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Geoffrey J. Hay (eds.):

Object-Based Image Analysis –
Spatial concepts for knowledge-
driven remote sensing applications

Preface

This book brings together a collection of invited interdisciplinary perspectives on the recent topic of *Object-based Image Analysis* (OBIA). Its content is based on select papers from the 1st OBIA International Conference held in Salzburg in July 2006, and is enriched by several invited chapters. All submissions have passed through a blind peer-review process resulting in what we believe is a timely volume of the highest scientific, theoretical and technical standards.

By way of a brief overview, the concept of *OBIA* first gained widespread interest within the GIScience (Geographic Information Science) community circa 2000, with the advent of the first commercial software for what was then termed ‘object-oriented image analysis’. However, it is widely agreed that OBIA builds on older segmentation, edge-detection and classification concepts that have been used in remote sensing image analysis for several decades. Nevertheless, its emergence has provided a new critical bridge to spatial concepts applied in multiscale landscape analysis, Geographic Information Systems (GIS) and the synergy between image-objects and their radiometric characteristics and analyses in Earth Observation data.

Over the last year, a critical online discussion within this evolving multidisciplinary community – especially, among the editors – has also arisen concerning whether or not *Geographic space* should be included in the name of this concept. Hay and Castilla argue (in chapter 1.4) that it should be called “Geographic Object-Based Image Analysis” (GEOBIA), as only then will it be clear that it represents a sub-discipline of GIScience. Indeed, the term *OBIA* may be too broad; for it goes without saying for Remote Sensing scientists, GIS specialist and many ‘environmental’ based disciplines, that ‘their’ image data represents portions of the Earth’s surface. However, such an association may not be taken for granted by scientists in disciplines such as Computer Vision, Material Sciences or Biomedical Imaging that also conduct OBIA. Because this name debate remains ongoing, we have chosen for this book to build on key OBIA concepts so as to lay out generic foundations for the continued evolution of this diverse community of practice. Furthermore, by incorporating a GEOBIA chapter in

this volume, we pave the road ahead for the GEOBIA 2008 conference at the University of Calgary, Alberta Canada.

Our primary goal in this book is to unveil the concept of OBIA as applied within a broad range of remote sensing applications. Consequently, the first five chapters focus on fundamental and conceptual issues, followed by nine chapters on multiscale representation and object-based classification. These nine chapters include specific aspects such as the incorporation of image-texture, key pre-processing steps and quality assessment issues. The latter being a hot research topic that is repeatedly tackled within the application centric contributions, as well as in the last section on research questions. Since most members of this community are already actively engaged either in OBIA method development or their operationalization, we only briefly address the theoretical scientific discourse regarding whether or not OBIA should be considered a paradigm shift according to Kuhn's definition.

The contributions in the first two sections explore and guide application driven development by explaining this new technological and user driven evolution in remote sensing image analysis as it moves from pixels to objects, and the software and infrastructure required to generate and exploit them. Notwithstanding this message, we suggest that the ultimate aim of OBIA should not be to focus on building better segmentation methods, but rather to incorporate and develop *geographic-based intelligence* i.e., appropriate information within a geographical context, and all that this implies to achieve it.

Another critical topic is the automation of image processing. Strongly related to the advent of high-resolution imagery, papers in these sections discuss automatic object delineation. Automated object-recognition is certainly an end goal. Realistically, it is at the moment mainly achieved stepwise, either with strongly interlinked procedures building workflows or with clear breaks in these workflows. In both cases the steps involve addressing various multiscale instances of related objects within a single image (i.e., individual tree crowns, tree clusters, stands, and forests). Several contributions also deal with object- and feature recognition and feature extraction which, though intrinsically tied to OBIA – in the majority of applications – are not an end in itself.

The 18 chapters of Sections 3, 4, 5 and 6 are dedicated to automated classification, mapping and updating. This wide range of applications is structured through four main fields, namely (i) forest, (ii) environmental resource management and agriculture, (iii) land use / land cover, and (iv) urban applications. The final two sections are more technical / methodological. The six chapters of Section 7 cover developments of new method-

ologies while the book closes with another five chapters on critical research questions, research needs and an outlook to the future.

This volume was planned as a coherent whole. The selection of submitted contributions was based on their quality, as well as on the overall design and story we wanted to present. Of course, due to the rapidly evolving nature of OBIA, this tome cannot be considered truly ‘complete’. While there are certainly technical and methodological issues as well as application fields which have not been addressed, this book does represent the first comprehensive attempt to synthesize OBIA from an international and interdisciplinary perspective without bias to a specific type of image-processing software or earth observation data type.

Finally, this book covers an extremely challenging topic: the Earth’s surface. This complex system can be represented by numerous multiscale image-objects extracted from a plethora of different Earth Observation data types, and yet such remote sensing imagery only indirectly provides clues to its underlying patterns and processes, each of which change with different scales of perception. Yet this linking – between imagery, patterns, process and scale - is exactly what is needed for effective environmental policy support. Only when the complex fabric of our planet can be segmented ‘appropriately’ and in a transparent and repeatable way, will we achieve ‘geo-intelligence’. This latter term is currently dismissed widely outside North America since it is associated with the (US) homeland security concept. However ‘geographic intelligence’ is a potential term to describe what OBIA really aims for: using Earth Observation data to delineate and explore the multiscale spatial relationships of appropriately defined image-objects and related ancillary information as they model real-world geographic objects, and provide us new insight to better understand this planet and its function.

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