MONASH
ENGINEERING

MONASH University

Faculty of Engineering
Summer Research Program 2022-2023

Project Title: Formation Control for Robot Swarms using Deep Reinforcement Learning

Supervisor(s): Dr Michael Burke, Dr Ahmet Sekercioglu, Dr Akansel Cosgun

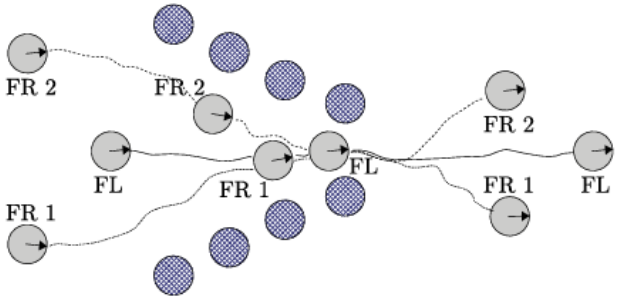
Department: ECSE

Email: james.saunderson@monash.edu

Website profile of project supervisor: http://michaelburke.co.za/wp/

Objective

The goal of this project is for a robot team to keep a given formation as much as possible while navigating obstacles. In recent years there has been an increasing interest in automated control and coordination of multi-robot systems, such as networked mobile robots or drones. Existing solutions are often based on rule-based heuristics methods. We will utilise cutting-edge deep learning methods to achieve the formation task.



Project Details

This project will focus on the machine learning part, namely deep reinforcement learning (Deep RL). We will explore various Deep RL approaches and tailor them to multi-agent systems. We will look to borrow ideas from pre-deep learning approaches in formulating the reward function or designing a curriculum if we end up using Curriculum Learning. This project will be conducted entirely in simulation, hence we will first select a simulator that is fast, generalisable to a different number of agents and offers a straightforward interface to Deep RL policies. Depending on the complexity of the problem and our initial experiments, we will choose whether we have a 2D world assumption (easier) aimed for mobile ground robots or a 3D world assumption (harder) for drones. The developed approach will be evaluated against non-deep-learning approaches as well as existing Deep RL approaches if any.

Prerequisites

- Experience with Python
- Experience with Deep Reinforcement Learning is a big plus