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

Jinyue Wang, Martin Metzner and Volker Schwieger (Germany)

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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Jinyue Wang, Martin Metzner, Volker Schwieger

Institute of Engineering Geodesy,

University of Stuttgart, Germany

Email: {jinyue.wang, martin.metzner, volker.schwieger}@ingeo.uni-stuttgart.de

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
gometric 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.