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Title

A Reinforcement Learning approach to UAV trajectory configuration

Authors

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Abstract

The continuously expanding use of autonomous UAVs brings forth the need for cost-effective, yet safe operations for both research and commercial applications. For example, autonomous UAVs can perform crop surveillance and pests' deterrent responses with the minimal human intervention [4]. However, these UAVs need to be equipped with a robust machine learning agent to achieve satisfactory performances in the field. This paper presents a Reinforcement Learning (RL) approach to UAV trajectory configuration, focusing on Proximal Policy Optimization (PPO).

Reinforcement Learning proves to be a suitable candidate for this task since RL doesn't require pre-existing data to train an agent successfully in addition to allowing unsupervised learning. Still, the main challenge in training agents for UAV applications is that the first training steps carry significant risks of hardware damage. Luckily, the RL agents can be trained in a simulated environment and then imported to the onboard computer of the UAV.
Proximal Policy Optimization is a state-of-the-art reinforcement-learning approach which has been successfully implemented in aerospace applications for UAV navigation [1], attitude control [2] and mission planning [3]. PPO has been chosen due to its increased stability and sample efficiency. Furthermore, its tendency to remain in the region of interest deems it safe for trajectory-tracking applications.

Our PPO agent has been trained in a simulation where the UAV dynamics and the surrounding environment have been modelled to imitate real-life conditions through urban and open-space scenarios. This simulated environment is designed to respond to the agent's actions through Gaussian rewards.

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