Objectives: Enhanced robot pathfinding on Prime Vision floorplans using deep reinforcement learning.

Completed works:

1. Incorporated the floorplans into the reinforcement learning simulation environment.

FPenv.py parses the floorplan JSON file to get nodes and edges, generates the adjacency matrix, and then creates the reinforcement learning environment

2. Trained the attention models with the autoregressive policy on real floorplans and tuned the parameters for better performance.

(1) Trained the attention models on both grid maps and Butterfly 14x11 floorplan.

(2) Tuned various parameters to improve the model performance:

a. Policy Optimization with Multiple Optima (POMO)

b. Allow temporary loops in training and testing

c. Increase the max number of steps (1000) and the max training epochs (200)

d. Apply gradient clipping to avoid gradient exploding

e. Tune the batch size to an appropriate number

f. Tune the decode type (training, validation, and testing) in the policy

In-progress Works:

1. Improve the policy to avoid the robots being stuck in the loop.

(1) Explore other decode strategies (e.g. multi-start greedy/sampling, beam search)

(2) Detect if the robot is stuck in loops: if so, develop strategies to exit the loop

2. Avoid crashing into other moving robots and robot congestion

(1) Treat other moving robots as moving obstacles in the environment

(2) Develop path-finding algorithms considering other moving robots

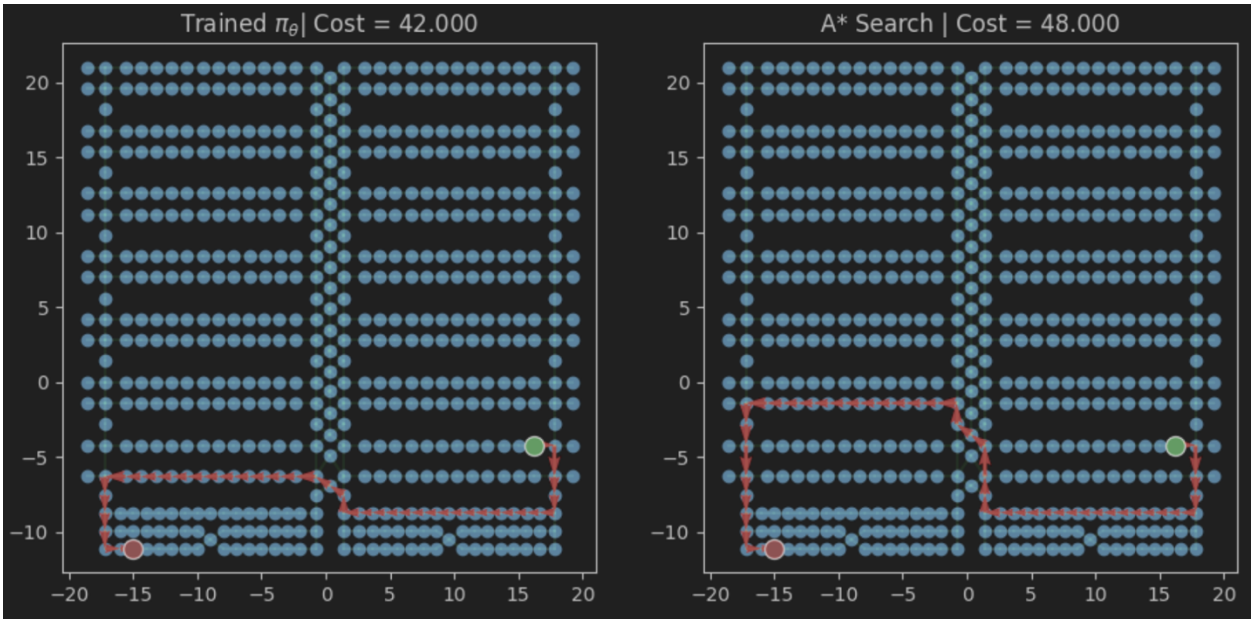
3. Develop vectorized environments to train in various environments (grid map + floorplans)

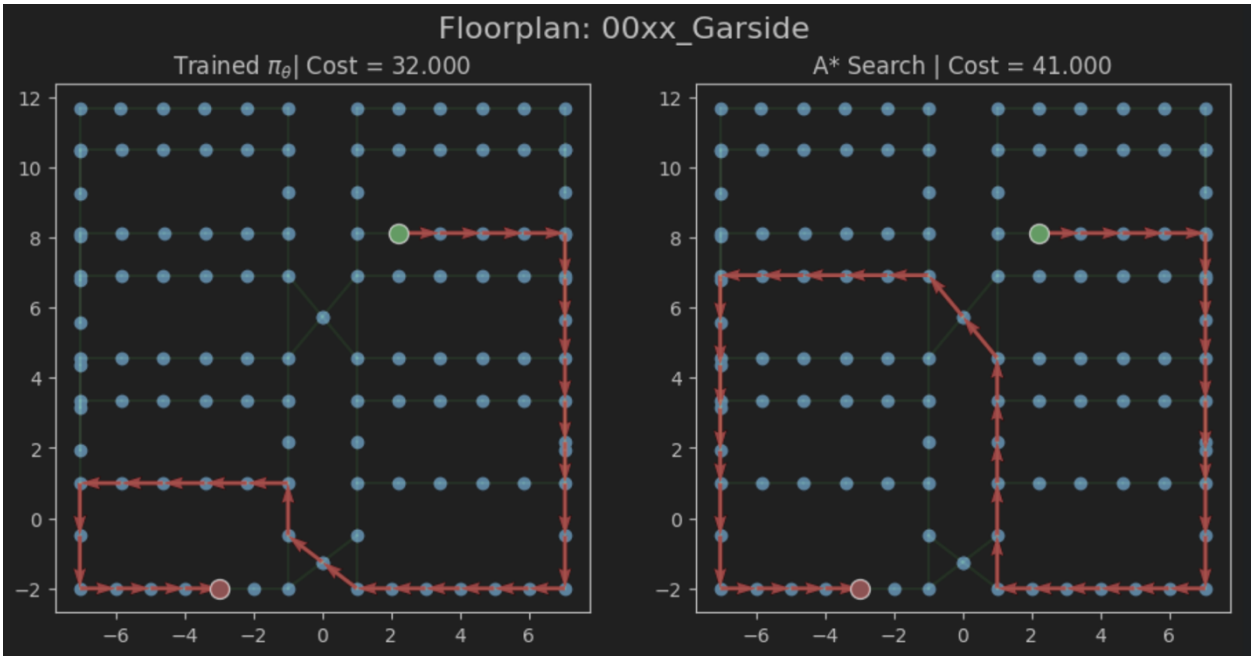
(1) Train an agent on multiple stacked environments per step

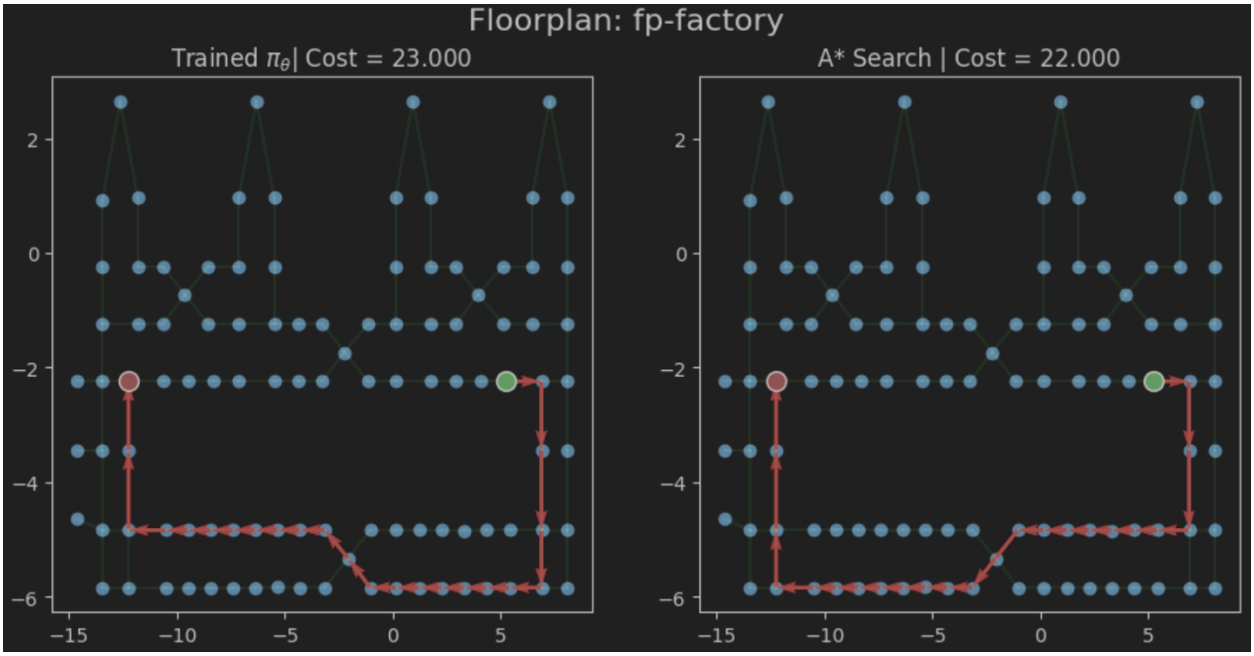
(2) Aim to improve the generalization ability of the models

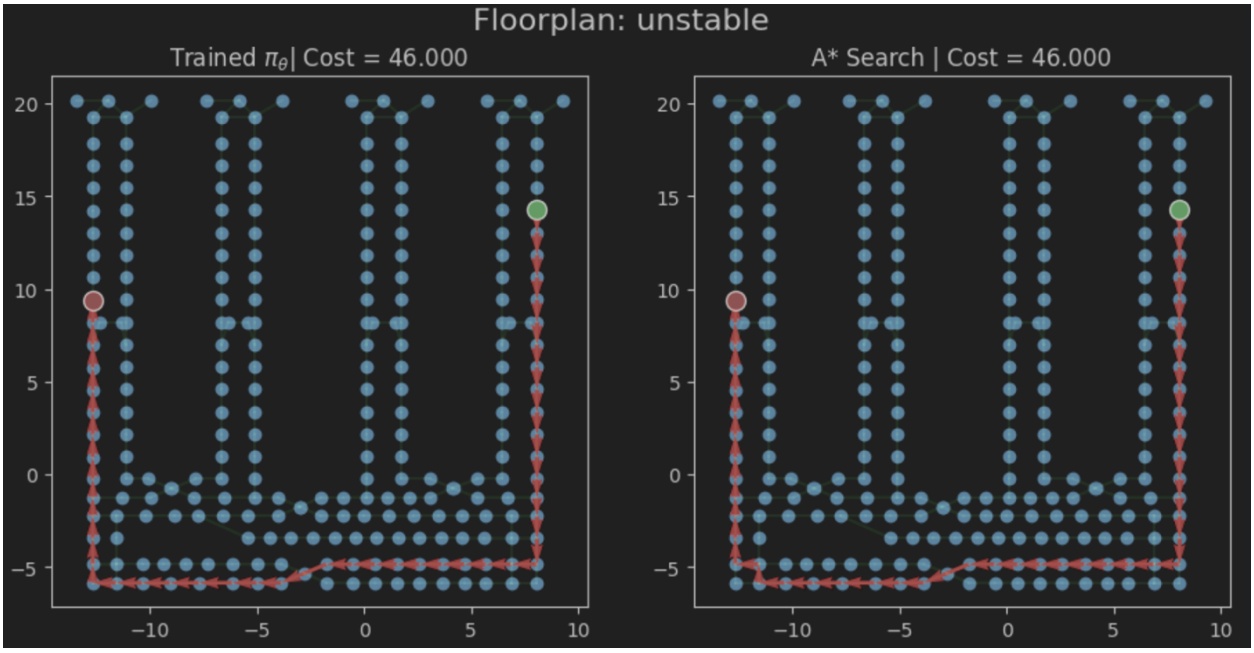
Successful Results:

Floorplan: Butterfly 14 x 11






Floorplan: fp-factory
Trained π_θ| Cost = 23.000
A* Search | Cost = 22.000


Floorplan: unstable
Trained π_θ| Cost = 46.000
A* Search | Cost = 46.000

Failed Results: