Assessing the quality of open spatial data for mobile Location-based Services research and applications

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New trends in GIS such as Volunteered Geographical Information (VGI), Citizen Science, and Urban Sensing, have changed the shape of the geoinformatics landscape. The first mashups with Google Maps API in 2005 delivered the first web applications where it was possible that the user could add their own geographical content to maps. The success of mixing web-based mapping and GIS with user generated spatial content has been phenomenal and Hudson-Smith et al. (2009) remarks "Volunteered Geographic Information (VGI) is revolutionizing the way in which maps are created and used". In our research at the National University of Ireland Maynooth we have witnessed this change in the GIS landscape since the beginning of our research in 2008/2009. During this time we could not use proprietary geodatabases or cartographical products in our research into areas such as: pedestrian navigation, progressive transmission of spatial data, visualisation of environmental data on web maps. They key obstacle was prohibitive costs and license issues. However the OpenStreetMap (OSM) project provided us with an exciting, evolving, free and open solution as a base dataset for our geoserver and spatial data provider for our research. OSM is probably the best known and best supported example of VGI and user generated spatial content on the Internet.

We carried out an OSM mapping campaign of our university campus and surrounding town in Maynooth. Due to resource limitations we mapped approximated an area of about five square kilometers. This area was sufficient for our testing and research purposes. Ironically this reflects one of the prominent quality issues in OSM. In his evaluation of OSM quality issues Haklay et al. (2010) mentions that "VGI datasets must be approached as heterogeneous datasets that should be evaluated locally and not globally". This is certainly true of our contribution to OSM. The surrounding areas of Maynooth, outside the range of our mapping campaign, are poorly mapped. The quality of the Maynooth OSM database is good. We are using this database for a number of projects in mobile Location-based Services. Zheng at al. (2010) reports on development of a mobile routing application (Windows Mobile) based on OSM data and the PostGIS PGRouting library. Jacob et al. (2010) reports on development of pedestrian navigation applications (on Android platforms) using Haptic feedback (vibrations) from the mobile device. Our work in Ciepłuch et al. (2009,2010) generate sets of customised tiles which can be used by these mobile applications. Spatially and temporally accurate data is an essential requirement for these mobile application development projects. While we are confident that the area mapped by us has both good fitness for propose quality and spatial accuracy we cannot be certain about the rest of OSM Ireland or other locations where our applications could potentially be deployed.

In this paper we will describe current results from the development of quality indicators or measures for OSM data. Initially we have analysed the Ireland OSM data in grid cells (5KM) to gather statistical data about the completeness, accuracy, and fitness for purpose of the underlying spatial data. This analysis included: density of user contributions, spatial density of points and polygons, types of tags and metadata used, dominant contributors in a particular area or for a particular geographic feature type, etc. There greatest OSM activity and spatial data density is highly correlated with centres of large population. There is much "white-space" on the map – the consistency of spatial data completeness is poor, particularly for rural areas. We are extending this analysis to other European countries. This will be performed on a high performance server as some of the spatial queries are computationally intensive. The ultimate outcome of this work will be an algorithm or set of algorithms which can assess the quality or usability of OSM data for a given region by analysing: how the data was collected and contributed, the types of edits (corrections,

deletions, additions) that took place on the data, the annotation and documentation of the geographic features (metadata), and overall completeness and coverage. The ability to quantify and assess if VGI, such as OSM, is of sufficient quality for mobile mapping applications and Location-based services is critical to the future success of VGI as a spatial data source for these technologies.

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