Big Data and Crowdsourcing for Smart City Applications

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Tutorial Objectives and Scope

Ever-increasing prevalence of social networking using mobile devices has catalyzed the growth of interesting and innovative new-age mobile crowdsourcing applications, which work at the intersection of human-centric computation (e.g., economic incentive management and social computing) and dynamic management of information and content in wireless networks. The prevalence and proliferation of mobile devices coupled with popularity of social media and increasingly technology-savvy users have fuelled the growth of mobile crowdsourcing and participatory sensing. In particular, participatory sensing can occur in various ways by means of devices (e.g., mobile phones, PDAs, laptops and various types of sensors) or by including humans in the loop or both. Notably, participatory sensing can also potentially act as a key enabling technology for various applications involving smarter cities initiatives.

Incidentally, large-scale collection of city-related event data is crucial to effective planning and decision-making for improving city management. Examples of city-related event data include traffic congestion, illegal parking, accidents, dysfunctional streetlights, broken pavements, potholes, planned road construction works, public rallies, waterlogging, uncleared garbage, and the like. Notably, existing sensor-based data collection mechanisms cannot always take human judgment and the context of the event into consideration, and the costs of deploying them across all city locations would be prohibitively expensive. Hence, event data collection by users can be used to complement sensor-based data collection. Observe that a vast majority of the users can be reasonably expected to carry mobile devices. Since mobile devices often come equipped with various kinds of sensors, resident-driven data collection is also well-aligned with current technological trends. However, note that incentives need to be provided to users for encouraging them to contribute event data. In case of disasters, tweets can be used for effective rescue management.

In this environment, research issues include efficient collection of data, harnessing data for analytics, incentives & economic models for crowd participation, large-scale big data management, resource discovery, mobile cloud, and learning for analytics on the collected data. Some other important issues include data authentication, authorization, resource access, location indexing & query processing, data security and trust. These issues have generated a significant amount of interest in academia as well as in industry. We will discuss some of the open research issues in this area and provide our perspectives on those issues. This tutorial intends to foster discussions on the key research challenges as well as the design issues of key enabling technologies that need to be addressed to make scalable next-generation mobile crowdsourcing and human computation effective in a real-world application.

Duration: Proposed duration of the tutorial is 3 hours.

References

Yasin Kabir and Sanjay Madria, A Deep Learning Approach for Tweet Classification and Rescue Scheduling for Effective Disaster Management, to appear in 27th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems (ACM SIGSPATIAL 2019), USA.

Ilarri, Sergio, Ouri Wolfson, and Thierry Delot. "Collaborative sensing for urban transportation." IEEE Data Engineering Bulletin 37 (2014): 3-14.

Nilesh Padhariya, Anirban Mondal, Sanjay Madria, Efficient Processing of Mobile Crowdsourcing Queries with Multiple Sub-tasks for Facilitating Smart Cities, to appear in SmartCities workshop with ACM Middleware, 2016, Italy.

Nilesh Padhariya, Anirban Mondal, Sanjay Kumar Madria: Top-k query processing in mobile-P2P networks using economic incentive schemes. Peer-to-Peer Networking and Applications 9(4): 731-751 (2016)

Nilesh Padhariya, Ouri Wolfson, Anirban Mondal, Varun Gandhi, Sanjay Kumar Madria: E-VeT: Economic Reward/Penalty-Based System for Vehicular Traffic Management. MDM (1) 2014: 99-102

Katrina Ward, Dan Lin and Sanjay Madria, A Parallel Algorithm For Anonymizing Large-Scale Trajectory Data, in ACM Transaction on Data Science, 2019.

Who Can Attend

This tutorial is designed for academicians and researchers working in the area of crowdsourcing, social computing, mobile data management, event management and analytics. It is to help human-computer interaction experts and database professionals/business analysts, such as, database and system administrators, designers, project and technical managers, people involved in planning, designing, developing, implementing and administrating wireless applications. It is also for students of Computer and Information Sciences as well as students in Social Computing, who are either pursuing or are planning to pursue a higher research degree.

Speaker Biography

Sanjay K Madria is a Curators' Distinguished Professor in the Department of Computer Science at the Missouri University of Science and Technology (formerly, University of Missouri-Rolla, USA). He received his Ph.D. in Computer Science from Indian Institute of Technology, Delhi, India in 1995. He has published over 275 Journal and conference papers in the areas of mobile and sensor computing, cloud and cyber security. He won five IEEE best papers awards in conferences such as IEEE MDM 2011, IEEE MDM 2012 and IEEE SRDS 2015. He is a co-author of a recent book on Secure Sensor Cloud published by Morgan and Claypool in Dec. 2018. He co-authored another book entitled "Web Data Management: A Warehouse Approach" published by Springer-verlag in 2004. He guest edited WWW Journal, several Data and Knowledge Engineering Sp. Issues on Web data management and Data warehousing. He was founding Program Chair for EC&WEB conference series. He served as a general co-chair of Mobile Data Management conference in 2010, IEEE Symposium on Reliability in Distributed Systems in 2012 and

PC co-chair of MDM 2015. He serves in steering committees of IEEE SRDS and IEEE MDM. He is serving/served as PC member of various conferences such as MDM, ICDE, VLDB, SIGPLAN, CIKM, ICDCS, and reviewer for many IEEE and ACM journals such as IEEE TKDE, IEEE Computer, ACM Internet Computing, IEEE TMC etc. Dr. Madria has given tutorials on mobile data management in many international conferences like ACM Middleware, DASFAA, WISE, EDBT, ICDCS, MDM and SRDS. He is regular invited panelist in NSF, NSERC (Canada), Hong Kong Research Council and Sweden Council of Research. NSF, NIST, ARL, ARO, AFRL, DOE, Boeing, ORNL, Honeywell, etc. have funded his research projects. He has been awarded JSPS (Japanese Society for Promotion of Science) invitational visiting scientist fellowship in 2006, and ASEE (American Society of Engineering Education) fellowship from 2008 to 2018. In 2012 and in 2018, he was awarded NRC Fellowship by National Academies. He received research faculty excellence awards six times from his university. He is ACM Distinguished Scientist, and served/serving as an ACM and IEEE Distinguished Speaker, and is an IEEE Senior Member as well as IEEE Golden Core Awardee.