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Prediction of inland vessel states using typical routes and a multiple hypothesis approach

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Abstract

A vital part of successful collision avoidance is the prediction of the future position of other ships over a relevant time horizon. We face two significant challenges when implementing algorithms for prediction: Limited information about other vessels provided by the on-board sensors like radar and AIS and the need for real time capabilities of the system. Typical routes created from historical data can be used to improve model based prediction and reduce computational requirements by enabling the use of less complex models.

The historical data is gathered from inland vessels using the argoTrackPilot [1], both while using the track-keeping system and while in manual mode, operating on major European waterways. The records are divided into categories by ship type and length and combined into one track for each category. A heatmap of the vessel position, as shown in figure 1, is one of the tools to visually identify the section of the river mostly used by ships. We will compare several approaches to automatic reference line generation and show their benefits and caveats.

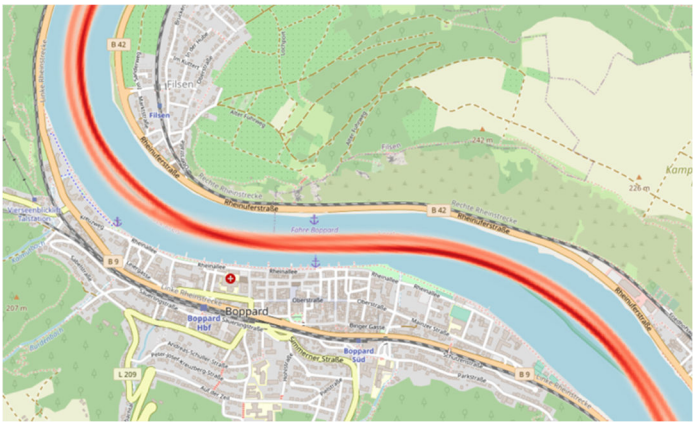

Figure 1: Heatmap of typical routes on the Rhine

A multiple hypothesis approach, employing multiple dynamical models and the generated typical routes, is a powerful tool for prediction. The technique of following several hypothesis for each target in parallel and choosing the most suitable one is useful to compensate for the limited amount of available data. The number of necessary hypothesis depends on the available information, especially geometric data received over AIS to select one of the aforementioned categories. We will present a framework, consisting of a model database and the generated typical routes, for real time prediction on standard hardware in real time. The first iteration of this framework deals with the prediction of large watercraft along the typical routes, both smaller vessels and maneuvering vessels will be dealt with at a later stage.

Literature

[1] https://www.argonics.de/argoTrackPilot