ABSTRACT

A PHOTOGRAMMETRIC APPROACH FOR GEOPOSITIONING OPENSTREETMAP ROADS

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As open source volunteered geographic information continues to gain popularity, the user community and data contributions are expected to grow, e.g. CloudMade, Apple, and Ushahidi now provide OpenStreetMap© (OSM) as a base layer for some of their mapping applications. This, coupled with the lack of cartographic and data quality standards and the expectation to one day be able to use this vector data for more geopositionally sensitive applications, like GPS navigation, leaves potential users and researchers to question the accuracy of the database. This research takes a photogrammetric approach to determining the positional accuracy of OSM road features using stereo imagery and a vector adjustment model. The method applies rigorous analytical measurement principles to compute accurate real world geolocations of OSM road shape points. After adjustment, the absolute positional accuracy of a road vector can be described by the Root Mean Square Error (RMSE) value of the shape point residuals. In addition, adjusted shape point locations and the statistical confidence in those positions (CE/LE

90) are computed. It is also suggested that once this information is known about the vector data, it should be carried along with and recorded as an attribute at the feature level, thereby providing useful provenance and increasing the overall utility of the database.

To demonstrate the proof-of-concept, several roads from the OSM database were used to compute positional accuracy. The results indicate that the proposed vector adjustment model can successfully predict the real world positional accuracy of roads in a geographic database, with recovery rates ranging from 94% to 99% when comparing the tested accuracy to that established by high order geodetic survey (ground truth), while post adjustment RMSE values improved from 77% to 98%. Since ground control points (GCP's) are used as absolute control in the adjustment, an investigation was conducted into how many GCP's are required to estimate the true positional accuracy and how the configuration of the GCP's in relationship to the tested vectors affects the outcome. The results show that only 3 GCP's are needed to produce accurate results, while their location only slightly affects the estimates coming out of the adjustment. To demonstrate a practical application a head-to-head comparison between OSM, the USGS National Map (TNM), and TIGER 2007 roads was performed to determine which database is the most positionally accurate over the area of interest. The results show the RMSE values of the adjustment residuals for the shape points in the test area to be 2.89 meters for the TNM, 4.35 meters for the OSM, and 19.17 meters for the TIGER 2007.