**Aalto University
School of Engineering**

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Near miss detection from AIS data based on ship manoeuvre characteristics

Title of the dissertation	Maritime Traffic Risk Analysis in the Northern Baltic Sea from AIS Data

Contents of the dissertation

The primary aim of this thesis is to improve maritime traffic risk analysis to support decision making for the prevention of and response to collision risk from the traffic management perspective, with a focus on advancing the latest methodology of utilising non-accident critical events detected from AIS data as the basis to assess traffic risk. To this end, a review and analysis of these related works is firstly conducted to understand the state-of-the-art of this non-accident critical events-based methodology. The analysis shows the feasibility and challenges of using it as a basis for maritime traffic risk analysis. This thesis seeks to improve response to these identified challenges, including the inadequate consideration paid to the dynamic nature of ship manoeuvres, the utilisation of only ship attributes to detect near misses and the in-adequate attention paid to multi-vessel encounters.

Therefore, this thesis proposes a framework for near miss detection from AIS data based on ship manoeuvre characteristics. The implementation of this framework is based on the understanding of the process of a navigator formulating and executing her manoeuvre strategy for collision avoidance. This framework enables the consideration of the dynamic nature of ship manoeuvres and the impact of four contributing factors on ship manoeuvres. The framework is applicable for both ship-pair encounters and multi-vessel encounters and is well integrated with the rules in the COLREGs. Under the guidance of this framework, methods for analysing the collision risk represented by ship manoeuvres are developed, and then applied to assess traffic risk in the Northern Baltic Sea. The dangerous waters with high risks of ship collisions in the Northern Baltic Sea are identified and found to be highly consistent with those dealt with in other similar works in terms of the occurrence position and frequency/possibility of dangerous encounters. The results also call for more attention to be paid to the waterway crossing between Stockholm and Turku as many serious encounters were detected there. In addition, the results identify traffic complexity as one of the direct causes of serious encounters. The findings of this thesis contribute to the development of an intelligent traffic supervision system and decision support system to enhance maritime traffic safety.

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