Using Volunteered Geographic Information to help Land Use/Land Cover mapping

Jacinto Estima

Instituto Superior de Estatística e Gestão de Informação, Universidade Nova de Lisboa, Campus de Campolide, 1070-312 Lisboa, Portugal
Email: jacinto.estima@gmail.com

1. Introduction

Land Cover mapping plays a very important role in a vast number of research fields (Fritz et al. 2009). Its production is based on imagery interpretation and classification made by highly trained and skilled people, but in some areas the use/cover characteristics are difficult to identify and observations in the field are needed. Once this is a very expensive and time-consuming task, Land Cover mapping becomes more focused on the most important themes and those with multiple applications, leaving behind those considered “less important”. The time between updates or new productions is also a critical factor, but once more, as a consequence of production costs, it is stretched and the maps become outdated quickly (Goodchild 2008).

Since 2005, with the introduction of the Web 2.0, the spatial data produced by volunteers became exponentially available over the Web. This production relies on the increase of the availability of positioning equipment at a lower cost, better and free imagery of the world, among others, and the willingness of private citizens to contribute for various reasons. The produced data is of very different nature but one of the most important characteristics is the local knowledge of its local contributors that know their surroundings better than any outsider. Why not try to use such data in the process of Land Cover mapping and try to reduce the cost and time consumption of its production?

There are some challenges regarding the use of data with such characteristics because of its heterogeneity, quality control and metadata absence, among other issues. Some of these can be minimized or even solved through the development of tools that provide mechanisms to avoid some types of errors. The integration of data from different sources and schemas it is also a very challenging problem. This leads us to the importance of creating a very robust data model/system able to manage properly this type of data.

This work aims at developing a methodology to use VGI data to help the production of Land Cover maps, reducing its costs and time-consumption.

2. Literature review

Geographic Information (GI) has been produced by mapping agencies and corporations and sold to users as paper maps or atlases (Goodchild and Glennon 2010). This approach is very expensive since it requires highly trained and skilled people as well as expensive precision equipment and procedures, favouring thus the most important and unchanging geographic themes and those with more applications (Goodchild 2008).

The development and introduction in 2005 of Google Maps and its Applications Programming Interface (API), a technology aligned with the Web 2.0, have made a revolution providing users with the possibility of embed its own varieties of Google Maps in their web pages (Batty et al. 2010). This along with the availability of cheaper positioning devices
combined with camera and mobile or smart phones, fine resolution imagery, broad band communications, among other improvements, is empowering citizens to produce and share their own maps (Elwood et al. 2011, Heipke 2010).

Terms like Neogeography (Turner 2006), Volunteered Geographic Information (VGI) (Goodchild 2007) and Crowdsourcing geospatial data (Hudson-smith et al. 2008), despite some differences (Elwood et al. 2011), are all related with a type of User Generated Content (UGC) that deals with spatial content and refers to volunteers and large groups of people, sometimes acting like a crowd, often without expertise, contributing with spatial data to the “community”, a function that for centuries has been reserved exclusively to official agencies.

The participation and contribution of citizens in this filed is not new. Some initiatives were held by volunteers in the 1930s, 1970s or 1990s (Elwood et al. 2011, Heipke 2010). The key difference after Google Maps and the Web 2.0 is that several VGI projects were started and have been contributing to the increasingly amount of available spatial data over the Web. In 2009, an inventory made by Elwood et al. (2011) counted ninety-nine VGI initiatives, 70 percent of them started in 2005 or later, such as Wikimapia, Flickr, OpenStreetMap (OSM), Panoramico and Degrees Confluence Project, among others.

In 2007, Google launched MyMaps, allowing users to create lines and shapes, embedding text, photos and videos with a simple drag and drop interface. Hudson-Smith et al. (2009) argue that this was probably one of the most important innovations in mapping since the development of GIS. The Centre for Advanced Spatial Analysis (CASA) has also developed a set of tools such as Google Map Creator (GMapCreator), London Profiler website and Map Tube (Hudson-Smith et al. 2009). The HD TrafficTM initiative from TomTom aims at providing instant information about traffic to its customers (Heipke 2010).

These interesting and important initiatives demonstrate the exponential growth of spatial data availability over the web. How can we integrate this kind of data with authoritative data to fill gaps in spatial data infrastructure augmenting, updating, or completing it (Elwood 2008a, Goodchild and Glennon 2010, Heipke 2010, Sui and Goodchild 2011)? Are the existing structures and practices for spatial data collection, retrieval, validation, and dissemination appropriate in this new context (Elwood 2008b)? What types of geographic information are the most suited for acquisition through the efforts of volunteers (Goodchild and Glennon 2010)? These questions are a small set of issues related with the acquisition, integration and management of spatial data regarding the production of Land Cover maps.

Some initiatives have been developed in the particular domain of Land Cover mapping. Geo-Wiki.Org is one of those projects, described as a global network of volunteers who wish to help improving the quality of global land cover maps (Fritz et al. 2009). The Virtual Interpretation of Earth Web-Interface Tool (VIEW-IT) for Collecting Land-Use/Land-Cover (LULC) Reference Data is another initiative based on the GE high resolution imagery (Clark and Aide 2011).

3. Hypotheses and Methodology

From the problem stated, the following hypothesis can be formulated: It is possible to build a platform that can integrate VGI data from different sources, in different formats, and use it to help in the production of Land Cover maps.

The approach starts firstly by an in-depth study of VGI acquisition and management, and Land Cover data production. It proceeds analysing the data produced by VGI initiatives and the tools used to produce it, once the tools used to collect data can provide ways to avoid some kind of errors.
According to the evaluation results from the previous points, the next step is to develop a new data model/system and new tools to enable the integration and management of VGI data from different sources and in different formats considering the possibility of using it in the production of Land Cover maps. Finally the obtained results and tools will be analysed and evaluated under a real environment.

4. Expected results

With this work it is expected that VGI data from different sources and formats can be properly integrated and managed to be used in the production of land cover data. The development of a methodology and a data model along with the right tools that provide such integration and management are also expected.

References


Elwood S, 2008a, Volunteered geographic information: future research directions motivated by critical, participatory, and feminist GIS. *GeoJournal*, 72(3-4), 173-183. doi:10.1007/s10708-008-9186-0


