Foreward for the GEOBIA Special Issue

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During the last decades the remote sensing community has witnessed major advances in almost every aspect related to this science, including, sensor capabilities, algorithms and methods, information and communication technology, as well as policies and regulations related to the generation and distribution of remote sensing products. Undoubtedly, a major step forward was the launch of the Ikonos satellite, providing unprecedented object resolving capability from an altitude of 681 kilometers.

This major event opened a new era in image analysis. The improved sensor characteristics fostered the introduction of spatial and geographical concepts into the classification process in order to formulate meaningful image objects (Blaschke and Strobl, 2001). The dominant-till-then pixel-centric approach was also criticized by Hay *et al.* (2001) who suggested a multiscale framework for analysis of high spatial resolution remote sensing data by incorporating an object-specific approach in order to overcome the 'H-Resolution' and MAUP problems.

From this point onward, a significant part of the remote sensing community gradually focused on image-objects instead of pixels for extracting and delivering information related to: land use and land cover (Myint *et al.*, 2011; Salehi *et al.*, 2013), forests (Chubey *et al.*, 2006; Mallinis *et al.*, 2008), rangelands (Laliberte *et al.*, 2007), forest fires (Gitas *et al.*, 2004; Mitri and Gitas, 2004), natural disaster management (Gitas *et al.*, 2008; Mallinis *et al.*, 2013; Stumpf and Kerle, 2011; Tiede *et al.*, 2011), invasive species detection (Xie *et al.*, 2008), and residential waste heat monitoring (Hay *et al.*, 2011) among others.

This shift in image analysis, termed 'Object-Based Image Analysis (OBIA)' or as proposed later by Hay and Castilla (2008) 'Geographic Object-Based Image Analysis (GEOBIA)' successfully managed to bridge the spatial concepts applied in multiscale landscape analysis, Geographic Information Science and the synergy between image-objects and their radiometric characteristics and analyses in EO data (Blaschke, 2010). The rate of the shift was affected from technology developments such as hardware and software evolution, facilitating the resource demanding GEOBIA processes.

Today, after years of sharp evolution, Geographic Object-Based Image Analysis is considered as a new and evolving paradigm (Blaschke *et al.*, 2014). Yet, the most important achievement is that within the last two decades and through various conceptual developments, GEOBIA has gained wide popularity and attracted the interest of both the scientific and professional communities for its efficiency to provide enhanced and reliable geospatial intelligence.

Given its growing success and the needs of the remote sensing community GEOBIA faces new challenges in order to become a dominant paradigm in image analysis. GEOBIA will have to serve the trend of processing ever more accurate measurements of the Earth's surface, in space and time. The spatial, spectral, radiometric, and temporal characteristics of the current and forthcoming sensors have further raised the expectations and demands of users for high level, accurate and timely information related to the state and the processes of the environment. The relentless advance of computer and processing technology that provides an ever increasing ability to acquire, store, access, and process large image datasets, will also impose the need to process massive archives with incredible information potential, available in various cloud-based data repositories.

The increased availability and the wide range of Earth Observation and geospatial data, as well as the establishment of global initiatives such as the Global Earth Observation System of Systems (GEOSS), is expected to further stimulate evolvement and spread of the GEOBIA paradigm not only among the Remote Sensing and GIScience communities but to a broad array of earth-related disciplines.

Among the drivers of evolution and establishment of the GEOBIA paradigm, the bi-annual international conferences devoted exclusively to Geographic Object-Based Image Analysis, have played and continue to play an outstanding role. The latest forum of this kind, GEOBIA 2014, was held in Thessaloniki, Greece from 21 to 24 May 2014. The conference that was hosted by the Laboratory of Forest Management and Remote Sensing, Aristotle University of Thessaloniki (AUTH), was organized in collaboration with the Interbalkan Environment Center (i-BEC) and the Democritus University of Thrace (DUTH).

GEOBIA 2014 was the fifth conference in the series following the successful OBIA International conference held in Salzburg, Austria (2006), GEOBIA 2008: Pixels, Objects, Intelligence: Geographic Object-based Image Analysis for the 21st Century, hosted in Calgary, Canada (2008), GEOBIA 2010, held in Ghent, Belgium (2010), and GEOBIA 2012, hosted in Rio de Janeiro, Brazil (2012) which have all provided the impetus for much progress in Geographic Object-Based Image Analysis.

GEOBIA 2014 eventually gathered over 230 contributors from 41 countries, five keynote addresses, two industry led workshops, one special session on ontologies (co-organized with IRD-ESPACE-DEV), and a roundtable with renowned experts representing international associations, academic, industry, public sector, and governmental organizations. Both oral and poster contributions presented the most recent evolutions on conceptual and methodological aspects of geographic object-based image analysis as well as innovative applications over a broad spectrum of domains. GEOBIA 2014 verified the progress and the growing interest in geographic object-based image analysis, as it is also demonstrated by the increasing number of high-quality peer-review manuscripts appearing in the literature, and the recent development of GEOBIA-related (open source/commercial) software packages.

It should be noted that extended abstracts of the works presented at GEOBIA 2014 were included in a special issue of the South-Eastern European Journal of Earth Observation and Geomatics (*http://ejournals.lib.auth.gr/seejeog/issue/view/726*) while the short versions of the abstracts were included in the conference abstract book.

As a continuum to GEOBIA 2014, all conference participants were invited to submit a paper to this special issue. As a result, twenty-seven very interesting manuscripts from authors located in all five continents were submitted. Seventy-six colleagues, to whom we are indebted, assisted with the double-blind review process which resulted in the selection of the seven articles to be included in this publication. These are briefly discussed below:

In the field of quantitative segmentation evaluation, Costa *et*

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al. present a new method for image segmentation quality assessment, which combines a traditional geometric-only method with the thematic similarity index; a metric that expresses the degree of thematic quality of objects from a user's perspective. Their approach allows the assessment to be tailored to the needs of the specific user.

In regard to image segmentation, Zhang *et al.* present an approach for dynamically determining scale parameters during segmentation procedure, making scale parameters adaptive to specific images and cover meaningful segmentation scales. The experimental results on a set of high spatial resolution images proved the effectiveness of an adaptively increased scale parameter on controlling multi-scale segmentation.

Doxani *et al.* address the change detection potential of GEOBIA, focused on urban setting, using only available building footprint information and a single very high-resolution multispectral image. Their object-based classification methodology employs advanced scale-space filtering, unsupervised clustering and knowledge-based classification.

Anders *et al.* assess automation potential of classification procedures and develop a transferable rule set for the extraction of glacial cirques, employing data fusion of lidar data and color-infrared orthophotographs. The rule set was developed and applied in areas that are positioned in different altitudinal zones in western Austria.

Related to automation and knowledge exchange Argyridis and Argialas propose the SPatial Ontology Reasoner (SPOR), which allows a time efficient development of GEOBIA ontologies by employing fuzzy, spatial and multiscale representations. They demonstrate their approach in building extraction using a QuickBird image.

Heenkenda et al. present an interesting study, comparing different approaches for mangrove tree crowns isolation based on data fusion of multispectral imagery from WorldView-2 and a digital surface model extracted from aerial photography. They identified increased accuracy in extracting tree crowns when incorporating the height information next to the spectral information of the remote sensing datasets.

Finally, Mitri *et al.* develop a model using a variety of geospatial biophysical and climatic data for estimating wildfire hazard over Lebanon.

For those seeking additional GEOBIA related resources, we invite you to access the proceedings of previous conferences (Blaschke *et al.,* 2008) as well as the special issues resulted from previous GEOBIA conferences (Hay and Blaschke, 2010) (Addink *et al.*, 2012). Finally, we would like to close this foreword by informing our readers that the next GEOBIA conference will be hosted in 2016 by the University of Twente, Faculty of Geo-Information Science and Earth Observation (ITC), Enschede, The Netherlands.

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