Accuracy and Quality Assessment of Various Digital Road Maps for Wrong-Way Driving Detection on German Autobahn

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Key words: Geoinformation/GI; GNSS/GPS; Positioning; Valuation; digital road map; geometric accuracy; completeness; map matching algorithm; vehicle trajectory; wrong-way driving

SUMMARY

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Wrong-Way Driving Detection on German Autobahn

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Digital road maps that are navigable and contain detailed traffic-specific and environmental information like the lane curvature or the lane width contribute significantly to improving the performance and the reliability of many advanced driver assistance and safety systems. In the last two decades, both the quality assessment of various digital road map data and the development of novel map matching technologies are becoming increasingly important and popular issues, particularly for safety-critical applications, such as control system of automobiles, trains or ships. With the rapid development of digital road maps over the years, current quality-assured digital road

g, a valid, reliable and comprehensive quality assessment of digital road maps from four different data providers (two commercial mapmakers: HERE and TomTom; the volunteered geographic information: OpenStreetMap data; the German official topographic-cartographic information system: ATKIS-Basis-DLM) is performed with proposed quality criteria in this work. It aims to investigate the use potential of these digital road maps for preparation and development of an intelligent wrong-way driving detection system. The quality criteria utilized for evaluation of geometric accuracy (absolute and relative positional accuracy) of the map data are presented in this work. Moreover the attribute completeness of each dataset is compared and discussed with prominent examples.

The results show that the map data which have been analyzed can provide completely the level of accuracy specified in the current literature. The investigated map data have achieved 2 m RMS absolute positional accuracy and 1 m RMS relative positional accuracy. It can also be demonstrated that HERE and TomTom have a higher completeness of traffic-related attributes, particularly the travel direction and the number of lanes, and hence are more compliant with road safety applications than OpenStreetMap and ATKIS-Basis-DLM.

Keywords— digital road map, geometric accuracy, completeness, map matching algorithm, vehicle trajectory, wrong-way driving.
