remote sensing

Editorial

Editorial for the Special Issue "Latest Development in 3D Mapping Using Modern Remote Sensing Technologies"

Ayman F. Habib

Lyles School of Civil Engineering, Purdue University, West Lafayette, IN 47907, USA; ahabib@purdue.edu

Recent advances in remote sensing technologies have provided the research community with unprecedented geospatial data characterized by high geometric, radiometric, spectral, and temporal resolution. This Special Issue, which consists of ten research papers [1–10], aims at highlighting advances in sensing and georeferencing modalities onboard traditional and emerging platforms, as well as their effectiveness in addressing the needs of traditional and new mapping applications. Innovative manipulation of remote sensing data (i.e., evolution from data to information to knowledge) is also discussed. More specifically, Ref. [1] deals with the integration of image and LiDAR data from a tripod-mounted platform for the derivation of stockpile volumes within indoor environments; Ref. [2] uses RGB-D images for the reconstruction of 2D floorplans; Ref. [3] utilizes LiDAR point clouds and associated intensity for the extraction of lane markings along transportation corridors; Ref. [4] involves a learning strategy for real-time semantic segmentation using CCD cameras onboard mobile robots; Ref. [5] integrates color, depth, and Inertial Measurement Unit (IMU) data for the development of an end-to-end 3D reconstruction system; Ref. [6] establishes metrics for the quality control of mobile LiDAR data along transportation corridors; Ref. [7] utilizes a learning-based strategy for the interpretation of large-scale point clouds; Ref. [8] integrates semantic information in real-time LiDAR odometry and mapping; Ref. [9] develops a novel strategy for integrating semantic information in Multi-View Stereo (MVS) matching; and Ref. [10] proposes a learning-free strategy for eliminating moving objects from mobile LiDAR data.

The papers in this Special Issue can be categorized as follows:

1. **Mobile Mapping Sensors**: Mobile mapping sensors might include passive imaging (i.e., electro-optical (EO) imaging), active LiDAR/depth, and/or direct georeferencing (e.g., Integrated Global Navigation Satellite Systems/Inertial Navigation Systems (GNSS/INS)) sensors. Both passive and active remote sensing technologies are considered. More specifically, articles [4,9] deal with imaging sensors, while those in [3,6–8,10] focus on LiDAR. Articles [1,2,5] deal with both imaging and LiDAR/depth sensors. Regarding georeferencing technologies, articles [3,5–7] deal with onboard GNSS/INS units, while articles [1,2] do not assume the presence of such sensors onboard the utilized platform.
2. **Mobile Mapping Platform**: Mapping platforms can be spaceborne, airborne (either manned or unmanned), or terrestrial (e.g., manned vehicles, unmanned vehicles, portable, or tripod-mounted). Article [1] deals with image and point cloud data acquired by a tripod-mounted platform. Articles [2,5] deal with indoor point cloud data that can be acquired by a variety of platforms. Articles [3,4,6–8,10] deal with image and LiDAR data acquired by wheeled vehicles. Article [9] deals with indoor/outdoor imaging platforms for the derivation of point cloud data.
3. **Type of Geospatial Data Used**: The geospatial data utilized in the different processing strategies are based on imaging, ranging, and/or georeferencing sensors. Moreover, either point/pixel or semantic data are involved. Articles [2,4,7–10] rely on semantically derived features/constraints in the processing of mobile mapping data.

Citation: Habib, A.F. Editorial for the Special Issue "Latest Development in 3D Mapping Using Modern Remote Sensing Technologies". *Remote Sens.* **2023**, *15*, 1109. https://doi.org/10.3390/rs15041109

Received: 27 January 2023
Revised: 30 January 2023
Accepted: 31 January 2023
Published: 17 February 2023

The remaining articles (i.e., [1,3,5,6]) are based on geometric features derived from either imaging or LiDAR geospatial data.

4. **Processing Strategy**: Both geometric/morphological and learning-based strategies are addressed in this Special Issue. Articles [1,2,5,6,10] mainly deal with geometric/morphological data processing strategies, while articles [4,7,8] deal with learning-based strategies. Articles [3,9], on the other hand, deal with both geometric/morphological and learning strategies.
5. **Intended Environment and Application Domain**: Different environments/application domains are addressed by the research papers. For example, article [1] deals with the estimation of the volume of stockpiles within indoor environments. Articles [2,5] deal with the 3D modeling of indoor environments, while articles [3,4,6–8,10] deal with the modeling of transportation corridors and their surrounding environment. Article [9] deals with the 3D modeling of both indoor and outdoor environments.

The diverse nature of authorships and covered topics in this Special Issue testifies to the growing interest of the professional and research communities in modern mobile mapping systems and their proliferation in a wide range of applications. In spite of this growing interest, more contributions are still required to (1) improve the quality of acquired data and delivered products while reducing the curation cost of such data/products; (2) provide hybrid data analytics (i.e., integrated geometric/learning strategies) that are less training-data-demanding; (3) develop meaningful quality control metrics for the evaluation of delivered data/products; (4) expand the application domains to include the mapping of underground infrastructure and GNSS-denied environments; and (5) reduce the time gap between technological developments and their adoption by the professional community.

Acknowledgments: The Guest Editor of this Special Issue would like to thank all the authors who contributed to this volume for sharing their scientific results and experiences. I would also like to thank the journal editorial team and reviewers for conducting the review process.

Conflicts of Interest: The author declares no conflict of interest.

References

1. Liu, J.; Hasheminasab, S.M.; Zhou, T.; Manish, R.; Habib, A. An Image-Aided Sparse Point Cloud Registration Strategy for Managing Stockpiles in Dome Storage Facilities. *Remote Sens.* **2023**, *15*, 504. [CrossRef]
2. Wang, Q.; Zhu, Z.; Chen, R.; Xia, W.; Yan, C. Building Floorplan Reconstruction Based on Integer Linear Programming. *Remote Sens.* **2022**, *14*, 4675. [CrossRef]
3. Cheng, Y.-T.; Lin, Y.-C.; Habib, A. Generalized LiDAR Intensity Normalization and Its Positive Impact on Geometric and Learning-Based Lane Marking Detection. *Remote Sens.* **2022**, *14*, 4393. [CrossRef]
4. Li, J.; Dai, Y.; Su, X.; Wu, W. Efficient Dual-Branch Bottleneck Networks of Semantic Segmentation Based on CCD Camera. *Remote Sens.* **2022**, *14*, 3925. [CrossRef]
5. Zhu, Z.; Xu, Z.; Chen, R.; Wang, T.; Wang, C.; Yan, C.; Xu, F. FastFusion: Real-Time Indoor Scene Reconstruction with Fast Sensor Motion. *Remote Sens.* **2022**, *14*, 3551. [CrossRef]
6. Kalenjuk, S.; Lienhart, W. A Method for Efficient Quality Control and Enhancement of Mobile Laser Scanning Data. *Remote Sens.* **2022**, *14*, 857. [CrossRef]
7. Zou, Y.; Weinacker, H.; Koch, B. Towards Urban Scene Semantic Segmentation with Deep Learning from LiDAR Point Clouds: A Case Study in Baden-Württemberg, Germany. *Remote Sens.* **2021**, *13*, 3220. [CrossRef]
8. Du, S.; Li, Y.; Li, X.; Wu, M. LiDAR Odometry and Mapping Based on Semantic Information for Outdoor Environment. *Remote Sens.* **2021**, *13*, 2864. [CrossRef]
9. Stathopoulou, E.K.; Battisti, R.; Cernea, D.; Remondino, F.; Georgopoulos, A. Semantically Derived Geometric Constraints for MVS Reconstruction of Textureless Areas. *Remote Sens.* **2021**, *13*, 1053. [CrossRef]
10. Fu, H.; Xue, H.; Xie, G. MapCleaner: Efficiently Removing Moving Objects from Point Cloud Maps in Autonomous Driving Scenarios. *Remote Sens.* **2022**, *14*, 4496. [CrossRef]