GEOgraphic Object Based Image Analysis (GEOBIA): Developing a New Sub-Discipline in GIScience

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Abstract

We introduce to the SKI-Canada community a recently proposed and rapidly evolving sub-discipline in GIScience referred to as *GEOgraphic Object Based Image Analysis* (GEOBIA). We further provide a background on its development, report on the first International GEOBIA Conference (held in Calgary Alberta August 05-08, 2008 - in partnership with the CSA, ASPRS and ISPRS), and outline a plausible path ahead.

Background and Relevance

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 we have only just begun to mine the wealth of these archives. Essentially we are data rich, but information poor. In most cases, data/image access is constrained by technological, institutional, and political barriers. Additionally 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 either the original data sources, or from products that represent the culmination of many different users input (i.e., the web) are not well understood and still developing.

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. However, along this new path from pixels, to objects, to intelligence and the consolidation of this new paradigm, there are numerous challenges still to be addressed. In an effort to identify these challenges and potential solutions the international conference titled *GEOBIA, 2008 - Pixels, Objects, Intelligence: Geographic Object Based Image Analysis for the 21St Century* was held at the University of Calgary, Alberta, Canada August, 5-8, 2008. A key objective of this event was to facilitate a forum for this growing international community to share in the latest developments of GEOBIA theory, methods and applications so as to more intelligently exploit remote sensing imagery.

GEOBIA (pronounced *ge-o-be-uh*) is a sub-discipline of GIScience devoted to developing automated methods to partition remote sensing imagery (of our planets surface) into meaningful image-objects, and assessing their characteristics through scale. Its primary objective is the generation of geographic information (in GIS-ready format) from which new *geo-intelligence* can be obtained (Hay and Castilla, 2008). Interest in GEOBIA is world wide. Based on Google statistics for the GEOBIA website

(April 12 2007- August 05, 2008) it shows 58,623 page views - representing 17,209 visits from 5865 unique visitors originating in 111 different countries/territories and 1647 individual city locations throughout the planet. Furthermore, a total of 137 participants from 19 different countries attended this conference and workshops over the 4-day period that featured three keynote addresses, more than 63 regular oral presentations in three concurrent sessions, poster sessions and a student prize award for best paper (provided by the Canadian Remote Sensing Society). Eight industry workshops were held along with a special session entitled *'GEOBIA in Support of Government of Canada Needs*'. GEOBIA 2008 was co-organized 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). Conference proceedings will be linked with ISPRS Commission IV – Geodatabases and Digital Mapping to provide literary/scientific standards and online access. A GEOBIA special issue of the ASPRS Journal *Photogrammetric Engineering and Remote Sensing* (*PE&RS*) featuring selected full papers from GEOBIA 2008 will be published in 2009, and a GEOBIA wiki (with over 6000 views) can be found at (http//wiki.ucalgary.ca/page/GEOBIA).

Discussion

In his concluding keynote remarks G.J. Hay noted that while the "I" in GEOBIA currently represents the word 'image', it could also be used to represent other key components of this evolving discipline that need to be met in order to truly realize its potential; namely (i) *Intelligence Acquisition* – in this case 'geo-spatial content in context'; (ii) *Identification* – of scene features based on shared user-defined feature libraries; (iii) *Interpretation* – based on shared semantic and network models; (iv) *Integration* – a common ontology is required allowing for its diverse members to communicate across different geo-data-base architectures; (v) *Innovation* – a Transdisciplinary approach to tool/method development, drawing upon numerous innovations in other fields including computer vision, biomedical imaging etc; (vi) *Images* rather that 'Image', indicating the need for multiscale image analysis (in time, space, spectra, etc) and the hierarchical mechanisms to support and exploit them.

Conclusions

GEOBIA is a recent sub-discipline of GIScience devoted to developing automated methods to partition remote sensing imagery into meaningful image-objects, and assessing their characteristics through scale. Its primary objective is the generation of geographic information (in GIS-ready format) from which new *geo-intelligence* can be obtained. In this presentation, we report on the first International GEOIBA conference tilted: *GEOBIA, 2008 – Pixels, Objects, Intelligence. Geographic Object-Based Image Analysis for the 21st Century* and outline key components to meet its potential.

References

Hay, G. J., and G. Castilla, 2008. Geographic Object-Based Image Analysis (GEOBIA): Paradigm shift or new methods? In T. Blaschke, S. Lang and G.J. Hay. 2008. (Eds). Series: XVII Lecture Notes in Geoinformation and Cartography. Springer-Verlag, pp 818, p304 illustrations with CD-ROM, ISBN: 978-3-540-77057-2 (http://www.springer.com/978-3-540-77057-2)