Preface

Special Issue on Recent Applications in Geomatics Serving Society Needs

Geomatics, the science of where, has become an indispensable tool for addressing the social challenges of the 21st Century. From environmental monitoring to urban planning, disaster management and education, geomatics technologies such as remote sensing, geographic information systems (GIS), and advanced spatial analysis provide important insights that support sustainable development, resource management, and informed decision-making.

This special issue, "Recent Applications in Geomatics Serving Society Needs," presents cutting-edge research demonstrating the potential of geomatics to solve real-world problems. Contributions range from educational innovations to environmental monitoring, urban analysis, and crime prediction, reflecting the interdisciplinary nature of geomatics and its profound impact on society. Hennig and colleagues investigate the role of learning laboratories in enhancing the use of digital geomatics in education, focusing on the University of Salzburg's iDEAS:lab. Through the ESDplus project, they demonstrate how cross-disciplinary approaches and user-centered training materials can empower educators to integrate tools such as online maps and satellite imagery into education for sustainable development. This work highlights the importance of building digital and geomedia competencies among learners to prepare them for a technology-driven world. It also addresses critical gaps in educational practice, with a particular emphasis on non-formal education.

In the realm of environmental monitoring, László and Tóth leverage Interferometric Synthetic Aperture Radar (InSAR) to study surface deformations caused by deep mining at the Márkushegy Mining Facility in Hungary. Their analysis of Sentinel-1 imagery reveals subsidence patterns and post-mining stabilization, highlighting InSAR’s potential for monitoring mining-induced environmental impacts.

Similarly, Udvardy and colleagues present a bathymetric survey of Dobra Lake in Romania using echo sounder technology, demonstrating its utility in creating digital elevation models for applications such as flood risk assessment and water resource management.

Wojtaszek and Vass employ the optical trapezoid model (OPTRAM) with Sentinel-2 data to map soil moisture variability in Hungary, offering valuable insights for agriculture and soil conservation through advanced remote sensing techniques.

Geomorphological and topological analyses are also well represented. Tarsoly's study of Hungarian non-karstic caves uses topological and geometrical parameters to classify cave morphologies, providing a framework for understanding speleogenetic processes. Nagy introduces a novel fuzzy landform classification method based on azimuth-based Fourier series, implemented through convolution filters in GIS software, offering a flexible approach to terrain analysis. These contributions enhance our understanding of complex natural landscapes and support applications in environmental planning and resource management.

In urban and societal applications, Sun and colleagues propose an improved YOLOv5 and SegFormer framework for extracting tailings ponds from high-resolution remote sensing images, addressing ecological and safety concerns in mining regions. Fawzy and colleagues utilize deep neural networks (U-Net) with multispectral imagery and digital surface models to classify urban land cover, achieving high accuracy in feature extraction for urban planning and management. Harmati and colleagues investigate the temporal effects on crime prediction accuracy in Budapest, using kernel density estimation and risk terrain modeling to improve crime prevention strategies, demonstrating geomatics' role in enhancing public safety.

Finally, advancements in data processing and modeling are addressed by Jancsó, Molnár, and Lengyel. Jancsó's general algorithm for gross error filtering prior to least squares adjustment offers a robust method for improving measurement accuracy in photogrammetry and geodesy. Molnár and Lengyel's workflow for orthorectifying archival aerial photographs using the Rational Polynomial Camera (RPC) model provides a practical solution for generating accurate orthophotos, with applications in historical mapping and land use analysis. Honti and colleagues compare 3D data acquisition techniques for capturing building geometries, evaluating modern mobile scanning systems against terrestrial laser scanning for applications in construction and indoor navigation.

These articles collectively demonstrate the multifaceted nature of geomatics in addressing societal needs, ranging from environmental sustainability and resource management to education, urban planning, and public safety. By integrating advanced technologies such as remote sensing, deep learning, and GIS-based modeling, the authors show how geomatics can provide practical solutions to complex challenges. We hope that this special issue will encourage further research and collaboration in the field, and promote innovations that continue to meet the evolving needs of society.

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Guest Editors