Heuristic for the dynamic scheduling of a fleet of drones for sport filming in a wide field of operations

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Abstract

We study the use of a fleet of unmanned aerial vehicles (UAVs) for covering sport filming in a very extensive area, so that the audio-visual producer is given the images of a set of participants (henceforth, the targets) whose different trajectories are known. The goal is the definition of a coordinated task assignment in order to provide both spatial and temporal coverage for the variety of points of interest (PoIs) marked at each target. We have to consider heterogeneity of UAVs regarding to their initial position and the charge of their batteries. Moreover, owing to the huge field of operations, every UAV in the fleet would require of battery replacements. Hence, the inherent problem that arises is a multi-trip capacitated vehicle routing problem.

Our assumption is that the planners require of a decision-support tool to clearly identifying the feasibility of the scheduling decisions with the safe operation of the fleet, particularly, to avoid the risk due to crossing trajectories among UAVs.
We have designed a decision-making procedure to generate plans according to a multi-criteria optimization problem, in which the total distance travelled by UAVs (to be minimized), the number of PoIs uncovered (to be minimized) and the number of risky crossing among the trajectories planned for the used UAVs (to be minimized) are jointly considered. Given the position and the time-windows for recording every PoI, we apply a sequential task assignment heuristic coded in Python to find the dynamic scheduling of the different UAVs in the fleet.

Keywords: unmanned aerial vehicles routing problem, UAV scheduling for persistent sport filming, multi, trip VRP, task assignment heuristic

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