A machine learning-based algorithm to solve the dynamic airspace sectorization problem

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Abstract.

Day by day, flights go through the world connecting and moving people and goods. Air traffic controllers are the specialized workers managing the safety of the airspace, avoiding collisions and unsafe perturbations. Controllers have a three-dimensional portion of the space to monitor, whose limits are usually predetermined. The overall configuration works well when planes respect schedules and trajectories, but, spoiler alert, flights experience delays, deviations, and cancellations.

When a disruption modifies the composition of the traffic, the workload among controllers may be negatively affected, and some workers may receive too many tasks to handle. This, despite being unfair, is potentially dangerous for travelers.

In this talk, we present an algorithm automatically redesigning the sectorization whenever a disruption occurs. We use a mix of machine learning and unconstrained optimization, and we can provide workable solutions, assessed by real-life controllers, extremely fast. The procedure is general and not linked to a particular set of workload and/or capacity definitions, making it flexible to different regulations. Finally, the learning can be adjusted in an online fashion, making it flexible when new unseen situations arise.

Keywords: airspace control; machine learning; unconstrained optimization