UAV cooperative control for multiple target tracking

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Abstract

This research is concerned with dynamically determining appropriate flight patterns for a set of UAVs, in an urban environment, for tracking a set of moving ground targets, in order to minimize the fused kinematic target location error of the ground targets, while also maximizing the connectivity of the resulting network. We assume there are two types of UAVs: the first set to keep accurate track of the targets, and the second set to act as a 'bridge' between the UAVs performing the tracking and a remote C2 station. We assume that there are limited communication capabilities among the UAVs, and there exist possible line of sight constraints between the UAVs and the targets. Each tracking UAV (i) operates its own dynamic feedback loop, in a receding horizon framework, incorporating local information on the targets (from UAV i perspective) as well as remote information on the targets (from the perspective of the 'neighbor' UAVs that are able to communicate with UAV i) to determine the flight path of UAV i over the planning window. This results in a decentralized (more realistic) model of the real-world problem modeled. In addition, each bridge UAV develops its' flight plan to dynamically maximize the total connectivity of the network. As the flight-plan optimization formulation is `NP-hard`, a new heuristic for continuous global optimization is applied to solve for the flight plan. Results show that efficient flight patterns for the UAVs can be achieved.

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