

SORS: Managing Big Trajectory Data: Online Processing of Positional Streams

MANAGING BIG TRAJECTORY DATA: ONLINE PROCESSING OF POSITIONAL STREAMS

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Abstract: As smartphones and GPS-

enabled devices proliferate, *location-based services* become all the more important in social networking, mobile applications, advertising, traffic monitoring, and many other

domains. Managing the locations and trajectories of numerous people, vehicles, vessels, commodities, etc. must be efficient and robust, since this information must be processed online and should provide answers to users' requests in real time. In this *geostreaming* context, such long-running continuous queries must be repeatedly evaluated against the most recent positions relayed by moving objects; for instance, reporting which people are now moving in a specific area, or finding friends closest to the current location of a mobile user. In essence, modern processing engines must cope with huge amounts of streaming, transient, uncertain and heterogeneous spatiotemporal data, which can be characterized as *big trajectory data*. In this talk, we examine big data processing techniques over frequently updated locations and trajectories of moving objects. Indeed, the big data issues regarding Volume, Velocity, Variety, and Veracity also arise in this case. There is a close synergy between the established stream processing paradigm and spatiotemporal properties inherent in motion features. Taking advantage of the spatial locality and temporal timeliness that characterize each trajectory, we present methods and heuristics from our recent research results that address such problems. We highlight certain aspects of big trajectory data management: regarding *Volume*, we suggest single-pass algorithms that can summarize each object's course into succinct, reliable representations; to cope with *Velocity*, an amnesic trajectory approximation structure may offer fast, multi-resolution synopses by dropping details from obsolete segments; detection of objects that travel together can lead to trajectory multiplexing, hence reducing the *Variety* inherent in raw positional data; as for *Veracity*, we discuss a probabilistic method for continuous range monitoring against user locations with varying degrees of uncertainty, due to privacy concerns in geosocial networking.

Bio: Timos Sellis received his diploma degree in Electrical Engineering in 1982 from the National Technical University of Athens (NTUA), Greece. In 1983 he received the M.Sc. degree from Harvard University and in 1986 the Ph.D. degree from the University of California at Berkeley, both in Computer Science. In 1986, he joined the Department of Computer Science of the University of Maryland, College Park as an Assistant Professor, and became an Associate Professor in 1992. Between 1992 and 1996 he was an Associate Professor at NTUA, where he served as a Professor till January 2013. He is currently a Professor at the School of Computer Science and Information Technology of RMIT University in Australia. Prof. Sellis was also the Director of a new research institute he founded in Greece, the Institute for the Management of Information Systems (IMIS) of the "Athena" Research Center (www.imis.athena-innovation.gr) between 2007 and 2012.

His research interests include big data, data streams, personalization, data integration, and spatio-temporal database systems. He has published over 200 articles in refereed journals and international conferences in the above areas, has over 10.000 citations to his work and has been invited speaker in major international events. He has also participated and co-ordinated several national and European research projects. Prof. Sellis is a recipient of the prestigious Presidential Young Investigator (PYI) award given by the President of USA to the most talented new researchers (1990), and of the VLDB 1997 10 Year Paper Award in 1997 (awarded to the paper published in the proceedings of the VLDB 1987 conference that had the biggest impact in the field of database systems in the decade 1987-97). He was the president of the National Council for Research and Technology of Greece (2001-2003). In November 2009, he was awarded the status of IEEE Fellow, for his contributions to database query optimization, and spatial data management, and in November 2013 the status of ACM Fellow, for his contributions to database query optimization, spatial data management, and data warehousing.

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