

ESE 650, SPRING 2024

HOMEWORK 3

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Solution 1 (Time spent: 10 hours).

(b) The initial value function for all the states is shown in figure 1.

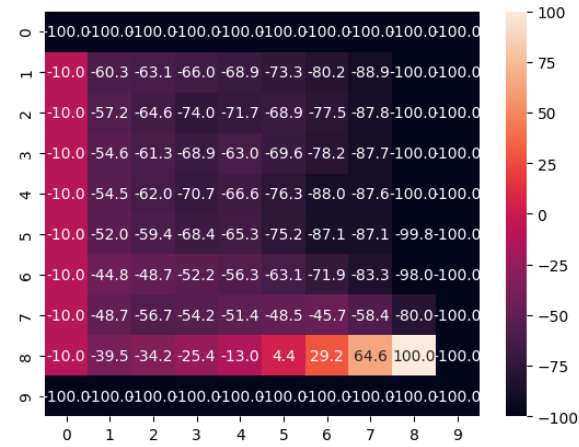


FIGURE 1. Policy iteration reward

(c) The value function and the action taken by the robot in the first 4 iterations are shown in figure 2 - 5.

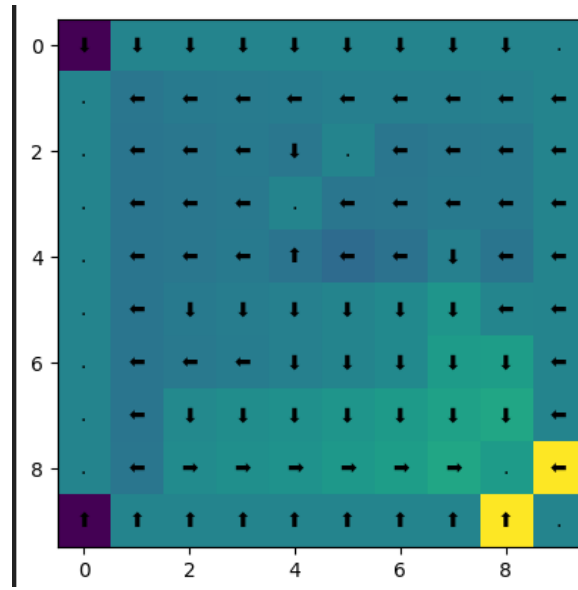


FIGURE 2. Reward and action at the 1st iteration

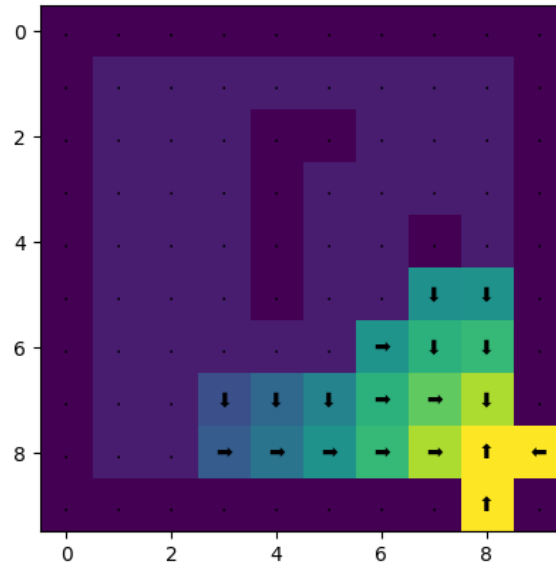


FIGURE 3. Reward and action at the 2nd iteration

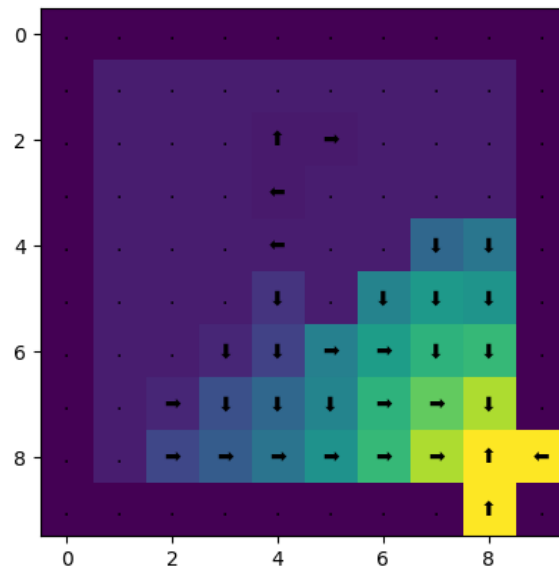


FIGURE 4. Reward and action at the 3rd iteration

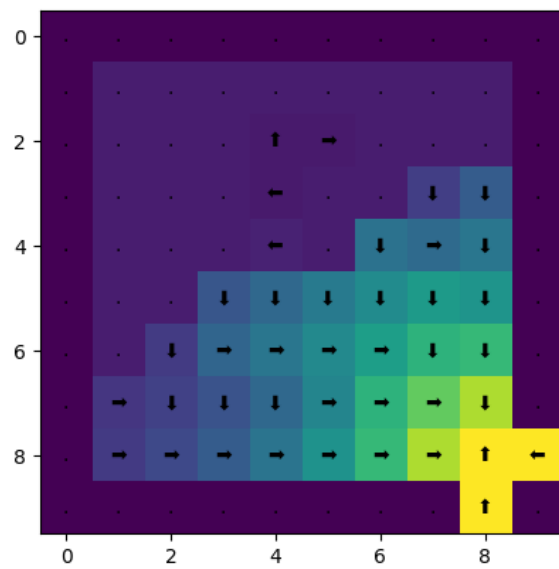


FIGURE 5. Reward and action at the 4th iteration

Solution 2 (Time spent: 40 hours).

(c) The trajectory using particle filter with only dynamics is shown in figure 6. The trajectory using onboard odometry is shown in figure 7.

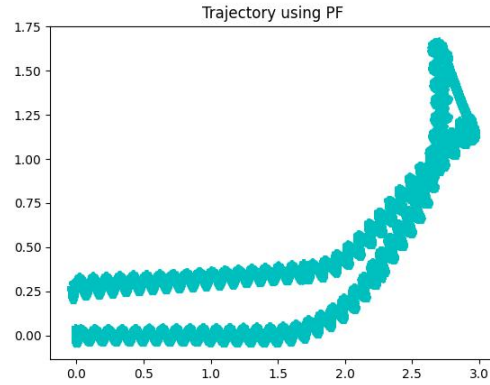


FIGURE 6. Dynamics

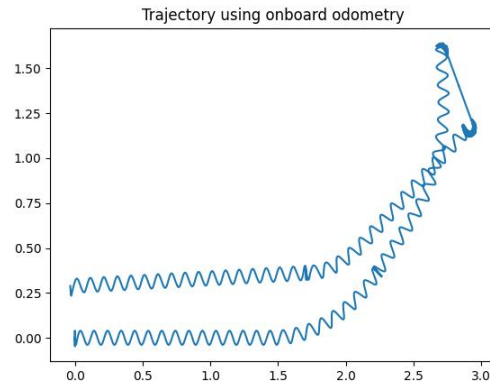


FIGURE 7. Odometry

(d) The output of initial observation step is shown below.

```
1 INFO:root:> Particles
2 : [[2.  0.2 3. ]
3    [2.  0.4 5. ]
4    [2.7 0.1 4. ]]
5 INFO:root:> Weights: [-0.0013551  0.98642819 0.01492692]
```

LISTING 1. observation step

(f) The final slam maps for 4 datasets are shown in figure 8 - 11.

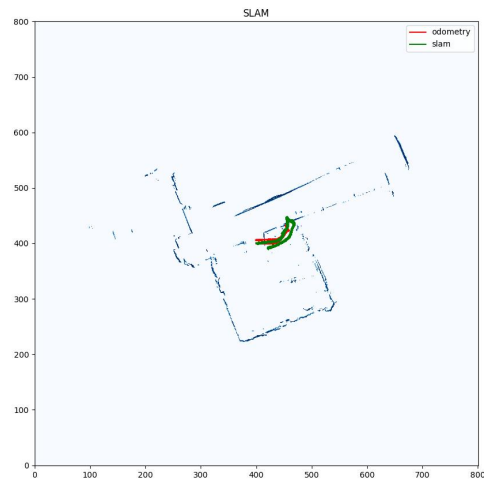


FIGURE 8. Final slam map for dataset 0

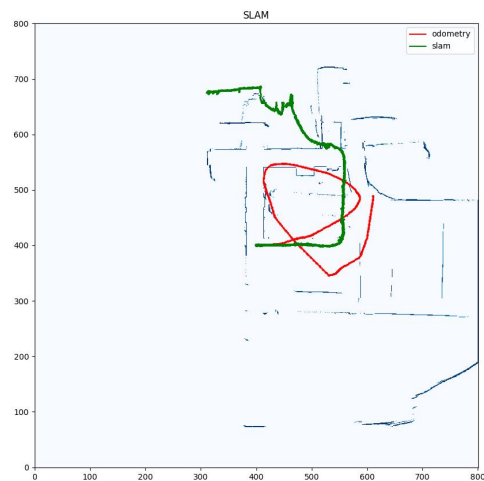


FIGURE 9. Final slam map for dataset 1

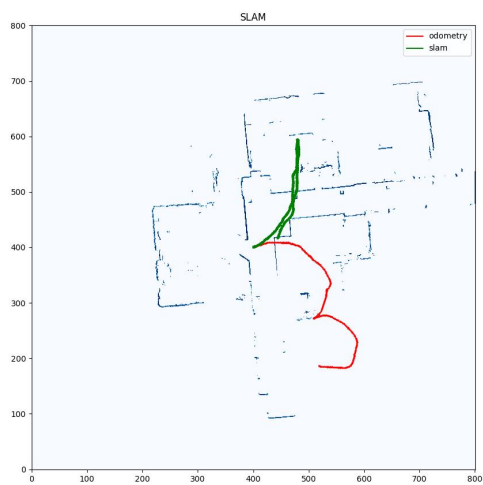


FIGURE 10. Final slam map for dataset 2

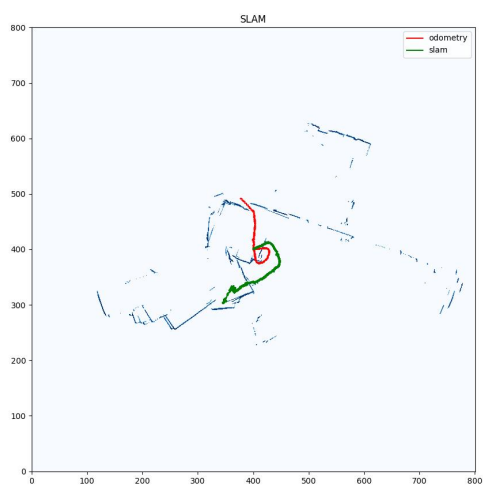


FIGURE 11. Final slam map for dataset 3

Solution 3 (Time spent: 20 hours).

The training loss is shown in the figure 12. I set near_point as 2, far_point as 6, number of sampled points along each ray as 64.

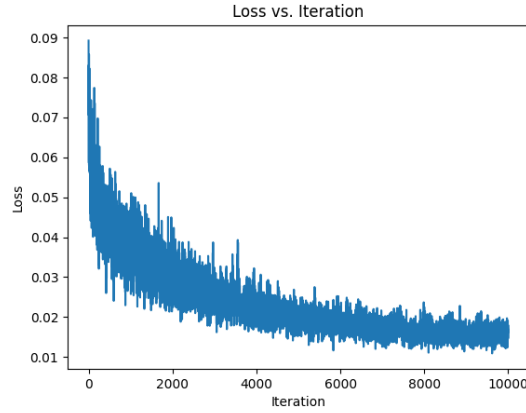


FIGURE 12. Loss vs Iterations

The ground truth and reconstruction images are shown in figure 13 - 17. The resolution I use to reconstruct the image is $32 * 32$.

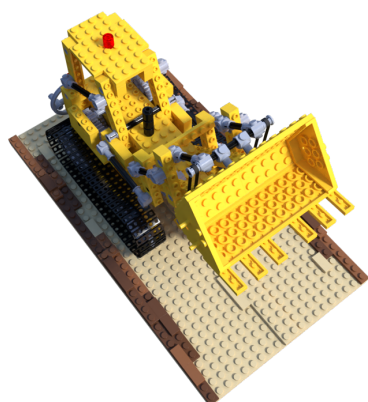


(A) ground truth



(B) reconstruction

FIGURE 13. A figure with two subfigures



(A) ground truth



(B) reconstruction

FIGURE 14. A figure with two subfigures

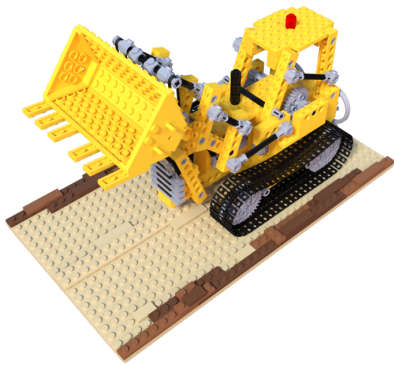


(A) ground truth

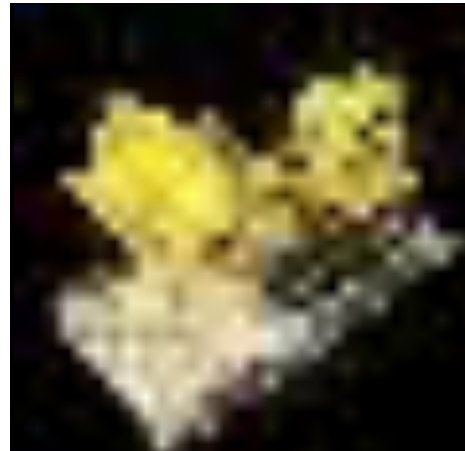


(B) reconstruction

FIGURE 15. A figure with two subfigures

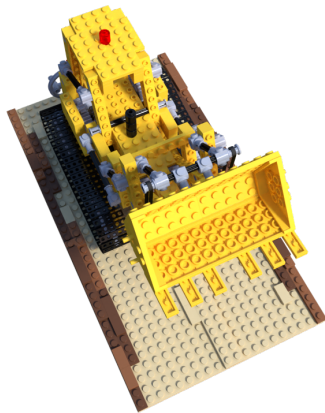


(A) ground truth

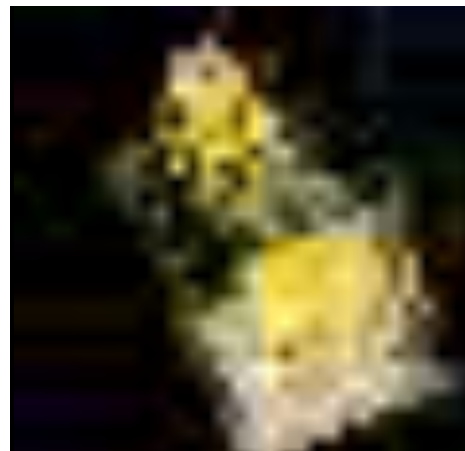


(B) reconstruction

FIGURE 16. A figure with two subfigures



(A) ground truth



(B) reconstruction

FIGURE 17. A figure with two subfigures