Foreword

Special Issue: Geographic Object-Based Image Analysis (GEOBIA)
by Geoffrey J. Hay and Thomas Blaschke

From global climate change to natural disaster response and national defense, remote sensing has provided critical information on vast areas of the Earth’s surface for over 30 years, and continues to do so today. Daily, terabytes of data are acquired from space- and air-borne platforms, resulting in massive archives with incredible information potential; however it is only recently that we have begun to mine the spatial wealth of these archives. In essence, we are data rich, but geospatial information poor. In most cases, data/image access is constrained by technological, national, and security barriers, and tools for analyzing, visualizing, comparing, and sharing these data and their extracted information are still in their infancy. Furthermore, policy, legal, and remuneration issues related to who owns (and are responsible for) value-added products resulting from the original data sources, or from products that represent the culmination of many different users input (i.e., citizen sensors) are not well understood and still developing. Thus, myriad opportunities exist for improved geospatial information generation and exploitation.

Over the last decade a quiet paradigm shift in remote sensing image processing has been taking place that promises to change the way we think about, analyze and use remote sensing imagery. With it we will have moved from more than 20 years of a predominantly pixel-spectra based model to a dynamic multiscale object-based contextual model that attempts to emulate the way humans interpret images (Hay and Castilla, 2008). However, along this new path from pixels, to objects, to (geo-)intelligence and the consolidation of this new paradigm, there are numerous challenges still to be addressed (Hay and Castilla, 2006). In an effort to better identify these challenges and their potential solutions the international conference GEOBIA, 2008 – Pixels, Objects, Intelligence: Geographic Object Based Image Analysis for the 21st Century was held at the University of Calgary, Alberta, Canada, 05–08 August, 5–8 in partnership with the Canadian Space Agency, the American Society for Photogrammetry and Remote Sensing (ASPRS), and the International Society for Photogrammetry and Remote Sensing (ISPRS). In total, 137 participants from 19 different countries attended this conference that included eight industry led workshops, three keynote addresses, and 65 regular oral presentations. A special joint session titled “GEOBIA in Support of Government of Canada Needs” was also held, as were poster sessions and a student award for best paper/presentation. A key objective of the conference was to facilitate a forum for this growing international community, and to share in the latest developments of GEOBIA theory, methods, and applications. Our theme — “Pixels, Objects, Intelligence: Geographic Object-Based Image Analysis for the 21st Century” was intended to highlight this goal, as well as the evolution of this new discipline. GEOBIA (pronounced ge-o-be-ah) is a sub-discipline of GIScience devoted to developing automated methods to partition remote sensing imagery into meaningful image-objects, and assessing their characteristics through scale (Hay and Castilla, 2008). Its primary objective is the generation of geographic information (in GIS-ready format) from which new geo-intelligence can be obtained (Hay, 2008). Here, geo-intelligence is defined as geospatial content in context.

Interest in GEOBIA is worldwide and rapidly evolving. GEOBIA 2008 built upon the success of OBIA 2006 (Lang et al., 2006) — the 1st International Conference on Object Based Image Analysis — held in Salzburg Austria, which was attended by over 120 participants from 24 different countries. An edited book (Blaschke et al., 2008) was published from extended peer-reviewed OBIA 2006 conference papers, and OBIA and GEOBIA Wikis have been developed to facilitate community interaction with over 20,000 combined views (Wiki, 2009). More recently, Blaschke (2009) conducted a comprehensive literature review, analyzing more than 820 OBIA/GEOBIA related articles (comprising 145 journal papers, 84 book chapters, and nearly 600 conference papers). From this review, it is evident that the early developmental years of OBIA/GEOBIA were characterized by a dominance of grey literature; however, over the last four to five years the number of peer-reviewed journal articles has increased sharply. This suggests that an image-processing paradigm shift is indeed taking place within the remote-sensing community. Similarly, GEOBIA 2008 website statistics (from 12 April 2007–05 August 2008) revealed 58,623 conference page views from all over the world (Figure 1). Specifically, these views represent 17,209 visits from 5,865 individuals in 111 different countries/territories spread over 1,647 unique cities.

Figure 1. GEOBIA 2008 web statistics, showing examples of major page- view locations from around the world (Source: Google Statistics)

In order to provide greater dissemination of the information shared during GEOBIA 2008, conference proceedings (Hay et al., 2008) are freely available from two online sources1. In addition, three new peer-reviewed GEOBIA related special journal issues are either underway (Alpin and Smith, 2010) or in preparation (Johansen and Bartolo, 2010; Addink, 2011). We also note that GEOBIA 2010 will be held (29 June–02 July, 2010) in Ghent, Belgium (http://geobia.ugent.be/), with planning already in-progress for GEOBIA 2012.

In support of the GEOBIA 2008 conference theme, this special issue is composed of three main areas: We begin with two papers representing the pixel theme. Johansen et al., present a comparison of geo-object- and pixel-based change detection applied to a high-resolution multispectral forest scene, followed by Kim et al., describing two studies that illustrate the importance of incorporating both spectral and non-spectral ancillary data for GEOBIA vegetation classifications from very high resolution (VHR) imagery. Within the object theme, Lizarrazo and Barros present a new fuzzy

1. Two online archives of GEOBIA 2008 proceedings may be found at (http://www.ucalgary.ca/geobia/Publishing) and (http://www.isprs.org/publications/archives.aspx) (last date accessed 02 December 2009).
image segmentation method for urban land-cover classification, followed by Smith, who argues for incorporating and exploiting existing digital cartography within the GEOBIA framework. This leads to a related study by Radoux and Defourny who describe an automated GEOBIA method to detect discrepancies between an existing (vector) forest map and a VHR image. The final theme is intelligence — referring to geo-intelligence — which denotes the “right (geographically referenced) information” (i.e., the content) in the “right situation” so as to satisfy a specific query or queries within user-specified constraints (i.e., the context). The first paper in this section by Moreno et al., describes a novel geographic object-based vector approach for cellular automata modeling to simulate land-use change that incorporates the concept of a dynamic neighborhood. This represents a very different approach for partitioning a scene, compared to the commonly used GEOBIA segmentation techniques, while producing a form of temporal geospatial information with a unique heritage and attributes. The final paper by Tiede et al., presents a fully operational workflow for the modeling of 31,698 biotope complexes at the regional level with geo-objects and a-priori knowledge. It represents one of the few published (to date) methodologically sound, yet operational and transferable, approaches to semi-automatically delineate biotope complexes.

Due to publication limitations, we regret that a number of very worthy manuscripts were unable to be included in this special issue. Initially 21 papers were submitted, only seven have been published. Our objective in selecting these papers is to provide a broad and relatively comprehensive sample of the many different kinds of research topics that are being addressed with Geographic Object-Based Image Analysis. We also wish to thank the 54 reviewers involved in the double- (and sometimes triple-) blind review process, whose comments have enhanced the high quality contributions found in this special issue. For those seeking additional resources, we invite you to further peruse the OBIA 2006 and GEOBIA 2008 proceedings, to sample the 43 chapters of the recent book by Blaschke et al., (2008) and to join us in Ghent, Belgium for GEOBIA 2010.

References


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