Probabilistic information Integration in Uncertain data processing for Trajectory Prediction ('PIU4TP')

Summary

Trajectory prediction is a basic capability to support the planning operations by different Air Traffic Management (ATM) functions and in different phases of the planning process, typically in strategic and pre-tactical phases.

Different tools are often used by diverse stakeholders, e.g. Airspace Users or ATFM (Air Traffic Flow Management), but almost all are characterized by providing "deterministic" outcomes, strongly relying on the expertise of operators and officials for the assessment of the "best" solution.

Actually, the trajectory prediction is by its nature uncertain, due to a wide number of uncertainty sources, such as meteorological conditions, ATC (Air Traffic Control) practices, stakeholder attitude and objectives, availability of actual data.

In spite of these uncertainties, the evolutions of the ATM paradigm towards the Trajectory Based Operations strongly claims for a more precise capability to predict trajectories and to better support a collaborative 4D trajectory clearance among the involved stakeholders.

Many projects and activities are on-going on the topic of trajectory prediction (TP), as part of the SESAR Engage activity and also in other exploratory research projects, some proposing to use machine learning techniques for TP, other for including meteorological information in TP. Studies are also on-going on how to integrate uncertainties in estimating a trajectory evolution.

In this project, a methodology for trajectories prediction, able to support final strategic and pre-tactical phases of the air traffic flow management process, is to be developed and tested. The proposed methodology provides trajectory prediction outcomes enriched with its relevant probabilistic information.

The proposed methodology will be based on machine learning algorithms and methods.

The application of machine learning techniques often needs large amount of data in order to train predictive or descriptive analytical models.

Possible changes in the current structures of historical data that could support the efficient application of machine learning techniques will be identified and suggestions proposed for future recording of data.

The project is structured in three main phases. The first phase will concern the definition of relevant reference scenario, including the investigation on structure of available data, the identification and tuning of models to generate data, and the realization of required databases. The second project phase will deal with the methodology development. The state-of-the-art of applied and applicable techniques will be analysed, the methodology implemented and possible lack of relevant data in current historical database identified. In the third phase, the proposed methodology will be evaluated and validated.

The Italian airspace is envisaged as reference scenario for the validation of the methodology.

The applicability of the methodology to the tactical ATFM phase will be also considered, identifying changes required for a convenient tactical application or barriers to use it.

The project foresees to arrange consultation exercises, two at least, with interested stakeholders.

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