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Editorial

Mobile Geospatial Computing Systems for Ubiquitous Positioning

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Geospatial computing involves using computing devices and sensors to acquire, process, analyze, manage, and visualize geospatial data. However, the tasks of geospatial computing systems are computationally demanding in terms of computation power, data storage capacity, and memory space. With the recent developments in mobile computing and sensor technologies, mobile devices are able to meet the demanding requirements for geospatial computing. As a consequence, mobile geospatial computing systems (MGCSs) emerge and are developed rapidly. Currently, MSCSs have shown their significant importance in facilitating our daily life in many areas, for example, personal navigation based on virtual reality, mobile games based on mixed reality, self-driving car, unmanned taxi-service, and many location-based services. It should be noted that among all the functionality within the MSCSs, the ubiquitous positioning is one of the key supporting technologies. The accuracy of the computed positioning largely affects the quality of service in other applications related to MSCSs, for example, the mobile mapping and mobile geographical information systems (GIS).

In the past decades, a variety of wireless positioning technologies have been developed, which include GNSS (Global Navigation Satellite Systems), methods to exploit signal-of-opportunities, such as WiFi, RFID, cellular LTE/4G, UWB, WLAN, Bluetooth, digital TV, acoustic/millimeter-wave/light signals, and the hybrid solutions encompassing inertial measurement unit, sonar, laser, infrared (IR), magnetic field, camera, and so on. However, there are still many challenges in emerging applications, which need to be solved, for example, navigation in indoor environments, the security of the navigation systems to defend against threats, the data fusion of all source positioning and navigation, and so on. To resolve such challenges, the sensor-rich and computation enabling MSCSs may offer new potential.

The special issue aims to publish the most recent advances in the usage of the MSCSs to improve the quality of the ubiquitous positioning, as well as the development of innovative methods to provide more accurate and reliable positioning for MSCSs. We received a total of 21 submissions, spanning a range of topics from user location, context detection, multisensor-based indoor localization and mapping, human travel behavior studies, point cloud data-assisted context sensing, to indoor map assisted localization. After a thorough peer review process, 9 articles are selected, which are summarized below.

The first article in this special issue entitled "Positioning Using Terrestrial Multipath Signals and Inertial Sensors" authored by C. Gentner et al. exploit multipath propagation for position estimation of mobile receivers. A particle filtering-based Channel-SLAM is proposed, which fuses heading information of an inertial measurement unit (IMU) to improve the position accuracy.

A. J. Lopez et al. in the second article "Assessment of Smartphone Positioning Data Quality in the Scope of Citizen Science Contributions" analyze the completeness aspects of the data quality using GNSS data collected through smartphones from the campaigns. The results can be used in human travel behavior studies.

In the third article, "An Efficient Normalized Rank Based SVM for Room Level Indoor WiFi Localization with Diverse Device," L. Pei et al., study the problem of received signal strength index (RSSI) variation of different devices in WiFi fingerprinting-based indoor localization. A normalized rank-based support vector machine classifier (NR-SVM) is presented, and the validation of the algorithm has been tested by using 16 different devices in a shopping mall.

X. Niu et al. in the fourth article, "An Online Solution of LiDAR Scan Matching Aided Inertial Navigation System for Indoor Mobile Mapping" present online navigation algorithm for indoor mobile mapping with LiDAR and IMU integrated unmanned ground vehicle (UGV) system.

The fifth article, entitled "Semantic Labeling of User Location Context Based on Phone Usage Features" authored by H. Leppäkoski et al. proposes a machine learning-based method to detect the user's home, work, and other visited places by utilizing mobile phone usage features.

The sixth article considers incorporating map constraints into localization algorithms with the aim to reduce the uncertainty of walking trajectories and enhance location accuracy. J. Hobby and M. Dashti propose a method to generate indoor maps from CAD floor plans and an adapted map-filtering algorithm for indoor navigation. More details can be found in "A Method to Incorporate Floor Plan Constraints into Indoor Location Tracking: A Voronoi Approach."

The seventh article entitled "Ubiquitous and Seamless Localization: Fusing GNSS Pseudoranges and WLAN Signal Strengths" authored by P. Richter and M. Toledano-Ayala presents seamless positioning based on a particle filter tightly integrated GNSS pseudoranges and WLAN received signal strength indicators (RSSIs).

K. Liu et al. in the eighth article, entitled "An Analysis of Impact Factors for Positioning Performance in WLAN Fingerprinting Systems using Ishikawa Diagrams and a Simulation Platform" consider the impact factors on the positioning accuracy during the procedure of the indoor RSSI fingerprint localization. The factors include, for example, the access points (AP) density, signal propagating attenuation factor, and the reference points (RPs) density etc.

Finally, Y. Chen et al. in the ninth paper, entitled "Feasibility Study of Using Mobile Laser Scanning Point Cloud Data for GNSS Line of Sight Analysis" detect the line of sight condition by using mobile laser scanning point cloud in the urban canyon scenarios to enhance the position accuracy.

Our guest editorial team would like to thank all the authors and reviewers for their contribution to this special issue.

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