UNIVERSITY OF CENTRAL FLORIDA
CENTER FOR RESEARCH IN COMPUTER VISION

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"From GPS and Google Maps to Spatial Computing 2020"

Friday, August 14, 2015 · 11:00AM · HEC 101

ABSTRACT

From virtual globes (e.g., Google Maps) to global positioning system, spatial computing has transformed society via pervasive services (e.g., Uber and other location-based services), ubiquitous systems (e.g., geographical information system, spatial database management system), and pioneering scientific methods (e.g., spatial statistics). These accomplishment are just the tip of the iceberg and there is a strong potential for a compelling array of new breakthroughs such as spatial big data, localization indoors and underground, time-travel (and depth) in virtual globes, persistent monitoring of environmental hazards, accurate spatio-temporal predictive models, etc. For example, a McKinsey report projected an annual $600B saving from leveraging spatial big data (e.g., smart-phone trajectories) for novel eco-routing services to reduce wasted fuel, greenhouse gas emission and pollution exposure during unnecessary waits at traffic lights and in congestion.

However, many fundamental research questions need to be investigated to realize the transformative potential. For example, how can spatial big data (e.g., smart-phone trajectories) be mined without violating privacy? How can spatial statistical and machine learning algorithms be generalized to model geographic concepts (e.g., context, hot-spots, hot-features, doughnut-hole patterns), address spatio-temporal challenges (e.g., auto-correlation, non-stationarity, heterogeneity, multi-scale) and scale up to spatial big data? How can eco-routing address the new challenges, e.g., waits at traffic-signals violate the sub-path optimality assumption in popular A* and Dijktra's algorithms?

This presentation shares a perspective on the societal accomplishments, opportunities, and research needs in spatial computing based on a recent community report following the Computing Community Consortium workshop titled From GPS and Virtual Globes to Spatial Computing -- 2020 held at the National Academies.

BIOGRAPHY

Shashi Shekhar is a Mcknight Distinguished University Professor at the University of Minnesota (Computer Science faculty). For contributions to geographic information systems (GIS), spatial databases, and spatial data mining, he was elected an IEEE Fellow as well as an AAAS Fellow and received the IEEE-CS Technical Achievement Award, and the UCGIS Education Award. He was also named a key difference-maker for the field of GIS by the most popular GIS textbook. He has a distinguished academic record that includes 300+ refereed papers, a popular textbook on Spatial Databases (Prentice Hall, 2003) and an authoritative Encyclopedia of GIS (Springer, 2008).

Shashi is serving as a co-Editor-in-Chief of Geo-Informatica: An International Journal on Advances in Computer Sciences for GIS (Springer), and a series editor for the Springer-Briefs on GIS. Earlier, he served on the Computing Community Consortium Council (2012-15), and multiple National Academies' committees including Models of the World for USDOD-NGA (2015), Geo-targeted Disaster Alerts and Warning (2013), Future Workforce for Geospatial Intelligence (2011), Mapping Sciences (2004-2009) and Priorities for GEOINT Research (2004-2005). He also served as a general or program co-chair for the Intl. Conference on Geographic Information Science (2012), the Intl. Symposium on Spatial and Temporal Databases (2011) and ACM Intl. Conf. on Geographic Information Systems (1996). He also served on the Board of Directors of University Consortium on GIS (2003-4), as well as the editorial boards of IEEE Transactions on Knowledge and Data Eng. and IEEE-CS Computer Sc. & Eng. Practice Board.

In early 1990s, Shashi's research developed core technologies behind in-vehicle navigation devices as well as web-based routing services, which revolutionized outdoor navigation in urban environment in the last decade. His recent research results played a critical role in evacuation route planning for homeland security and received multiple recognitions including the CTS Partnership Award for significant impact on transportation. He pioneered the research area of spatial data mining via pattern families (e.g. collocation, mixed-drove co-occurrence, cascade), keynote speeches, survey papers and workshop organization.

Shashi received a Ph.D. degree in Computer Science from the University of California (Berkeley, CA). More details are available from http://www.cs.umn.edu/~shekhar.