CS470 Assignment 5

20180185 김해찬

1. A∗ algorithm [65 pts]

1.1 A∗ algorithm implementation [50 pts]

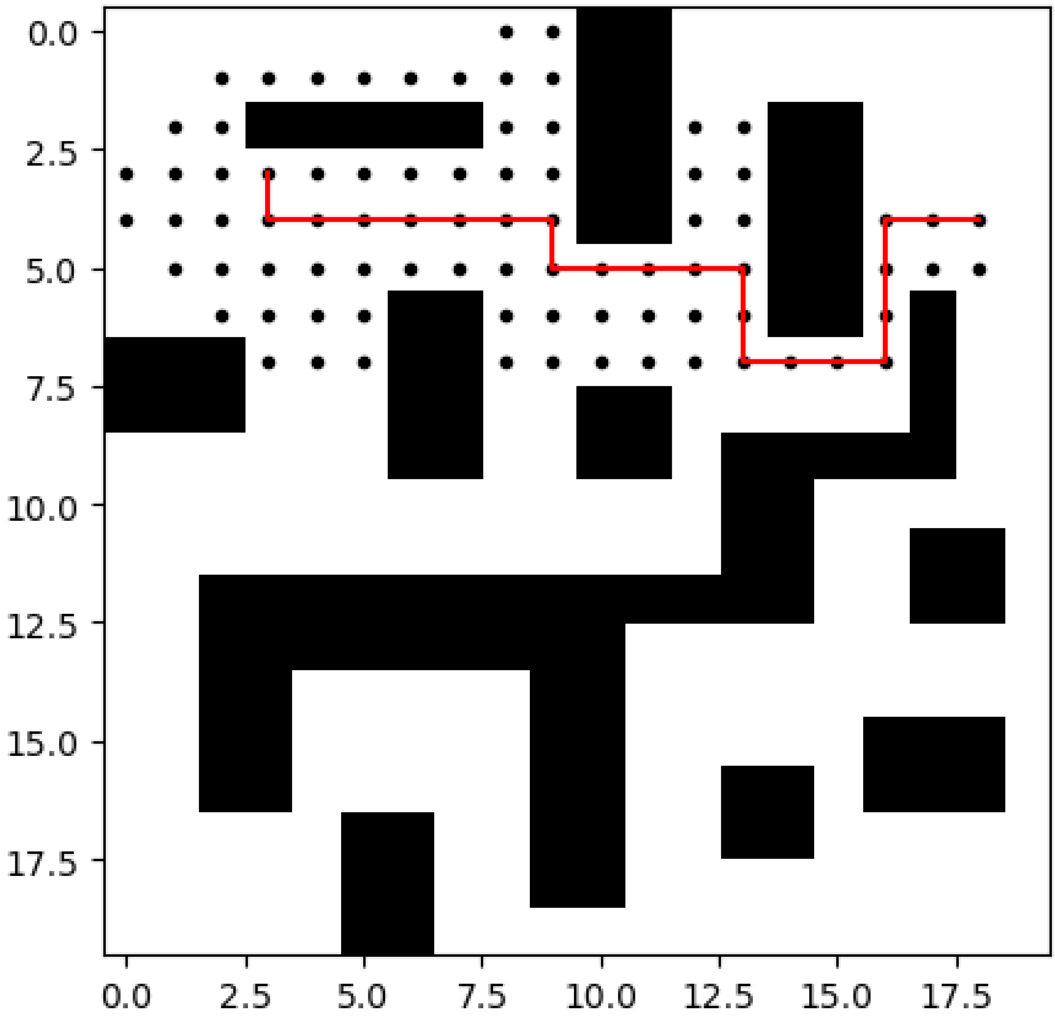
- describe (justify within 100 words) your selected heuristics function for this grid-based search problem,

  I have selected the Manhattan distance between the position and the goal as the heuristic function for this grid-based search problem. Although there are many metrics for measuring the distance between two points, such as Euclidean distance, Manhattan distance is the most suitable for grid-based situations because the movement of the robot is constrained to the grid.

- count the explored nodes at the end of the search (start=[3,3] and goal=[4,18]),

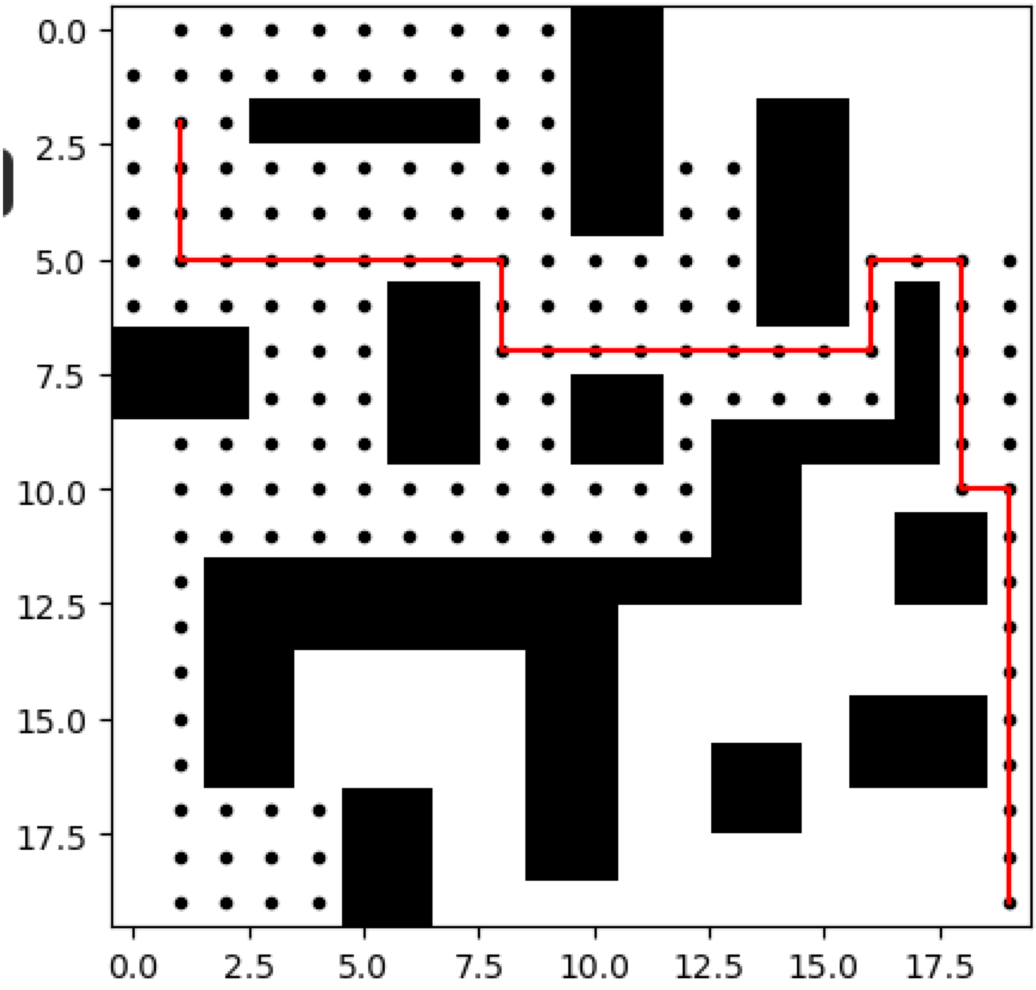
  82

- plot the explored nodes at the end of the search (same as above), and

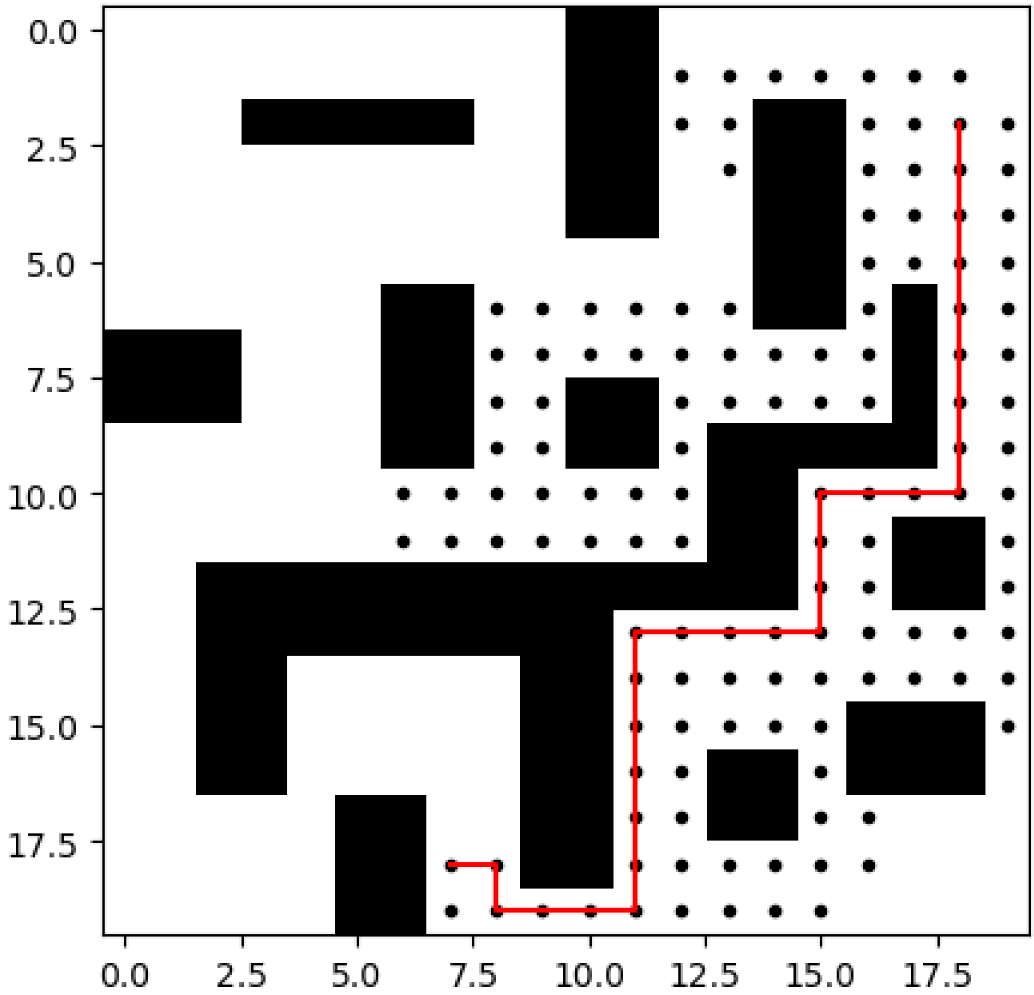


- plot the obtained paths from a start to a goal. You have to show the results of two scenarios:

  (i) start=[2, 1], goal=[19, 19]



(ii) start=[2, 18], goal=[18, 7]

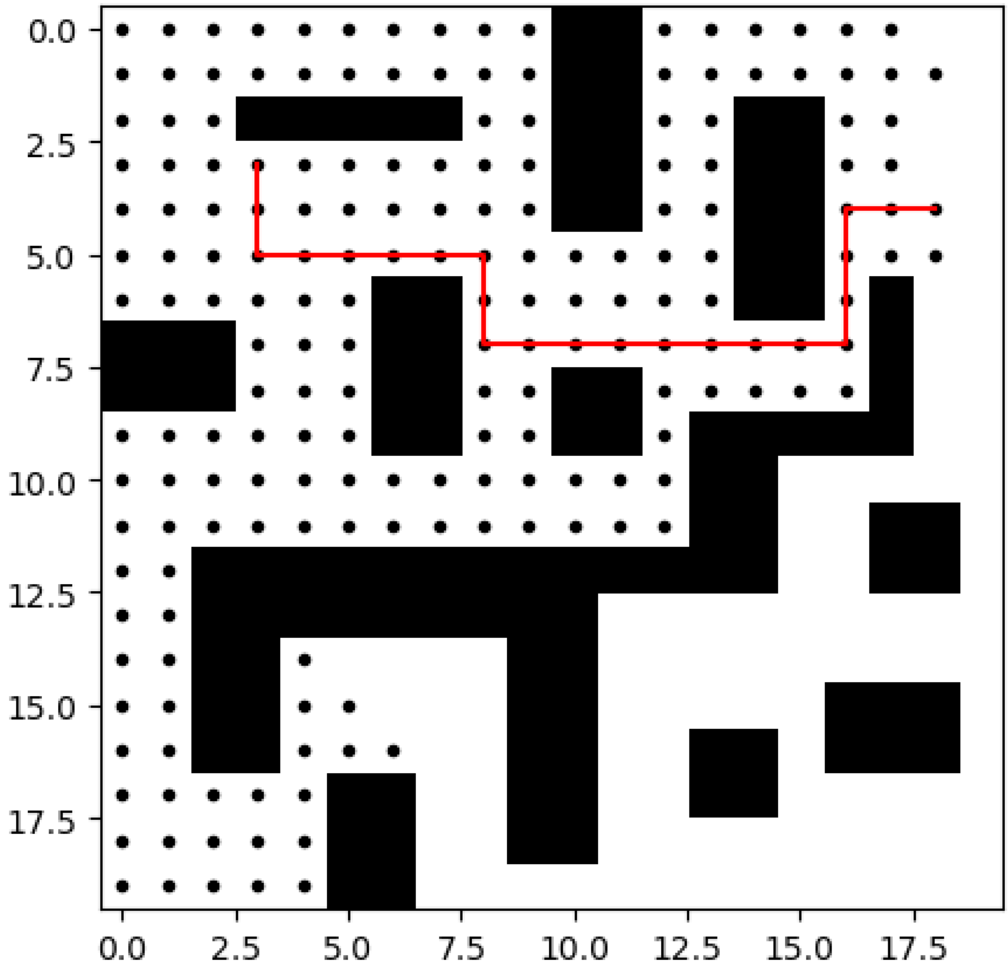


1.2 Comparison of A-star vs. Dijkstra algorithms [15 pts]

- count the explored nodes at the end of the search (same as Problem 1.1),

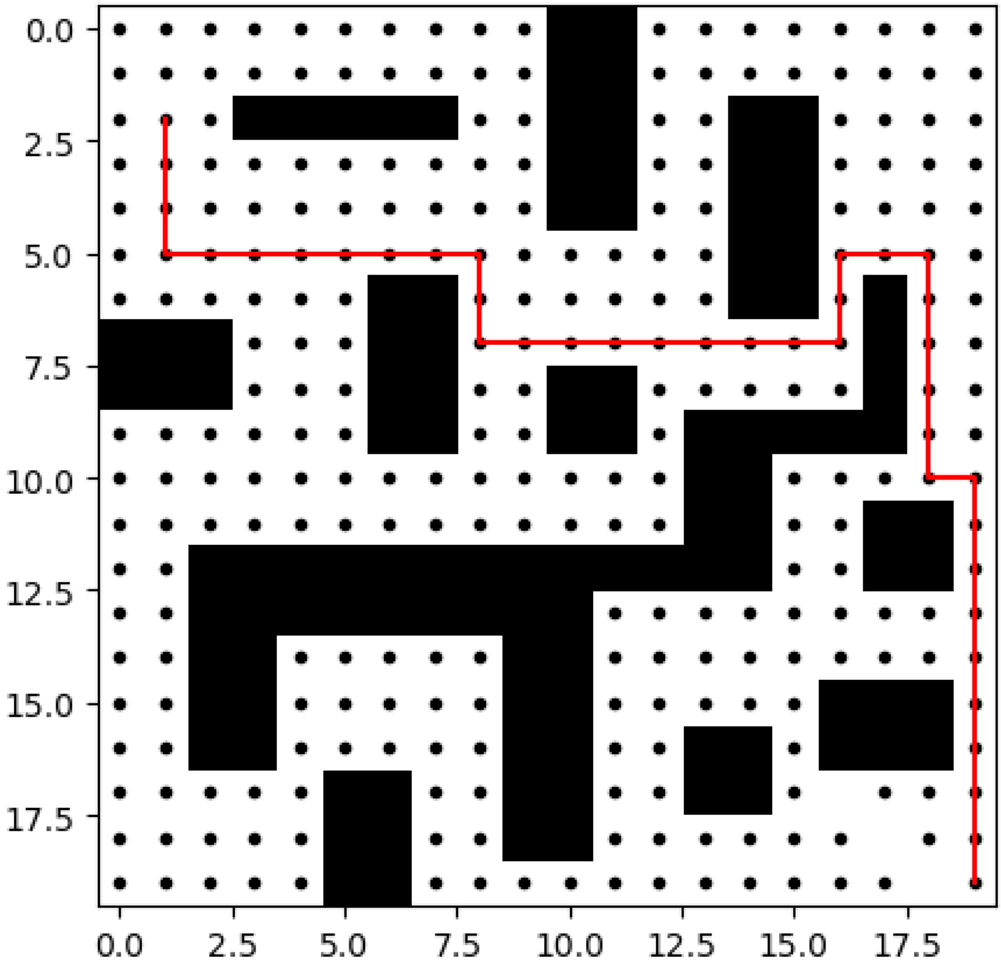
  189 (start=[3,3] and goal=[4,18])

- plot the explored nodes at the end of the search (same as Problem 1.1), (start=[3,3] and goal=[4,18])

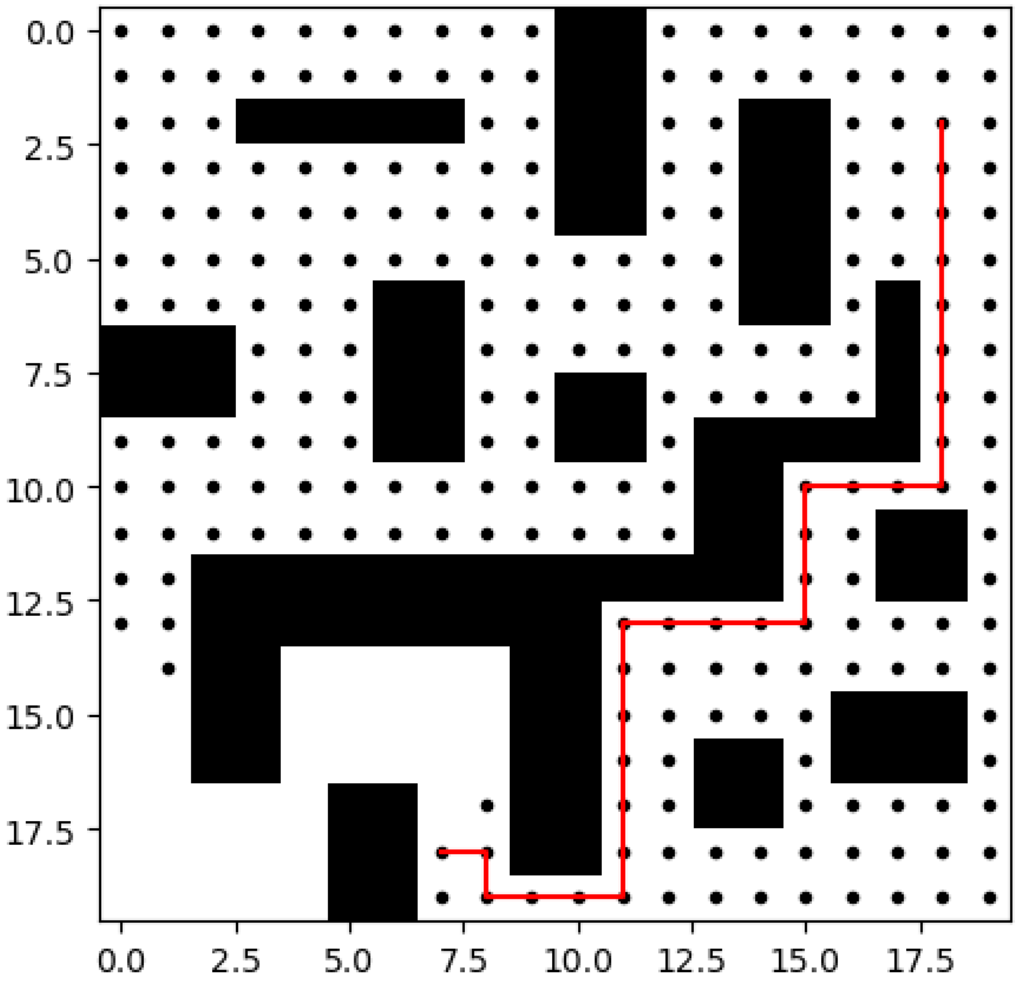


- plot the obtained path from a start to a goal. You have to consider the same scenarios given in Problem 1.1 above, and

  (i) start=[2, 1], goal=[19, 19]



(ii) start=[2, 18], goal=[18, 7]



- describe the difference between Dijkstra and A-star methods based on the results.

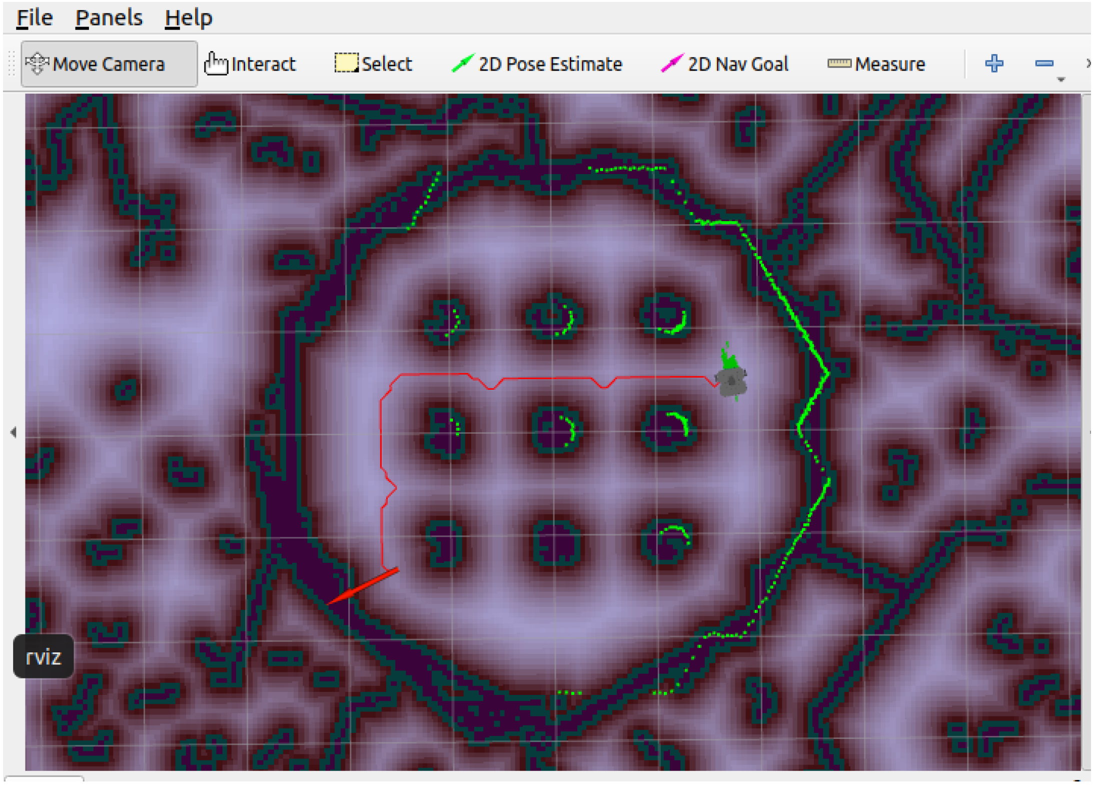
  When comparing the Dijkstra and A-star algorithms, there is no significant difference in the length of the resulting path and its cost. However, we can observe a disparity in the number of explored nodes, represented by black dots (i.e., nodes in the CLOSED_SET), between the two methods. This observation suggests that the A-star algorithm is more computationally efficient than the Dijkstra algorithm in finding the shortest path. Additionally, the A-star algorithm requires storing fewer nodes in both the OPEN_SET and CLOSED_SET compared to Dijkstra. Thus, the A-star algorithm outperforms Dijkstra in terms of spatial efficiency.

  This is why the A-star algorithm is utilized when dealing with a large number of states, such as in the case of a 15-puzzle problem (4 by 4) that has approximately 20 trillion states.

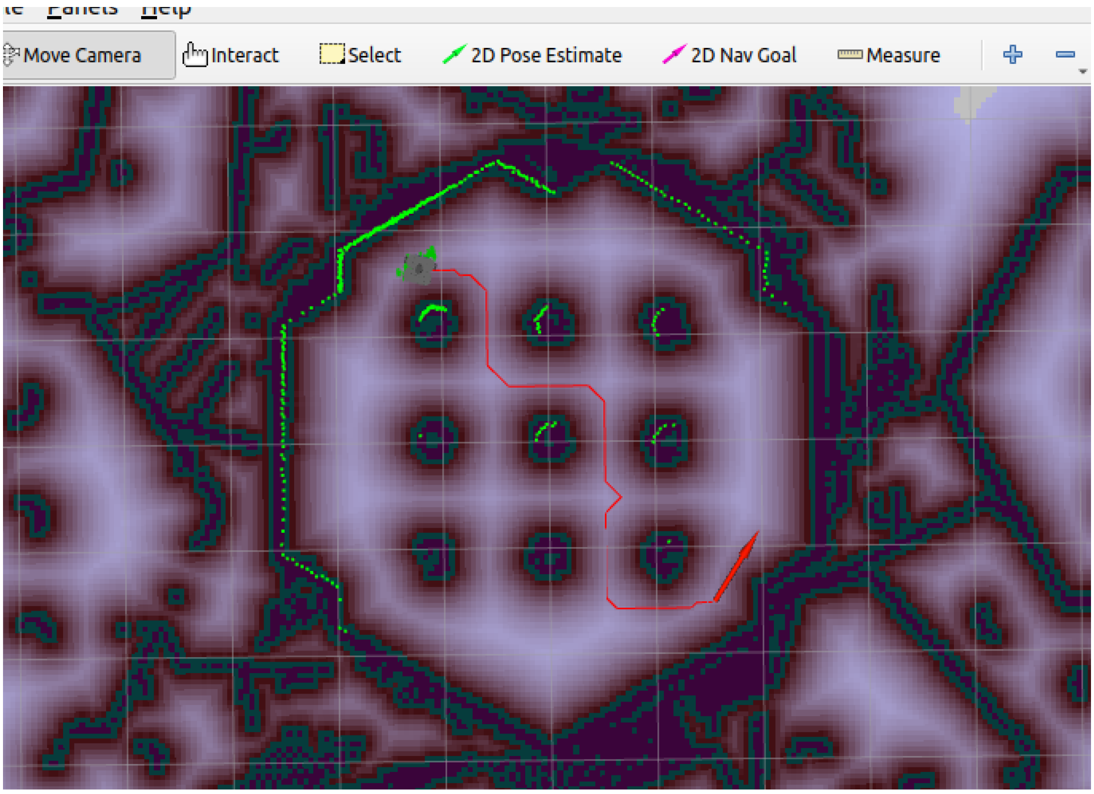
2. Running A∗ on Turtlebot3 [35 pts]

- attach three different obstacle-avoidance paths captured from RViZ, and

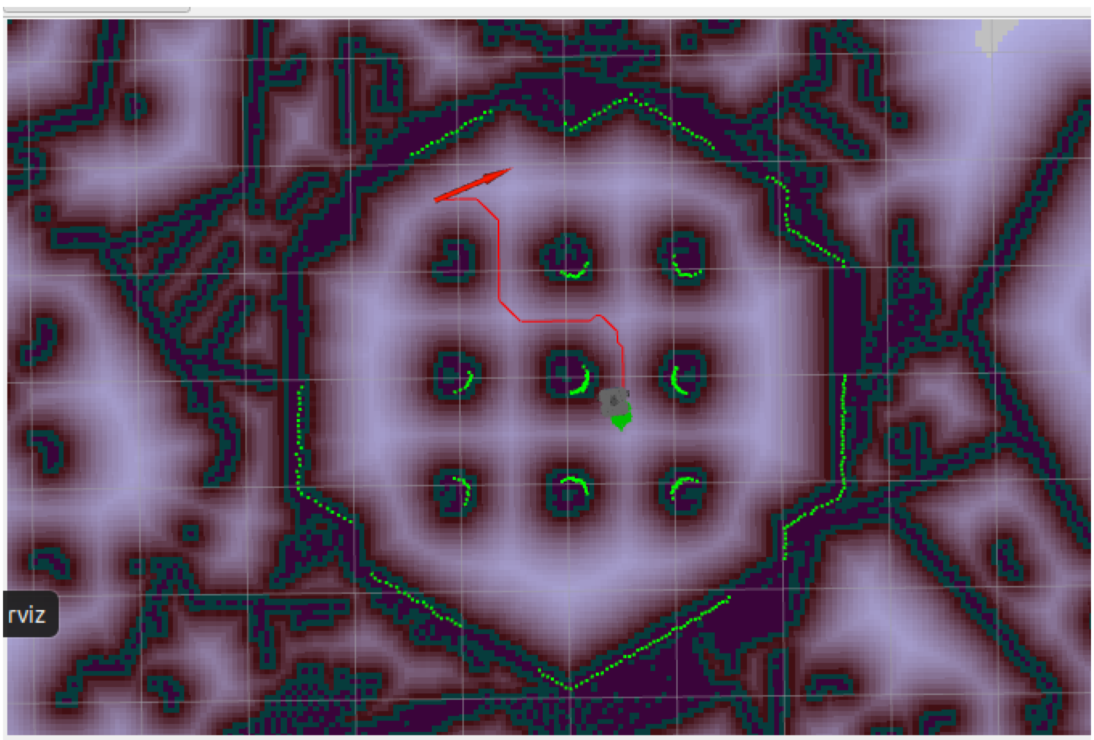
1. first



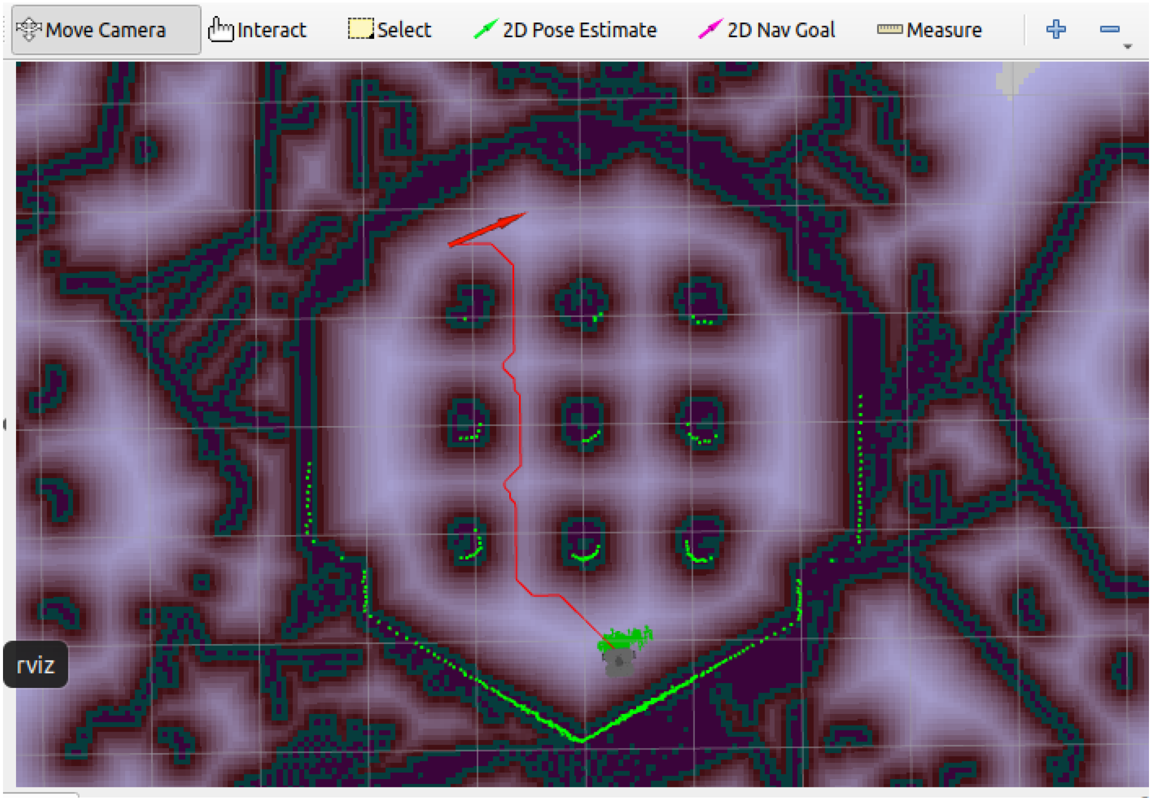
2. second

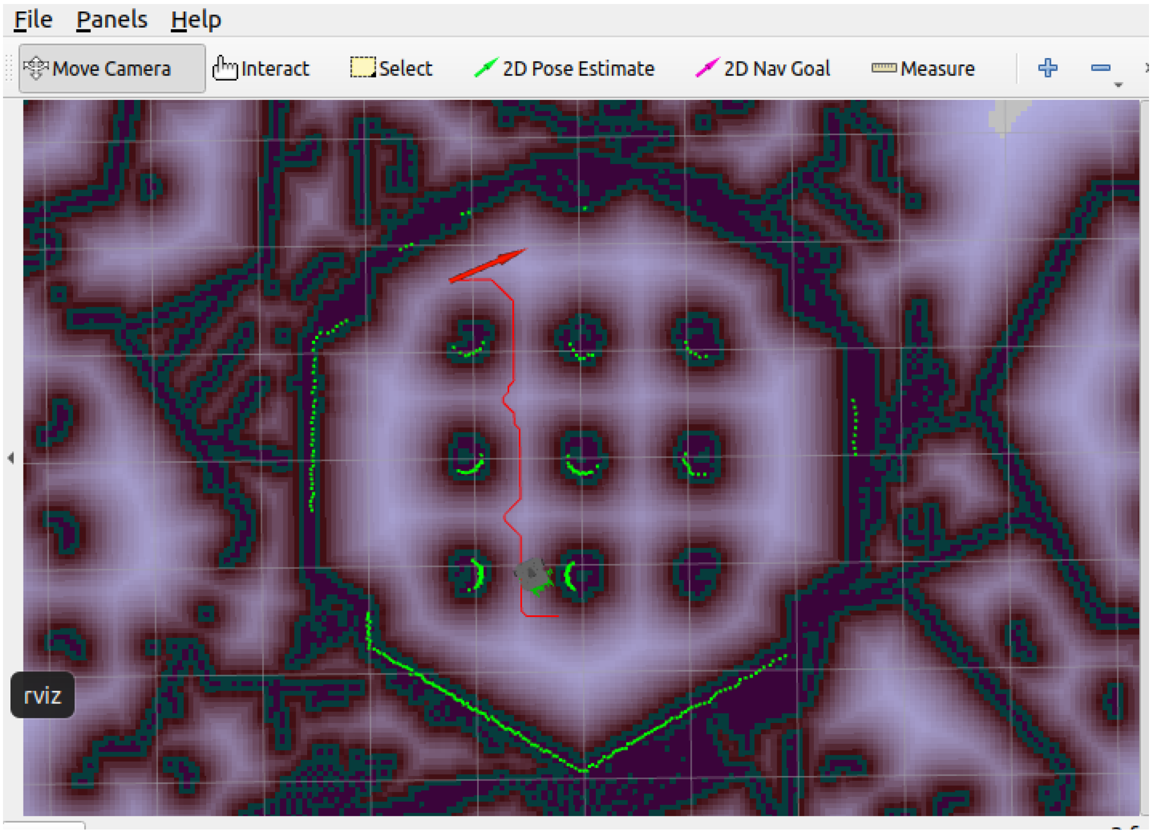

Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure

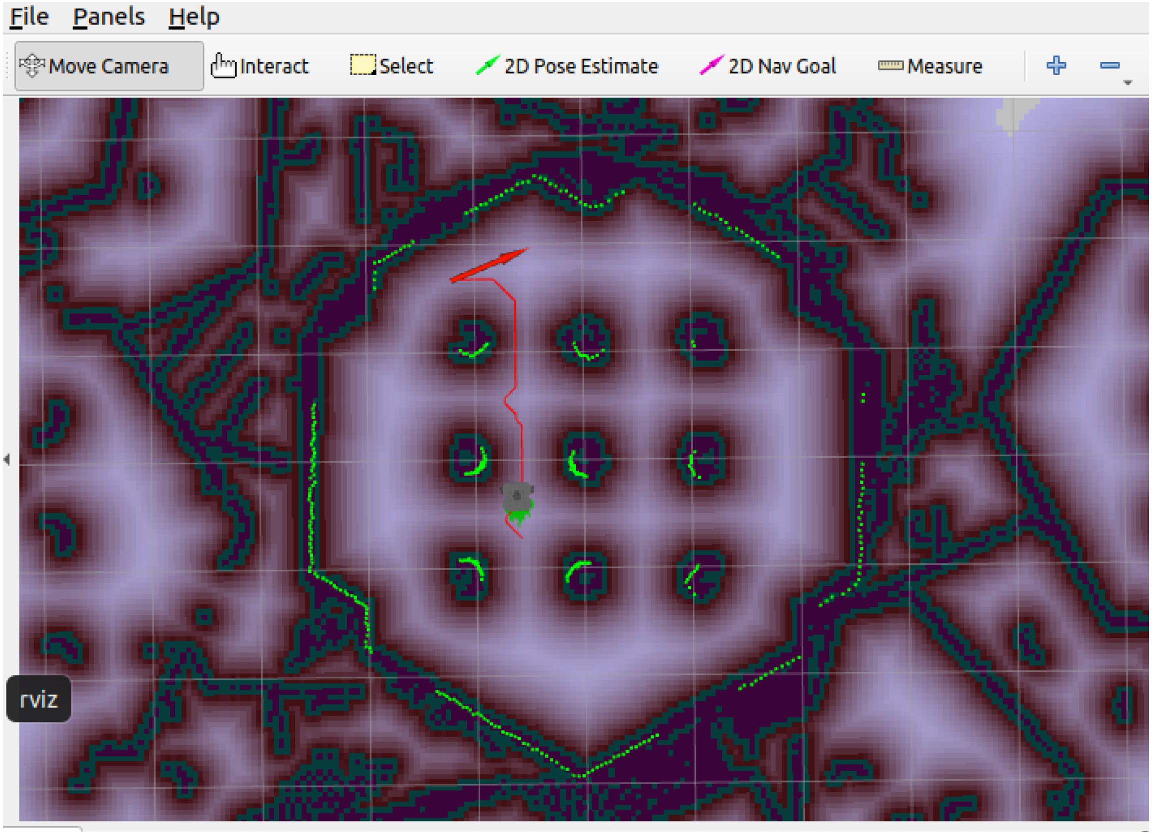
3. third

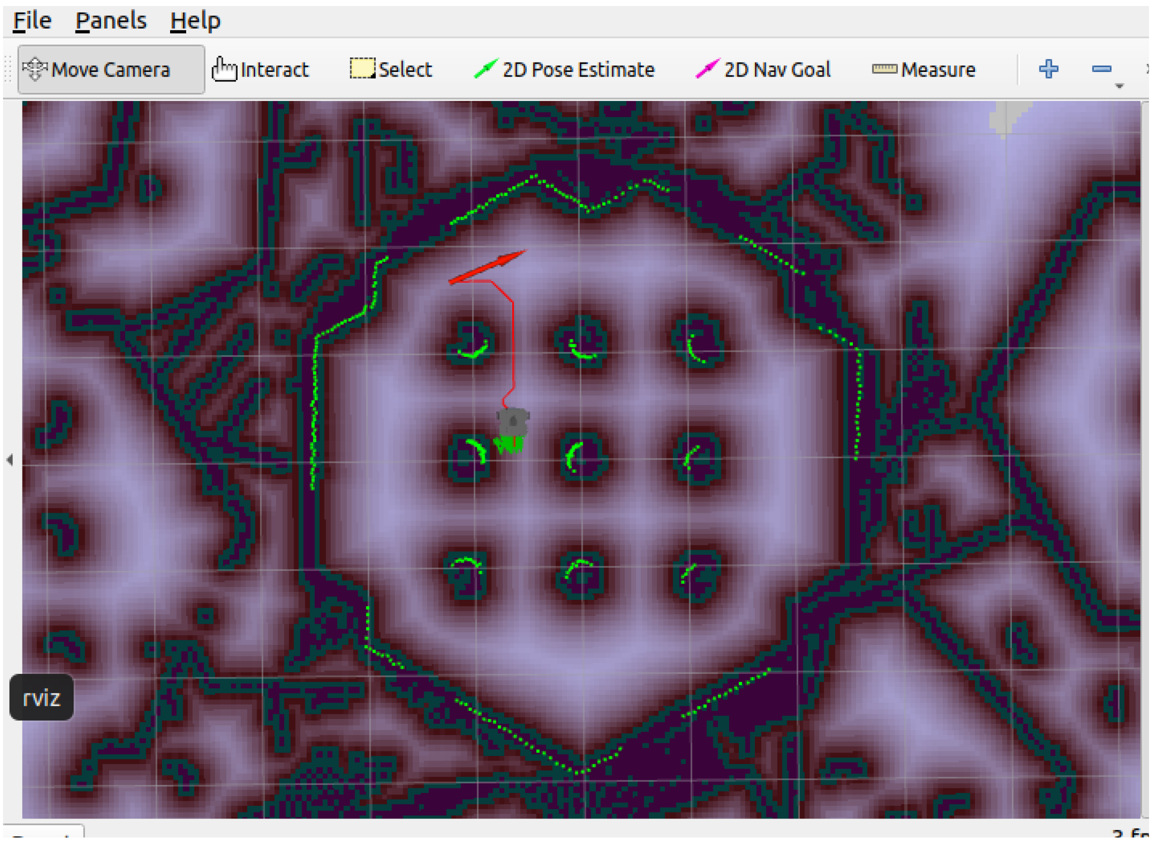

rviz

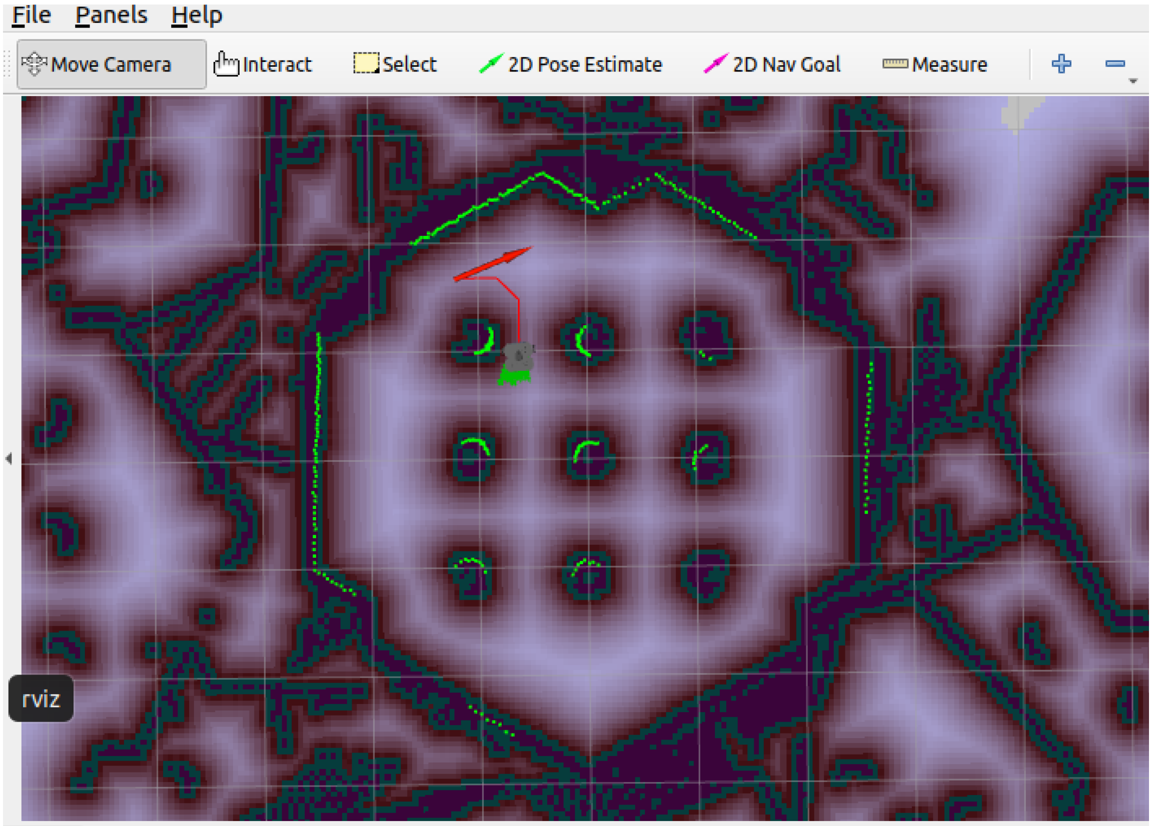
- attach a sequence of screen captures that show your robot is tracking a computed path

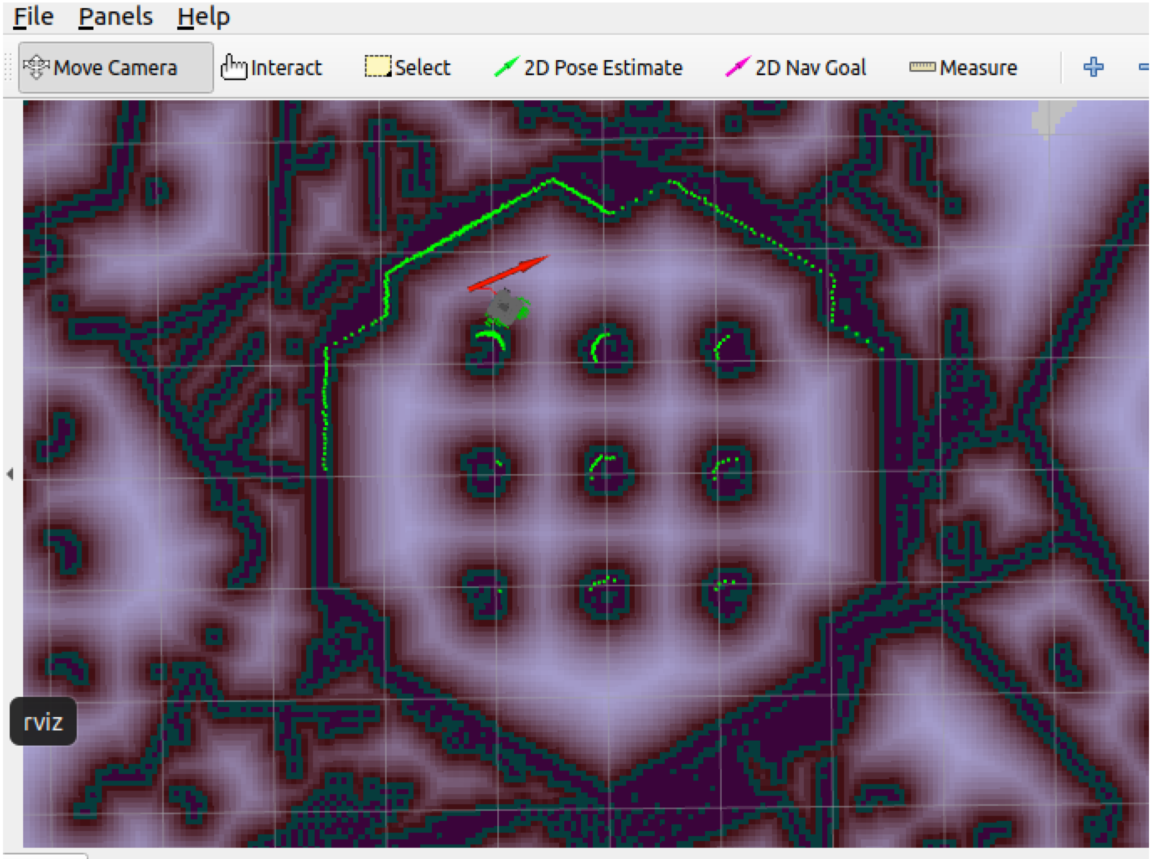





File Panels Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
rviz


File Panels Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
rviz


File
Panels
Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
rviz


File
Panels
Help
Move Camera
Interact
Select
2D Pose Estimate
2D Nav Goal
Measure
rviz