Model Free Reinforcement Learning

Application to Area Coverage Optimization

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Outline

- Concept of Area Coverage Algorithm
- Problem Setup
- Current Milestone
- Actor-Critic
- Results

Area Coverage Algorithm

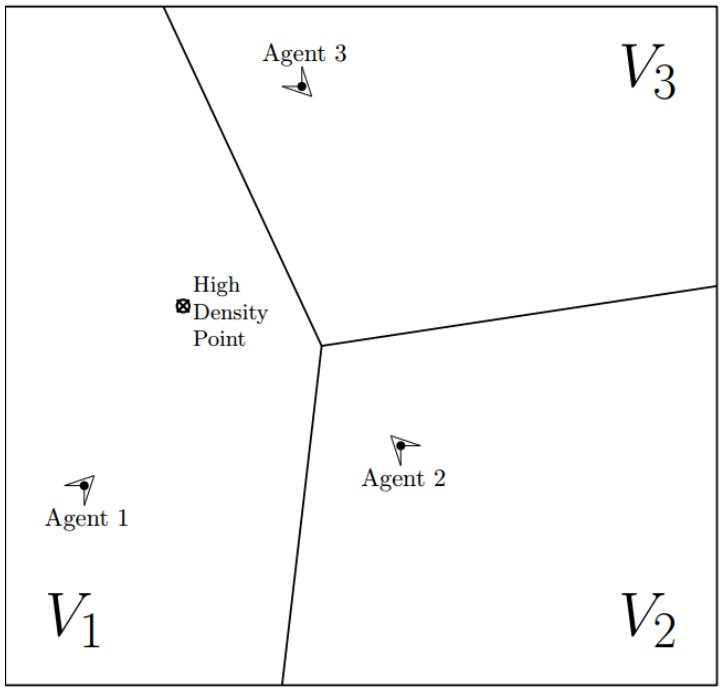


Figure: Voroni regions

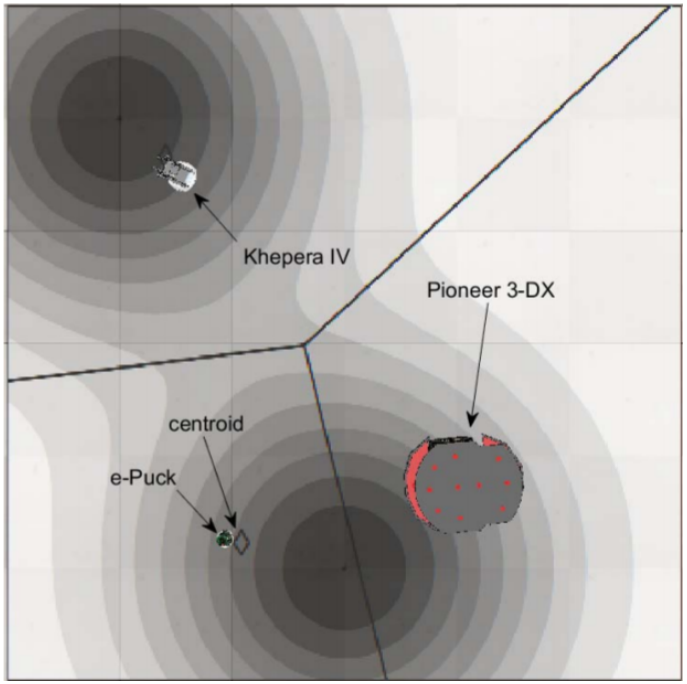


Figure: V-rep simulation

Problem Setup

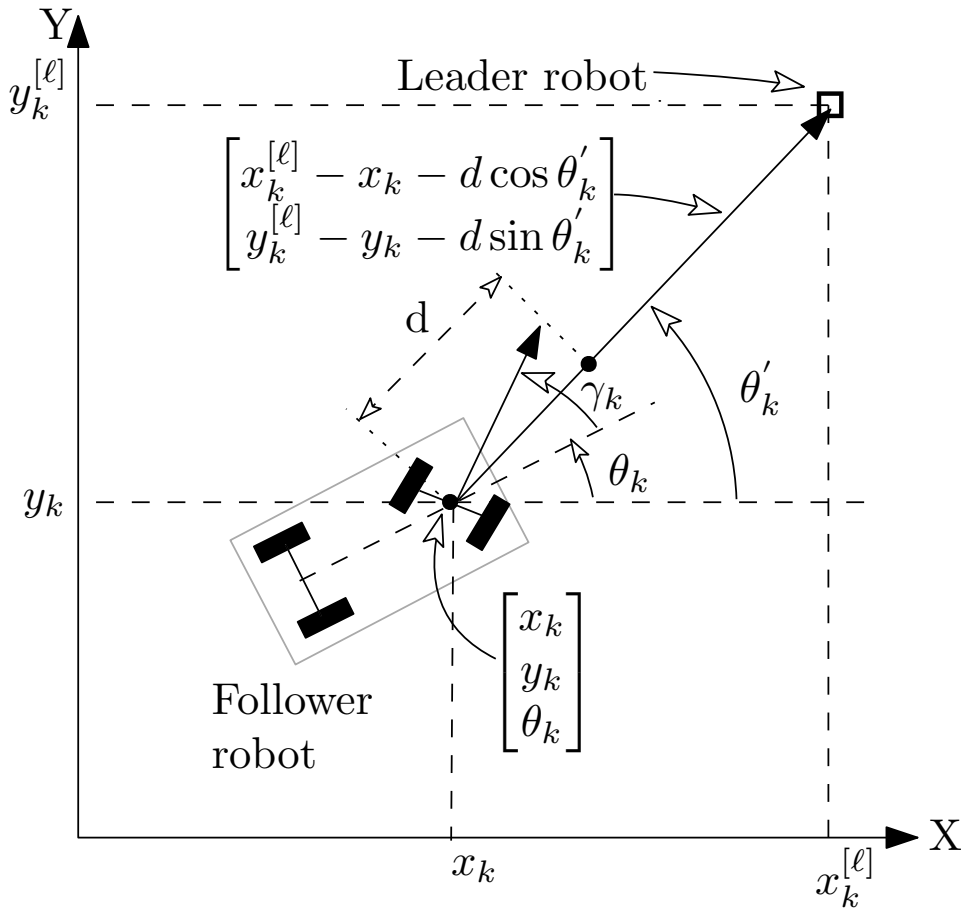


Figure: Problem Setup

NN Archetiture

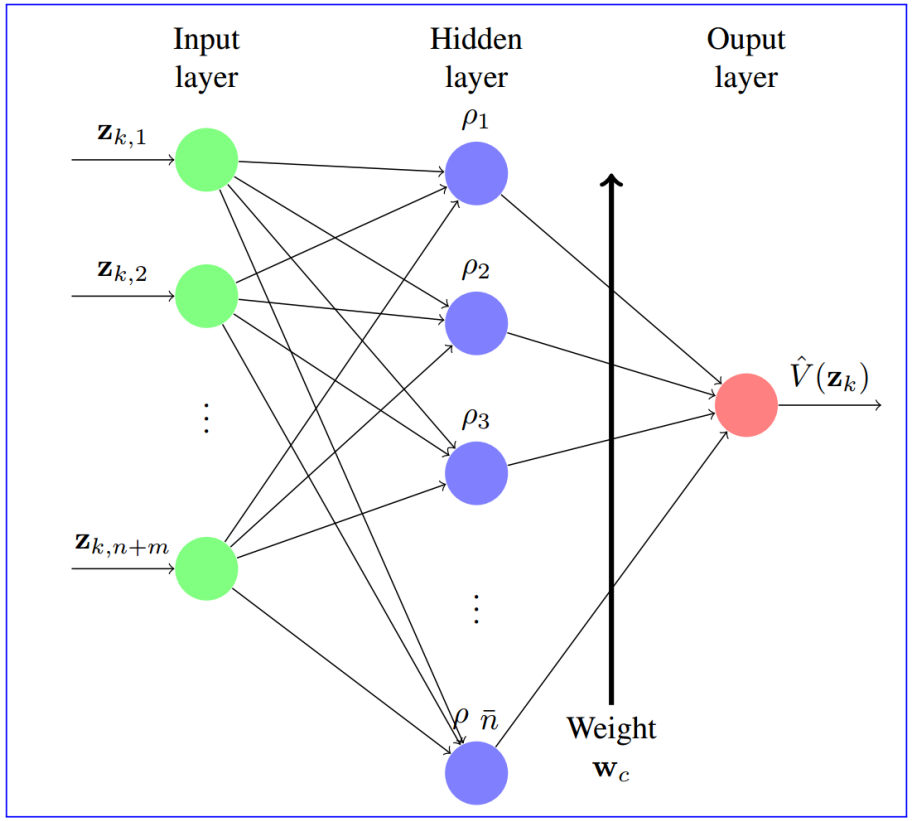


Figure: Neural Network Architecture

Current Milestone

Objective

Find a general weight matrix to be applied for different scenarios without the need of manually tunning the inital weights. our potential solutions can be one of the following:

- Actor critic neural algorithms.
- Using LQR.
- Using ADP.

Actor-Critic Network

- The idea behind Actor-Critic Algorithm is to split the Model into two parts, one responsible for the actions (Actor) and one responsible for the learning(Critic).

Results

Case Study 1

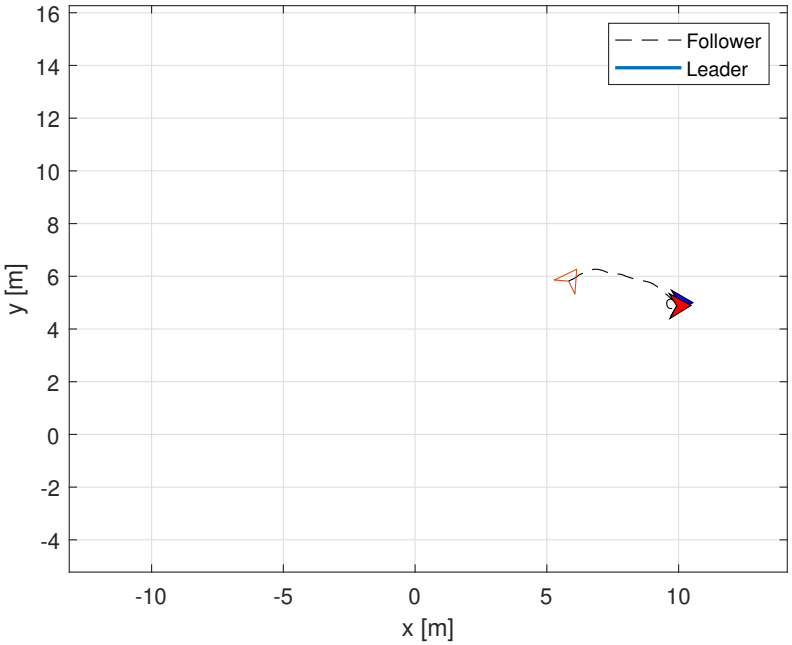


Figure: Trajectory

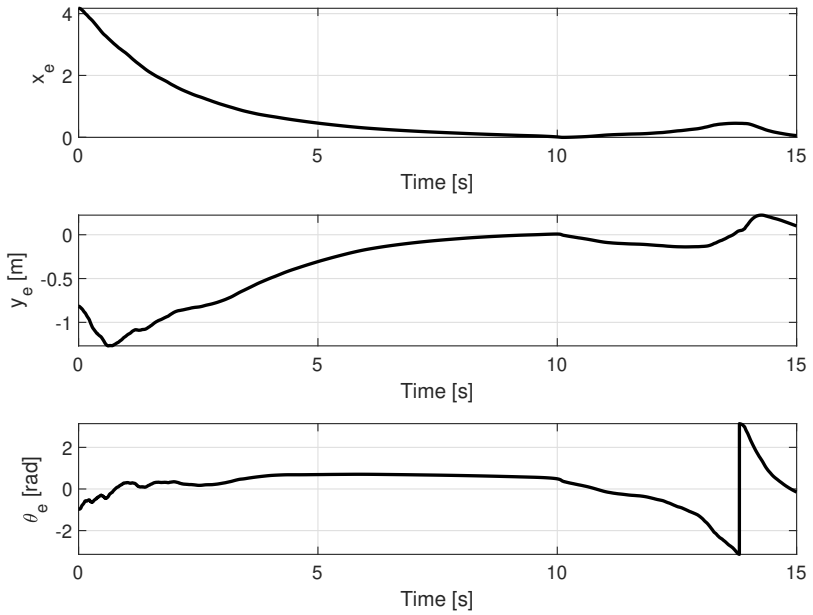


Figure: follower position error

Results

Case Study 1

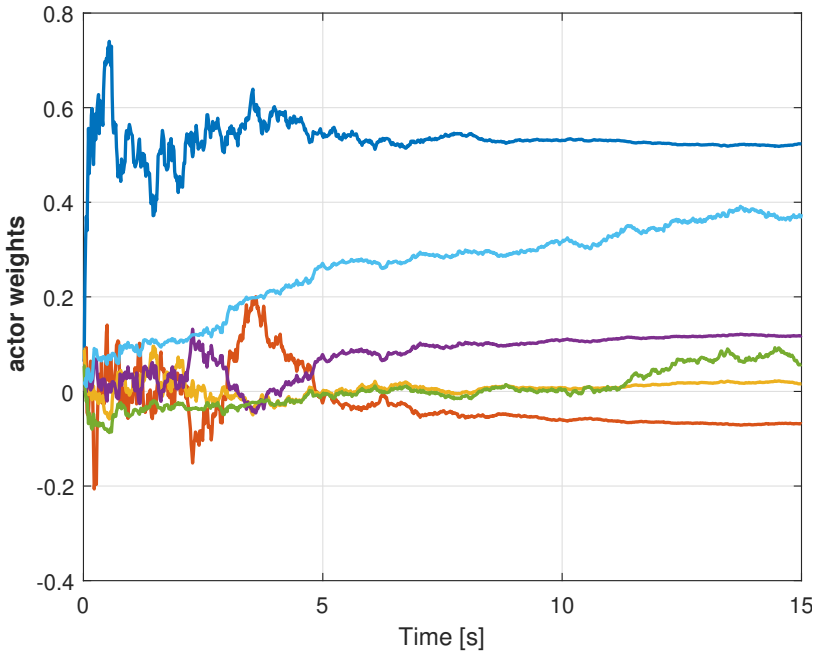


Figure: Actor Weights

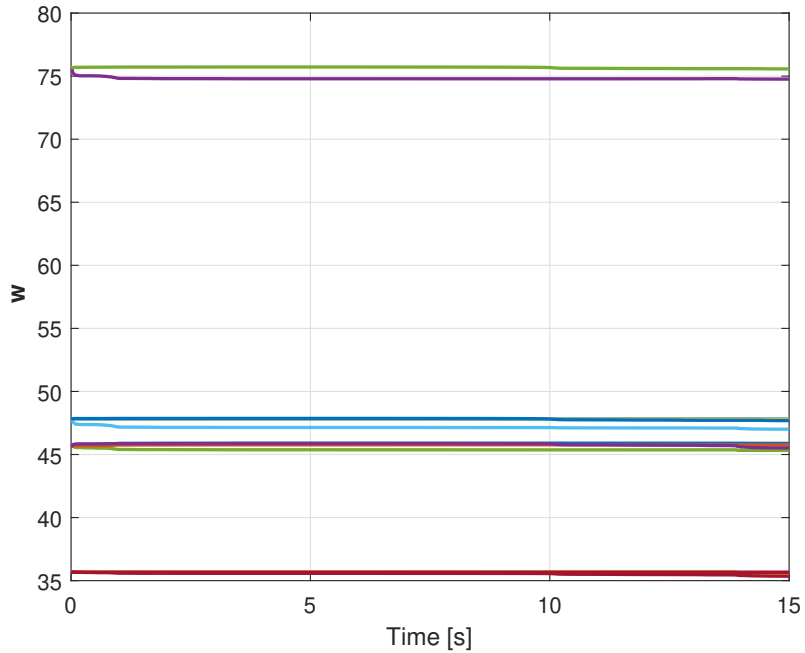


Figure: Critic Weights

Results

Case Study 2

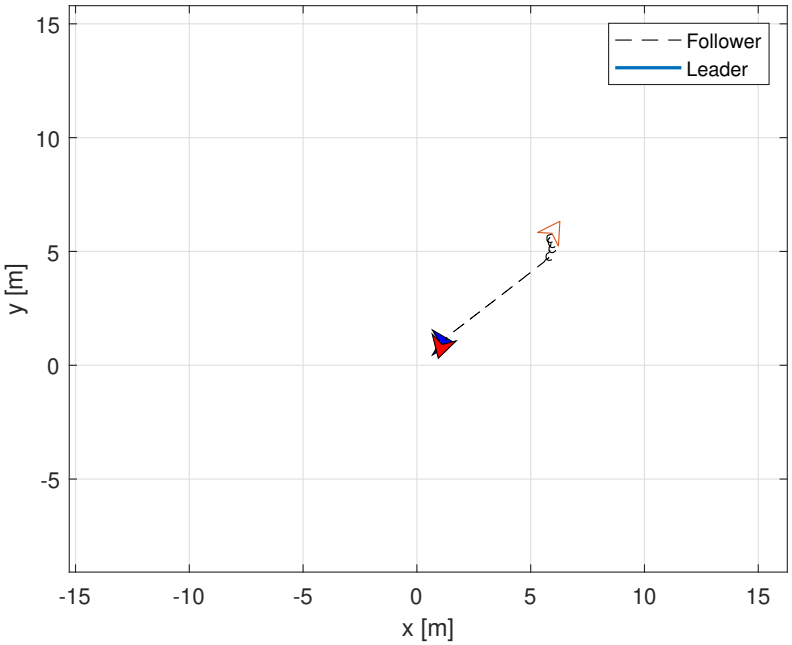
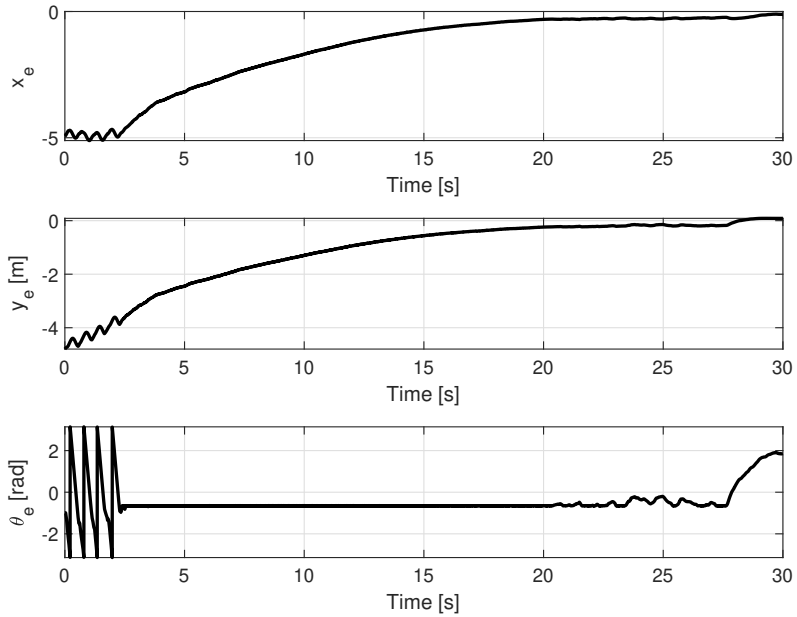


Figure: Trajectory



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Case Study 2

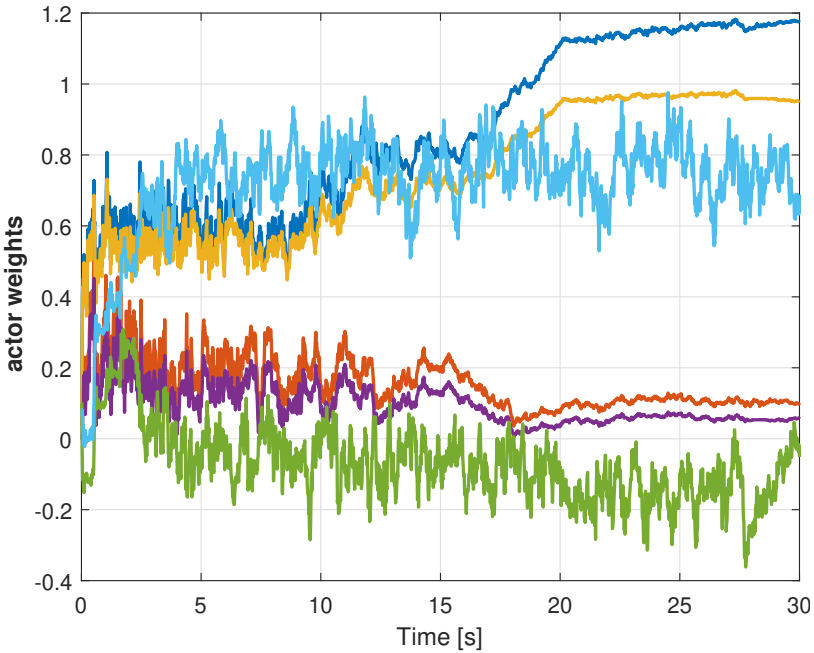

Figure: Actor Weights

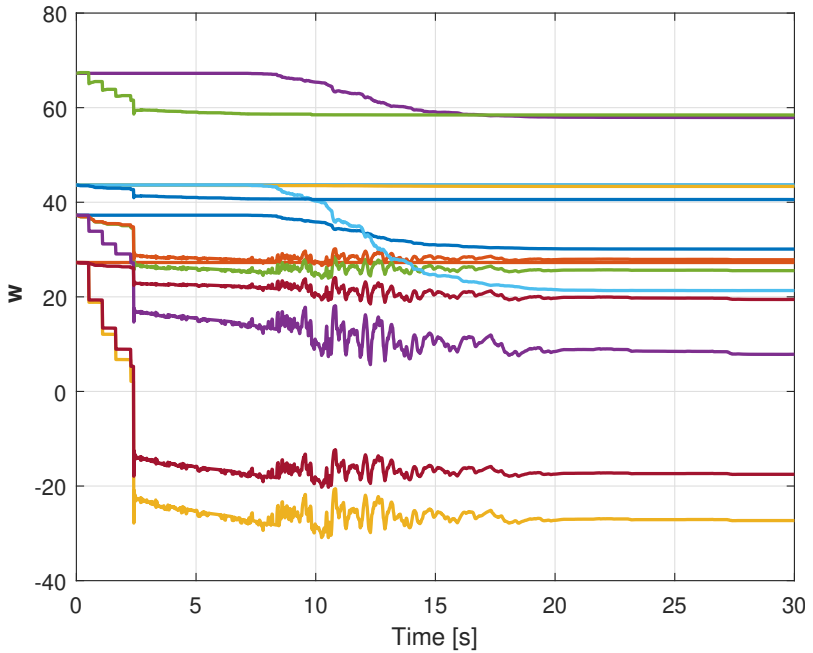

Figure: Critic Weights

Comments and Observations

Gradient Descent

it was found that the solution still depends on a certain weights matrix , the actor critic neural network achieved promising results in different scenarios even with adding random noise to the inital p matrix

Questions?