Foreword to the special issue on Urban Remote Sensing

This 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 observation 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 submission. 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 remote sensing community. Summarizing, the special issue has been organized into to six thematic areas (Fig. 2a):

1. Processing techniques: object detection and classification (9 papers)
2. Processing techniques: 3D, reconstruction and urban mapping (4 papers)
3. Risk and post catastrophe assessment (3 papers)
4. Global urban studies: population, settlements and indexing (5 papers)
5. Energy fluxes and urban heat islands (4 papers)

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6. Multi-temporal studies (3 papers)

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

The variety of data types is maintained (Fig. 2b), and the trend towards 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 form 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 cover very diverse topic of urban remote sensing and constitute a comprehensive, diverse and contemporary snapshot of the research in the field. We are looking forward to monitor the evolution of this
fields 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).

The Guest editors
Devis Tuia, Paolo Gamba, Carsten Juergens and Derya Maktav.

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We would like to thank the authors who submitted their high quality works, as well as the reviewers who committed their time and knowledge to make this special issue happen. We also would like to thank Profs. J. Chanussot and J. Du for welcoming our special issue in JSTARS. And finally, our deepest thanks go to the organizing team of JURSE 2015 (in particular to C. Kaiser, F. Golay, V. Boillat and the volunteers – M. Parkan, N. Rey, D. Marcos, E. Rochat, S. Duruz, T. Produit, S. Joost, M. Bruhin, R. Ceré) for their invaluable help for making JURSE 2015 a great success.

REFERENCES


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)
Devis Tuia S’07–M’09–SM’15) was born in Mendrisio, Switzerland, in 1980. He received a diploma in Geography at the University of Lausanne (UNIL) in 2004, the Master of Advanced Studies in Environmental Engineering at the Federal Institute of Technology of Lausanne (EPFL) in 2005 and a Ph.D. in Environmental Sciences at UNIL in 2009. He was then a visiting postdoc researcher at the University of Valencia, Spain and the University of Colorado, Boulder, CO, USA. He then worked as Senior Research Associate at EPFL under a Swiss National Foundation program. Since 2014, he is SNF Assistant Professor at the Department of Geography of the University of Zurich. His research interests include the development of algorithms for information extraction and data fusion of remote sensing images using machine learning algorithms. Dr. Tuia serves as a Chair of the Image Analysis and Data Fusion Technical Committee of the IEEE GRSS. He is an Associate Editor of the IEEE Journal of Selected Topics in Applied Earth Observation and Remote Sensing. Visit http://devis.tuia.googlepages.com/ for more information.

Paolo Gamba (SM’00–F’13) received the Laurea degree (cum laude) in electronic engineering from the University of Pavia, Pavia, Italy, in 1989, and the Ph.D. degree in electronic engineering from the same university in 1993.

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Dr. Gamba served as the Editor-in-Chief of the IEEE GEOSCIENCE AND REMOTE SENSING...
LETTERS from 2009 to 2013, and as Chair of the Data Fusion Committee of the IEEE Geoscience and Remote Sensing Society from October 2005 to May 2009. Currently, he is the VP for Professional Activities and Chair of the Chapters’ Committee of the same society. He has been the Organizer and Technical Chair of the biennial GRSS/ISPRS Joint Workshops on “Remote Sensing and Data Fusion over Urban Areas” from 2001 to 2015. He also served as Technical Co-Chair of the IEEE Geoscience and Remote Sensing Symposium (IGARSS) in 2010 and 2015, and will serve again as Technical Co-Chair of the 2020 IGARSS. He has been the Guest Editor of special issues of the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING, the IEEE JOURNAL OF SELECTED TOPICS IN REMOTE SENSING APPLICATIONS, ISPRS Journal of Photogrammetry and Remote Sensing, International Journal of Information Fusion and Pattern Recognition Letters, and Journal of Applied Remote Sensing.

Carsten Juergens was born in 1961, graduated with a Diploma degree in geography from Trier University, Trier, Germany, in 1989, received the Ph.D. degree from the same university in 1992, and then moved to the University of Regensburg, Regensburg, Germany, for an Assistant Professorship. In 1999, he finished his Habilitation. He is a Full Professor for Remote Sensing with the Geomatics Group, Geography Department, Ruhr-University, Bochum (RUB), Bochum, Germany. In 2004, he was appointed Full Professor for Remote Sensing with RUB. He has been the organizer and technical chair of the mostly biannual Joint Workshops on “Remote Sensing of Urban Areas” from 1997 to 2015. Since 2003, he is the Chairman of the EARSeL Working Group “Urban Remote Sensing.” From 2000 to 2004, he was Co-Chairman of Working Group 4 Human Settlements and Impact Analysis of ISPRS Commission VII (Resource and Environmental Monitoring). He was the Co-Chair of ISPRS-WG VIII/1 Human Settlements and Urban Impacts (2004–2008) of Commission VIII (Remote Sensing Applications and Policies). After that, he was the Co-Chairman of Working Group 8 Land of ISPRS-Commission VIII (Remote Sensing Applications and Policies). He has organized and was a member of the organizing committees of numerous national and international symposia. From 2003 to 2013, he served as the Editor of the German journal Photogrammetrie-Fernerkundung-Geoinformation (PFG), and from 2008, he is the Co-Editor of EARSeL eProceedings. In addition to that, he reviewed numerous articles for many national and international journals. His research interests include urban remote sensing, change detection, digital image processing and GIS.

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Derya Maktav was born in 1951, graduated with the B.Sc. degree in geomatics engineering from Istanbul Technical University (ITU), Turkey, in 1975. In 1976, he was awarded a Certificate in photogrammetry from the University College London, U.K. He received the M.Sc. degree in civil engineering and surveying from Karlsruhe Technical University, Germany, in 1979, and the Ph.D. degree in geomatics engineering from ITU in 1985. He gained a Certificate on “Digital Analysis of TM Data” from the Laboratory for Applications of Remote Sensing (LARS), Purdue University, USA, in 1985. He was a Visiting Scientist with the Karlsruhe Technical University between 1983-1984. He is a Full Professor with the Department of Geomatics Engineering, ITU. At ITU, he was the Appointed Associate Professor (1985) and Full Professor (1986) with the Remote Sensing Division. In 1993, he was a Visiting Fellow with the Department of Land Information, Centre of Remote Sensing, Royal Melbourne Institute of Technology, Australia. He was the Chair of ISPRS-WG VIII/1 Human Settlements and Urban Impacts and representative of ISPRS (GeoUnions Joint Science Program Team-Cities and Megacities) (2004–2008),
Co-Chair of the European Association of Remote Sensing Laboratories (EARSeL)-SIG: Urban Remote Sensing, national representative of Urban Data Management Society (UDMS). He has organized and was a member of the organizing committees of 25 international symposia including various NATO, NASA, EARSeL, and JURSE events in different countries. He also served as the Reviewer of the NASA-LCLUC projects. He has 32 years teaching experience at ITU. He also Lectured on “Remote sensing theories” at the Optoelectronic Techniques for Environmental Monitoring and Risk Assessment, Summer School, North University of Baia Mare, Romania, in 2006, and the University of Graz, Austria, in 2010. He has authored over 250 publications consisting of textbooks, proceedings (editor), symposium papers, articles in journals, and research project reports detailing his research activities. He also presented several invited papers in Turkey and international institutes such as the Russian Academy of Sciences, Edinburgh University, Swedish Research Institute, University of Graz, etc.. His research interests include remote sensing, digital image processing, GIS, and photogrammetry.

Dr. Maktav was elected as a Council Member of the EARSeL in 2007. He has served as a Patron Member of the New York Academy of Sciences, EARSLe, Turkish National Association of Remote Sensing and Photogrammetry, Turkish Chamber of Mapping and Cadaster, and the German Association for Photogrammetry and Remote Sensing. He was the Guest Editor for four Special Issues of the International Journal of Remote Sensing and the IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING. He was the recipient of the Henry Ford European Conservation Awards 1998, National Award with the “International Mediterranean Project” by the Council of Europe, World Heritage and Ford. http://web.itu.edu.tr/maktavd