Introduction to the Special Issue on Urban Computing and Smart Cities

In recent years, the urban networks infrastructure has undergone a fast expansion, which increasingly generates a large amount of data, such as human mobility data, human transactions data, regional weather and air quality data, and social connection data. These heterogeneous data sources convey rich information about a city and can enable intelligent solutions to solve various urban challenges, such as urban facility planning, air pollution, and so on. While, on one hand, these big urban data can help us to tackle big urban challenges, on the other hand, it is challenging how to manage, analyze, and make sense of the big urban data.

The Urban Data Sciences special issue aims to publish work on multidisciplinary research across the areas of computer science, electrical engineering, environmental science, urban planning and development, social sciences, operation research, and industrial engineering on technologies, case studies, novel approaches, and visionary ideas related to data science solutions and data-driven applications to address real-world challenges for enabling smart cities. The objective of this special issue is to publish leading work in urban data science and present future challenges in this area. This special issue received 22 high-quality submissions, and 9 of them were accepted. As a result, the acceptance ratio is 40%. The topics of the accepted articles are briefly introduced below.

The article titled “[Mapping Road Safety Features from Streetview Imagery: A Deep Learning Approach](#)” focuses on the problem of road safety feature mapping. The authors utilize Google Streetview imagery as the data source, using CNN for extracting semantic features from individual images and LSTM for modeling linear spatial autocorrelation effect between those images along a road network path. The authors validate the proposed framework on the Streetview imagery dataset in Alabama, which outperforms various baselines.

In the article titled “[User and Entity Behavior Analysis under Urban Big Data](#),” the authors proposed a malicious behavior detection mechanism, as well as a prediction method, based on multi-dimensions historical data and the deep learning approaches.

The article titled “[A Unified Framework for Robust and Efficient Hotspot Detection in Smart Cities](#)” presents a unified framework for spatial hotspot detection that integrates a non-deterministic normalization based scan statistic and the likelihood ratio based framework. The proposed approach is capable of addressing the two limitations of traditional spatial scan statistics-based approaches, including the effect of spatial non-determinism and robustness against false positives. Extensive experiments are conducted to demonstrate the effectiveness and efficiency of the proposed approach.

The article titled “[Task Allocation in Hybrid Big Data Analytics for Urban IoT Applications](#)” investigates the task allocation problem for the Internet-of-Things (IoT) environment related to transportation big data, which is challenging, since data processing and management are in both

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batch- and stream-mode. The authors propose a task allocation framework that can handle dynamic workloads. Evaluation results obtained using simulated data are promising.

The article titled “[Searching Activity Trajectories by Exemplar for Transactions on Data Science](#)” studies a novel problem of searching trajectories by exemplar with activities and spatial temporal information. The authors firstly propose an inverted-index-based approach and then develop a more efficient method called Quad-tree threshold approach to quick locate candidates and prune unnecessary trajectories, and a parallel version of the method is also provided. The proposed methods perform efficiently in extensive experiments.

In the article titled “[Adaptive Weighted Finite Mixture Model: Identifying the Feature-influence of Real Estate](#),” the authors propose an adaptive weighted finite mixture model for real estate price prediction and identifying influential features in the prediction.

In the article titled “[GeoMatch: Efficient Large-scale Map Matching on Apache Spark](#),” the authors develop GeoMatch, a map-matching framework based on Apache Spark. It mainly uses Hilbert space-filling curves to build the global index for both the road network data and the spatial data to be matched, where the local index based on R-tree is built to perform matching in each partition. Experiments show the proposed solution outperforms various baseline methods.

In the article titled “[Physics-guided Energy-efficient Path Selection Using on-board Diagnostics Data](#),” the authors addressed the energy-efficient path selection problem using a maximal-frequented-path-graph shortest path algorithm. To improve the system efficiency and handle the negative ECC values on the road network, an informed path selection algorithm with an admissible heuristic is proposed. The problem studied in this paper has many potential applications in urban computing scenarios, e.g., taxi routing and logistics, to reduce energy consumption. The proposed method is evaluated extensively using real-world and synthetic data.

Moreover, in the last article of the special issue, titled “[Data-driven Bus Crowding Prediction Models Using Context-specific Features](#),” the authors formulate the prediction of bus crowding level as classification problem, where authors utilize random forest classifier and negative binomial regression model in their framework. The proposed method was validated using real-world data with promising results.

Yanhua Li
Worcester Polytechnic Institute
Jie Bao
JD.com
Zhi-Li Zhang
University of Minnesota
Saif Benjaafar
University of Minnesota
Guest Editors