SEARCH : The roadmap generated above was fed to the A* Search algorithm to find the shortest path from start node to goal node. Below picture shows the nodes that lie on the shortest path.

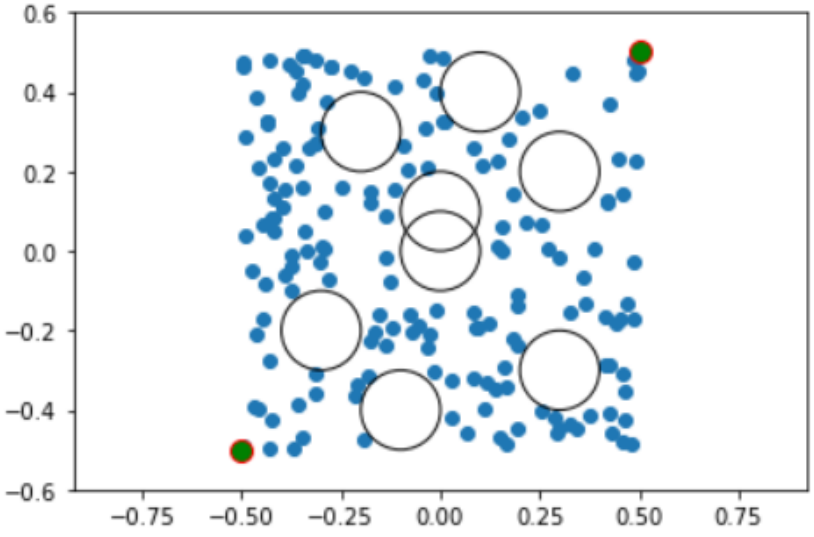


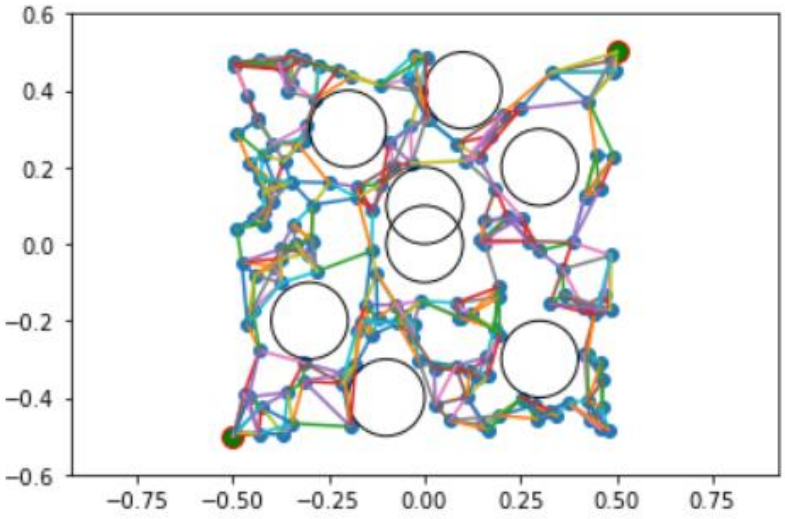
5) COPPELIA SIM visualization of the problem :

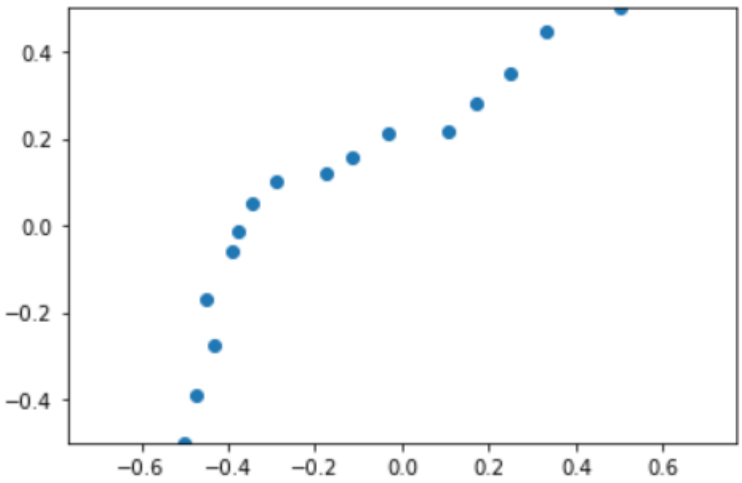


RESULTS WITH 250 POINTS : (Random seed changed)








0.4
0.2
0.0
−0.2
−0.4
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6