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Introduction for the Special Issue on Beyond the Hypes of Geospatial Big Data: Theories, Methods, Analytics, and Applications

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Introduction for the Special Issue on Beyond the Hypes of Geospatial Big Data: Theories, Methods, Analytics, and Applications

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We live in the era of 'Big Data'. In particular, Geospatial data, whether captured through remote sensors (e.g., satellite imagery) or generated from large-scale simulations (e.g., climate change models) have always been significantly large in size. Over the last decade however, advances in instrumentation and computation has seen the volume, variety, velocity, and veracity of this data increase exponentially. Of the 2.5 quintillion (1018) bytes of data that are generated on a daily basis across the globe, a large portion (arguably as much as 80%) is found to be geo-referenced. Therefore, this special issue is dedicated to the innovative theories, methods, analytics, and applications of geospatial big data.

A total of 37 manuscripts were submitted and 10 were selected based on a robust peer-reviewed process. The 10 articles are authored by researchers from seven research institutes and universities, and reflect state of the research developments and initiatives in the collection, processing, modeling, analysis as well as applications of geospatial big data and future directions. Specifically, topics across global navigation satellite systems (GNSS), geographic information system (GIS), remote sensing (RS), land-use planning, environmental sustainability, and mining deformation monitoring are included.

The lead article, "LNA Design for Future S Band Satellite Navigation and 4G LTE Applications" by Arsalan et al. [Arsalan and Wu (2019)], addresses a critically important question regarding the frequency band design of GNSS receiver and proposes a new design procedure for a Low Noise Amplifier (LNA). The designed LNA can be widely applied to collect the spatiotemporal data, such as wireless network, mobile communications and future S band satellite navigation.

The two articles following, "The Quality Assessment of Non-integer-hour Data in GPS Broadcast Ephemeris and its Impact on the Accuracy of Real-time Kinematic Positioning over South China Sea" by Sun et al. [Sun, Xu, Gao et al. (2019)], and "RAIM Algorithm based on Fuzzy Clustering Analysis" by Gu et al. [Gu, Bei, Shi et al. (2019)], investigate the data processing methods of gross errors in GNSS navigation and observation data, respectively. The two articles present some novel data processing strategies to reduce or

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control the impact of gross errors in GNSS data and improve the accuracy and reliability of the GNSS navigation and positioning solutions.

The next two articles, "Exploring Urban Population Forecasting and Spatial Distribution Modeling with Artificial Intelligence Technology" by Zou et al. [Zou, Zhang and Min (2019)], and "Inferring Spatial Distribution Patterns in Web Maps for Land Cover Mapping" by Liu et al. [Liu, Lan and Xing (2019)], demonstrate the benefits of GIS technology to geospatial data modeling and analysis. The former uses powerful GIS spatial analysis tools to construct the high spatial and temporal distribution model of urban population and the later explores the spatial distribution patterns in Web Maps to improve the land cover map production on a larger scale.

The next three articles focus on image data processing and applications. "Monitoring Multiple Cropping Index of Henan Province, China Based on MODIS-EVI Time Series Data and Savitzky-Golay Filtering Algorithm" by Wang et al. [Wang, Feng, Shen et al. (2019)]; and "Frequency Domain Filtering SAR Interferometric Phase Noise Using the Amended Matrix Pencil Model" by Gao et al. [Gao, Zhang, Zhang et al. (2019)] investigate RS image data processing methods and techniques. Yu et al. [Yu, Wang, Zhi et al (2019)]'s article "3D Imaging Reconstruction of a Fiber Using Sequential Multi-Focus Images" proposes a new 3D image reconstruction method of fiber system filtering material using optical microscopic image processing technology.

The last two articles examine how to apply geospatial data to the environment monitoring and mining deformation monitoring. "Optimization of Well Position and Sampling Frequency for Groundwater Monitoring and Inverse Identification of Contamination Source Conditions Using Bayes' Theorem" by Zhang et al. [Zhang, Liu, Qiang et al. (2019)], proposes a method to optimize the monitoring well geospatial location and monitoring frequency for identifying groundwater contamination sources. "A Data-Intensive $FLAC^{3D}$ Computation Model: Application of Geospatial Big Data to Predict Mining Induced Subsidence" by Gong et al. [Gong and Guo (2019)], introduces the big data analytics to the surface subsidence monitoring in mining areas for the first time and a significant improvement of subsidence prediction accuracy is obtained.

In summary, we have entered a golden age of digital innovation, in which big data plays a central role. The publication of this special issue is very timely as big data is regarded as a driver of technological innovation, industry competition as well as commercial productivity. We thank all authors for submitting high quality manuscripts and the reviewers for their participation in the review process. Finally, we thank the entire editorial team for their commitment and support in publishing this special issue.

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