Homework 3: Planning Report

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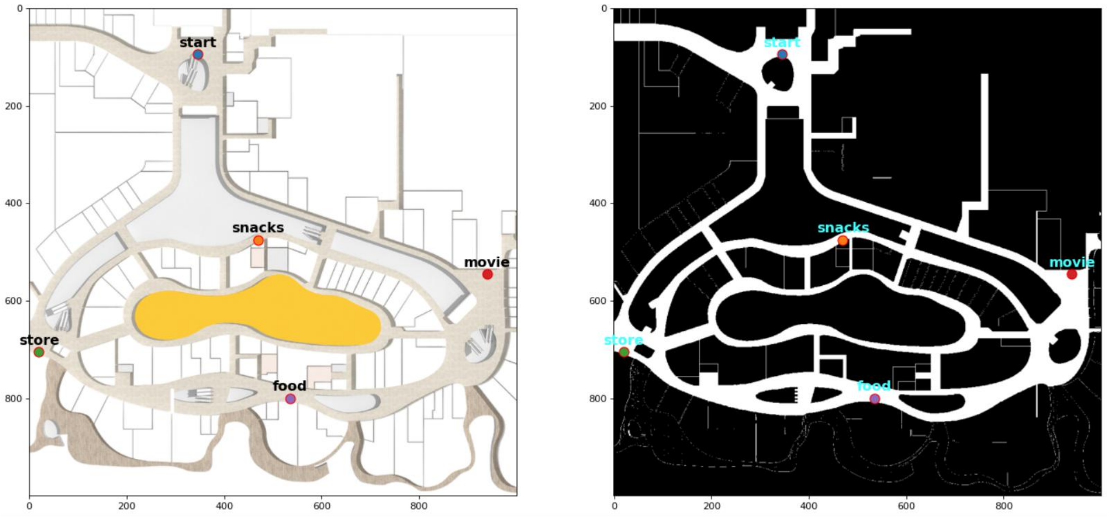
Task 1: Task 1: Global Planning

Task 1.1:

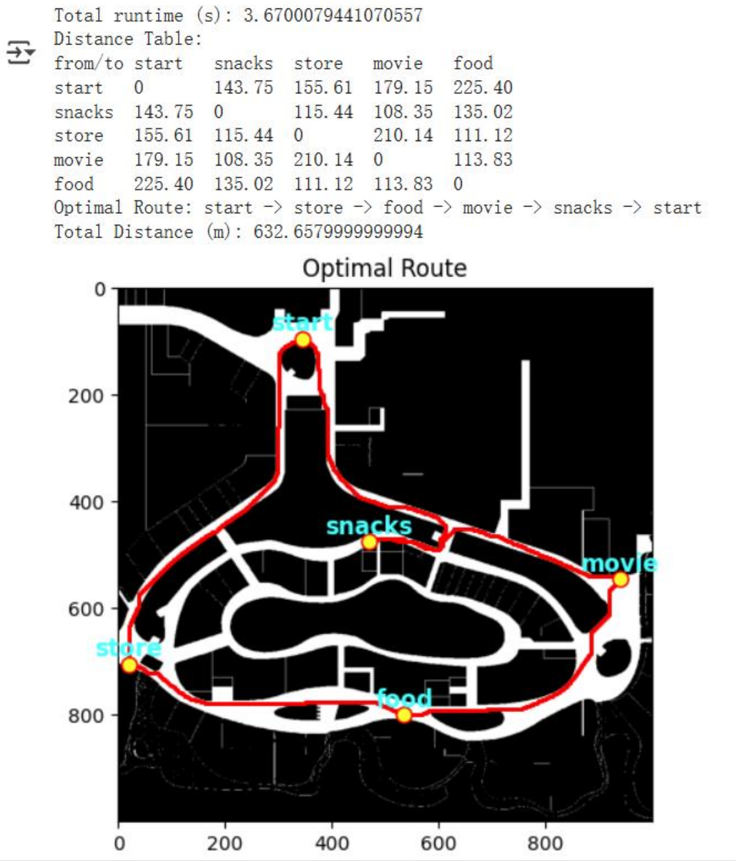
The aim of this task is to write an SVD-based ICP algorithm to calculate
For both Task 1&2 of your planning homework, you will be using a map of the VivoCity level 2, as shown. The left picture is the original floor plan, while the right one is a grayscale version to be used by your planning algorithms. The whole map has a size of 1000 x 1000 pixels (grid cells), with each cell representing a 0.2m x 0.2m square area. Each grid cell belongs to one of two possible states: Free (value `255`) or Occupied (value `0`). You yourself, as a human, are expected to have a circular footprint of no less than0.3m radius. There are five given key locations on the map you wish to visit: `start`, `snacks`, `store`, `movie`, and `food`. Your mission is to plan a path/trajectory between each pair of a start and end points, display your plan on the map and count the total travel distance of your plan in meters. Finally, use the distances you calculated, find the most efficient route for yourself, that is currently standing at the level 2 escalator (the start), to visit all the four locations and return to the start.

First Step: before using A*, map loadingis done first.



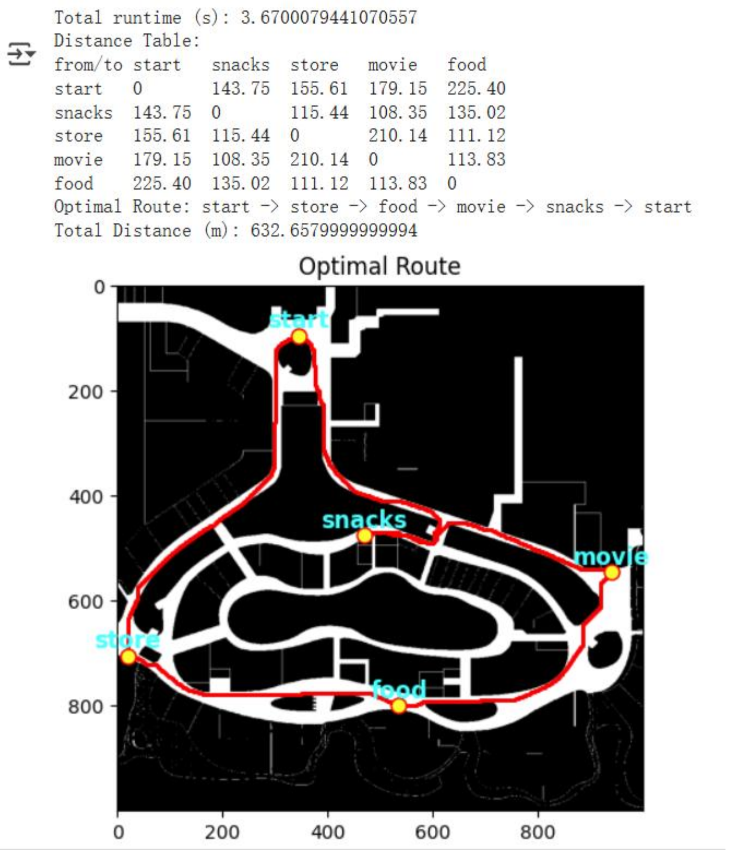
Step 2:A* algorithm

Result:



```
Total runtime (s): 3.6700079441070557
Distance Table:
from/to start   snacks  store   movie   food
start   0       143.75  155.61  179.15  225.40
snacks  143.75  0       115.44  108.35  135.02
store   155.61  115.44  0       210.14  111.12
movie   179.15  108.35  210.14  0       113.83
food    225.40  135.02  111.12  113.83  0
Optimal Route: start -> store -> food -> movie -> snacks -> start
Total Distance (m): 632.6579999999994
```

Step 3:Degenerate the A* algorithm to Dijkstra’s Algorithm
Result:



```
Total runtime (s): 3.6700079441070557
Distance Table:
from/to start   snacks  store   movie   food
start   0       143.75  155.61  179.15  225.40
snacks  143.75  0       115.44  108.35  135.02
store   155.61  115.44  0       210.14  111.12
movie   179.15  108.35  210.14  0       113.83
food    225.40  135.02  111.12  113.83  0
Optimal Route: start -> store -> food -> movie -> snacks -> start
Total Distance (m): 632.6579999999994
```

Step 4: Comparison

From the results we can see, A*algorithm is way faster than Dijkstra algorithm.Summarize the shortest distances between each pair of locations in a table:

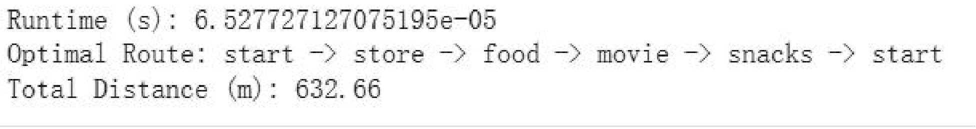
Distance Table produced by A*

From\to	start	snacks	store	movie	food
start	0	144.23	155.97	179.38	226.11
snacks	144.23	0	115.68	105.58	135.73
store	155.97	115.68	0	210.26	111.12
movie	179.38	108.58	210.26	0	113.95
food	226.11	135.73	111.12	113.95	0

Task 2:The “Travelling Shopper” Problem

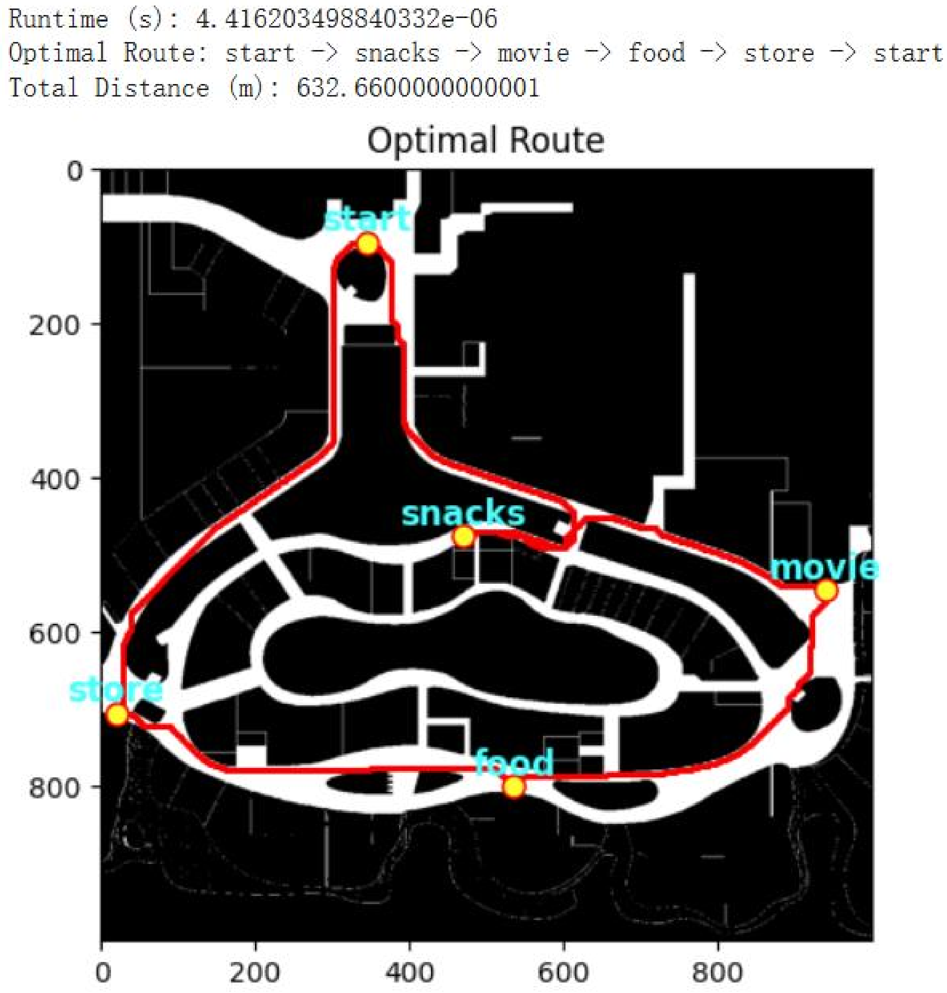
You are now at the VivoCity level 2 escalator (the start), and you wish to visit all the four locations andthen return to the escalator. Based on the distance table you obtained in Task 1, find the optimal route for you to visit all stores and come back to the start location.

For Greedy method:



```
Runtime (s): 6.527727127075195e-05
Optimal Route: start -> store -> food -> movie -> snacks -> start
Total Distance (m): 632.66
```

For Traversal method:



```
Runtime (s): 4.416203498840332e-06
Optimal Route: start -> snacks -> movie -> food -> store -> start
Total Distance (m): 632.6600000000001
```

The final shortest route and the total distance are shown on the map.

Appendices:

The code and file can be found here:
https://github.com/Zhou-Tianli/ME5413_Homework3_planning