Name:

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Title:

Computer-Vision Based Pose Estimation of Neighboring Aircraft in an Uninhabited Aerial Vehicle (UAV) Swarm

Abstract:

With the recent advancements in machine learning and computer vision, particularly in the development of more efficient algorithms for these applications, the possibility of incorporating vision systems on small uninhabited aerial vehicles (UAVs) has become a reality. As the complexity level of desired tasks to be carried out by UAVs increases, it is important to explore the potential benefits of operating a UAV swarm. By utilizing multiple UAVs working in unison, it is possible to simplify operations by dividing tasks and payload amongst the different aircraft in the unit. Most UAV swarms currently utilize the Global Navigation Satellite System (GNSS) as its main driver for movement and interaction between each member; however, this is not a feasible option for operations in GNSS-denied regions. With the development of more efficient and robust machine vision algorithms, it has become possible to utilize machine vision for real-time navigation purposes. This paper aims to investigate and identify suitable inter-unit identification and tracking methods for a low-cost, vision-based flight control system for small UAVs operating in a swarm setting. Initial work will involve the testing of various target tracking methods, and to determine the necessity of the fusion of multiple methods to achieve a fast and accurate solution. Further testing will be carried out to determine the feasibility of pose estimation of neighboring UAVs utilizing machine vision, for applications in co-operative formation flight operations. Results of each tested identification and tracking method will be presented in this paper, and the optimal solution for inter-unit positional awareness will be determined. Initial results of a method for carrying out the pose estimation process of neighboring aircraft will also be presented.

Speaker Bio:

Brendan Ooi is a Master of Applied Sciences in Aerospace Engineering candidate at Carleton University. His research group, Carleton UAV, under the supervision of Dr. Jeremy Laliberte, focuses on the novel applications of RPAS for industrial and research applications. His current research work centers around the application of Computer Vision techniques for RPAS, with his thesis focusing on the pose estimation and positioning of neighboring aircraft in a RPAS swarm for data collection purposes. He has been involved in the design and development of fixed-wing and rotary-wing RPAS since 2014, while completing his Bachelor of Science in Aerospace Engineering at the Florida Institute of Technology.