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Introduction to the special issue on smart transportation

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Transportation is getting smarter and smarter, with the prominence of connected automated vehicle technologies in the global auto industry's near-term growth strategies, of big data analytics and unprecedented access to sensing data of mobility, and of integration of this analytics into the optimization of mobility and transport. These developments are setting off a wave of smart transportation innovations, which are featured by new methods and applications driven by various forms of sensor data such as GPS, CAN bus, LIDA, images, etc. At the same time, complexities surrounding the use, conflation, and processing of disparate data in near real-time is of essence for the design and development of futuristic smart transportation.

Computational methods for transportation science are the drivers for smart transportation, and thus essential for a sustainable future of cities concerning urban mobility (people) and transport (freight). The fundamentals of these computational methods are rooted in space and time, and thus at the core of transportation research. A research subject of smart transportation that has become extremely active within the last few years is trajectory computing. Trajectories, sometimes called probe data or location/GPS traces, are a treasure nowadays for understanding travelers, traffic, and locations. Trajectory computing sees many applications in transportation such as map making, traffic information, routing, driver behavior, activity recognition, etc. To tackle the challenges brought up by the numerous and typically imprecise trajectory data, the research community has been exploring solutions to trajectory storage, retrieval, and mining, as well as uncertainty management, map matching, privacy preservation etc.

The special issue of Smart Transportation contains five papers on various aspects of smart transportation. They cover ridesharing, human mobility modeling, trajectory computing, routing, and privacy control.

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The first paper, "Optimum Versus Nash-Equilibrium in Taxi Ridesharing", by Luca Foti, Jane Lin, Ouri Wolfson, compares optimum plans and "fair" plans in the context of taxi ridesharing. While an optimum plan matches the passengers to optimize system-wide cost savings, a fair plan finds the Nash equilibrium in which no pair of unmatched passengers would both benefit more if they were matched. The paper shows that in contrast to the theoretical indications, the fair plan is almost optimum. Furthermore, the fairness concept may help attract more passengers to rideshare and thus further reduce vehicle miles traveled.

The second paper, "Improving Human Mobility Identification with Trajectory Augmentation", by Fan Zhou, Ruiyang Yin, Goce Trajcevski, Kunpeng Zhang, Jin Wu, Ashfaq Khokhar, addresses the problem of linking trajectories to their corresponding generating users. The ability to correlate such trajectories to users may enable more informed decision-making in personalization of, e.g., marketing campaigns. Moreover, such linking could help in detecting potential criminals, based on values from similar types of sparse mobility data such as the transient phone signals as well as other check-in events.

The third paper, "Geographical and Temporal Huff Model Calibration using Taxi Trajectory Data", by Shuhui Gong, John Cartlidge, Ruibin Bai, Yang Yue, Qingquan Li, Guoping Qiu, utilizes trajectory data to calibrate the Huff model for estimating the probability of shopping center patronage based on a shopping center's attractiveness and the cost of a customer's travel. The paper discovers some general shopping trends by calibrating the Huff model in Shenzhen, China, and New York, USA, using taxi trajectory GPS data and sharing bikes GPS data. The paper also studies the factors affecting urban travel behaviors (wealth and employment) as practical contributions that may help optimize urban transportation design.

The fourth paper, "Constrained Shortest Path Problems in Bi-Colored Graphs: A Label-Setting Approach", by Amin AliAbdi, Ali Mohades, Mansoor Davoodi, uses colored vertices in the road network to model routing restrictions such as height or weight limits and the intersections with long stoplights. Finding an optimal path is then translated to minimizing the length and minimizing the number of specially colored vertices. The paper proposes an efficient time label-setting algorithm to solve this problem, and compares the proposed algorithm with the related path planning methods on random graphs as well as real-world environments.

The fifth paper, "Mobile Participatory Sensing with Strong Privacy Guarantees Using Secure Probes", by Iulian Sandu Popa, Dai Hai Ton That, Karine Zeitouni, Cristian Borcea, presents PAMPAS, a privacy-aware mobile distributed system for efficient data aggregation in mobile participatory sensing. PAMPAS provides a system architecture that protects users' location privacy by preventing location tracking from any third-party server. It also provides efficient aggregation protocols that satisfy the real-time constraints despite the resource limitations of secure devices. The privacy guarantee gives users strong incentives for participation.

The aforementioned papers comprise only a small fraction of the research on smart transportation. We hope that you enjoy reading them and that this special issue can promote interest and appreciation for research on smart transportation.

Many people have contributed to this special issue. We would like to thank all referees, staff of the GeoInformatica journal, and the publisher for their excellent comments and contributions.