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ENGINEERING

MONASH University

Faculty of Engineering
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Project Title: Learning Pursuit-Evasion Games between Drones

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Objective

The main objectives of this project is 1) implement the learning-based software enabling real-time, three-dimensional mixed-strategy pursuit-evasion trajectory generation, 2) demonstrate its feasibility on a laboratory micro-drone setup, and 3) evaluate the performance of the framework in various aspects.

Project Details

Aerial pursuit-evasion games have been of great interest for many years because of its importance in military and civilian applications [1]. However, producing solution trajectories to the game in real-time has not been feasible due to the mathematical complexity even if it is highly approximated. The recent development in so called deep declarative networks [2] provides a potential way to compute high-quality pursuit-evasion trajectories in real-time, which is demonstrated in a simple computer simulation [3]. In this project, we will attempt to extend the framework to a two-agent pursuit-evasion game in three-dimensional space and validate it in a physical micro-drone testbed. Various formulations will be tested and their performance will be measured to find the most efficient trade-off between the computational cost and the quality of solutions. Demonstration with respect to a human pilot controlling the evader or pursuer would also be attempted if time permits.

Prerequisites

Pre-exposure to PyTorch is required. ROS skills may be helpful for implementation.

Additional Information

Applicants may be required to attend an interview if there are multiple applicants.

[1] Chung, Timothy H., Geoffrey A. Hollinger, and Volkan Isler. "Search and pursuit-evasion in mobile robotics: A survey." *Autonomous robots* 31 (2011): 299-316.
[2] Gould, Stephen, Richard Hartley, and Dylan Campbell. "Deep declarative networks." *IEEE Transactions on Pattern Analysis and Machine Intelligence* 44.8 (2021): 3988-4004.
[3] Peters, Lasse, et al. "Learning mixed strategies in trajectory games." *arXiv preprint arXiv:2205.00291* (2022).