

Title: Use of Reinforcement Learning for Small Remotely Piloted Aircraft System (RPAS) Navigation

Remotely Piloted Aircraft Systems (RPAS, also known as UAVs) have become a popular platform to use in recreation, industry and research fields. With their versatility, high-speed, low cost, multiple sensor payloads, and ability to access regions often inaccessible by humans, they are increasingly being used in applications such as wildfire monitoring, search and rescue, and photogrammetric mapping.

One of the important aspects in photogrammetric mapping is for an RPAS to follow a specific trajectory path ensuring complete coverage of the interest area. The success in using RPAS for aerial surveys depends on the need for their pilot operator to have a strong and complete knowledge of the flight environment, and good experience with operating and the mechanics of RPAS. These requirements are emphasized when automatic flight using waypoint/flight path routing and the stability features of RPAS are unavailable due to Global Navigation Satellite System (GNSS) failures or GNSS denied environments. In the case of pilot inexperience or sensor system failures, errors can be introduced during both the operation flight and in the final mapping product, and in some cases even deem the RPAS unsafe and unusable.

This research proposes a method of reducing or eliminating these difficulties through the integration of vision-based methods and artificial intelligence to support automation and autonomy in operations. More specifically, Reinforcement Learning (RL) is used to work towards developing an artificially intelligent, autonomous aerial mobile mapping system. Reinforcement learning (RL) is a computational approach in which an agent, such as a RPAS platform, learns the best actions to take in an environment through its own interactions with it. Our current research on the implementation of RL to enable a RPAS to identify and follow an optimal path in a simulated environment will be presented.

Keywords: Remotely Piloted Aircraft Systems (RPAS), reinforcement learning, machine learning, artificial intelligence, navigation, path following