Foreword to the Special Issue on Urban Remote Sensing

HIS Special Issue presents a collection of papers focusing on the application of remote sensing to urban areas. We present the 28 papers selected, which distill the state of the art and advances in the analysis and use of remote-sensing technologies to describe, understand, and act on cities. This Special Issue follows the Joint Urban Remote Sensing Event (JURSE) held in Lausanne, Switzerland, in 2015. It contains both extended versions of papers presented in JURSE 2015 and also regular papers submitted to JSTARS dealing with the study of urban areas with remote sensing.

With this foreword, we would like to summarize the content of the Special Issue and provide a global view of the papers that constitute it.

Topics represented become wider: The Word Cloud in Fig. 1 summarizes the keywords present in the titles of the papers of the Special Issue. At a first glance, topics of data analysis and image processing, including building detection and urban mapping, cover most of the submissions. This is in line with what is observed in the two previous Special Issues of the J-STARS series related to urban remote sensing [1], [2]. However, a closer inspection revealed other emerging trends that we decided to represent in additional thematic groups: urban heat islands and global studies resorted as new fast moving topics that are becoming prominent in the urban remotesensing community. Summarizing, the Special Issue has been organized into six thematic areas [Fig. 2(a)].

- 1) Processing techniques: object detection and classification (nine papers).
- 2) Processing techniques: three-dimensinsional (3-D), reconstruction, and urban mapping (four papers).
- 3) Risk and postcatastrophe assessment (three papers).
- 4) Global urban studies: population, settlements, and indexing (five papers).
- 5) Energy fluxes and urban heat islands (four papers).
- 6) Multitemporal studies (three papers).

Division between applied and methodological urban remote sensing is fading: If the two first groups are mainly methodological, we see a rising trend of applicative papers. However, unlike in the past, such papers still make use of statistical learning methods to explain trends in time series, access large collections of data, or provide times series used to map human settlements or impervious surfaces at a larger scale. The clear division between the mathematical and applicative sides of urban remote sensing seems to be fading, following the requirements of processing cities as global ecosystems evolving in time. By following this assumption, describing cities

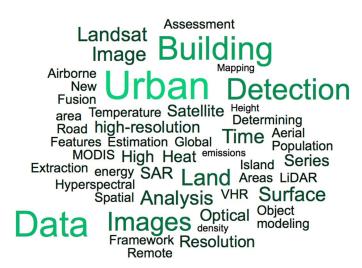


Fig. 1. WordCloud summarizing the titles of the papers in the Special Issue. Size and color relate to the frequency of appearance of the word (created with Worditout.com)

with remote sensing becomes a big data problem that cannot be tackled without advanced processing techniques.

The variety of data types is maintained [Fig. 2(b)], and the trend toward complex fusion techniques is confirmed: Among the papers of the special issue, most contributions considered very high-resolution sensors (13): this is again in line with what was observed in the previous special issues [1], [2] and is a clear signal that a significant part of the community if focusing on precise mapping of urban objects and exploiting the rich geometric information contained in VHR data. It is noteworthy to observe, as mentioned in the analysis of the topics, that a large share of papers considers low-to-medium resolution data, typically acquired by the MODIS (4) and Landsat (9) sensors. This is explained by the strong representation of wide area studies, spanning scales going from the entirety of a city to the globe. Additionally, following another trend observed in the 2012 special issue [1], multimodal studies are strongly pursued, confirming the benefits of observing cities from different points of view such as optical, radar, and LiDAR images, or exploiting vector data, such as census or traffic statistics. Multimodal [3] and multitemporal studies [4] are two of the fast moving topics in remote sensing and urban remote sensing seems to be ready to take advantage of the global and diverse availability of earth observation data. We also observe a substantial number of papers using volunteered geographical data (VGI) to train or validate the proposed model, a trend that is likely to become prominent in the years to come, by the increased availability and trustworthiness of such data sources.

We hope that you will appreciate this Special Issue and find new inspiring ideas. The papers included in this Special Issue

Color versions of one or more of the figures in this paper are available online at http://ieeexplore.ieee.org.

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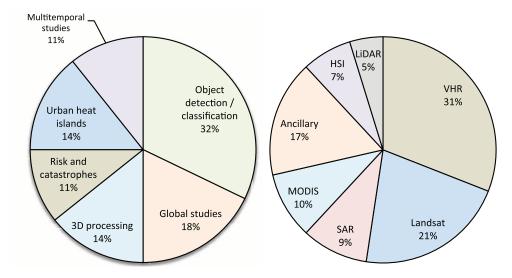


Fig. 2. Left: Distribution of the six thematic areas of the Special Issue. Right: data types used in the submissions.

cover very diverse topics of urban remote sensing and constitute a comprehensive and contemporary snapshot of the research in the field. We are looking forward to monitor the evolution of this field in the years to come, as the pressure on urban areas will certainly increase, thus, calling for new actions for sustainable planning and monitoring from space. The JURSE conference will remain a privileged forum for observing such evolution, and we are already looking forward to the 2017 edition in Dubai, UAE (http://www.jurse2017.com).

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