

## *Spatial and Spatio-Temporal Data Mining*

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The recent advances and price reduction of technologies for collecting spatial and spatio-temporal data like *Satellite Images*, *Cellular Phones*, *Sensor Networks*, and *GPS devices* has facilitated the collection of data referenced in space and time. These huge collections of data often hide *interesting* information which conventional systems and classical data mining techniques are unable to discover. Spatial and spatio-temporal data are embedded in continuous space, whereas classical datasets (e.g. transactions) are often discrete. Spatial and spatio-temporal data require complex data preprocessing, transformation, data mining, and post-processing techniques to extract novel, useful, and understandable patterns. The importance of spatial and spatio-temporal data mining is growing with the increasing incidence and importance of large geo-spatial datasets such as maps, repositories of remote-sensing images, trajectories of moving objects generated by mobile devices, etc. Applications include Mobile-commerce industry (location-based services), climatologically effects of El Nino, land-use classification and global change using satellite imagery, finding crime hot spots, local instability in traffic, migration of birds, fishing control, pedestrian behavior analysis, and so on. Thus, new methods are needed to analyze spatial and spatio-temporal data to extract interesting, useful, and non-trivial patterns.

The main goal of this tutorial is to disseminate this research field, giving an overview of the current state of the art and the main methodologies and algorithms for spatial and spatio-temporal data mining. This tutorial is directed to researchers and practitioners, experts in data mining, analysts of spatial and spatio-temporal data, as well as knowledge engineers and domain experts from different application areas.

**KEYWORDS:** Spatial data mining, Spatio-temporal data mining, geometric trajectory data mining, semantic trajectory pattern mining

Prof. Dra. Vania Bogorny is professor at Departamento de Informática e Estatística of Universidade Federal de Santa Catarina (UFSC) Brazil. She received her M.Sc.(2001) and Ph.D.(2006) in Computer Science from Universidade Federal do Rio Grande do Sul, Porto Alegre/Brazil. In 2006, she received the Best PhD Thesis Award from the Brazilian Computer Society. From November/2006 to January/2008 she joined the research staff of the Theoretical Computer

Science Group, of Hasselt University, Belgium, to work in the context of the European project *GeoPKDD*, which had its focus on trajectory data analysis. She has published in refereed journals and conference proceedings, such as the IEEE ICDM, ACMGIS, IEEE IS, GIScience, IJGIS, and Geoinformatica. She has served as reviewer and technical committee member of international journals and recent conferences and workshops (IEEE-STDM, IEEE-SSTD, GEOINFO, GeoInformatica, IJGIS, DMKD, TKDD, Transportation Research Part C, etc.). Her general areas of interest are databases, spatial and spatio-temporal data mining, spatial data modeling, and geographic information systems. Prof. Bogorny is working on spatial and spatio-temporal data mining since 2002.

Prof. Dr. Shashi Shekhar is Professor at the University of Minnesota, Minneapolis, USA. He was elected an IEEE Fellow and received the IEEE Technical Achievement Award for contributions to spatial database storage methods, data mining, and geographic information systems (GIS). He is serving as a co-Editor-in-Chief of the *Geo-Informatica Journal* (ISSN 1384-6175) as well as an Encyclopedia of GIS (Springer, 2008, ISBN 978-0-387-30858-6) and a member of the steering committee of the ACM GIS Conference. He served on two committees of the National Research Council National Academy of Sciences, namely, the committee on mapping sciences (2004-2009) and the committee to review the basic and applied research at National Geo-spatial Intelligence Agency (2005). He has served as a member of the Board of Directors of University Consortium on GIS (2003-2004), a member of the editorial boards of IEEE Transactions on Knowledge and Data Engineering, a member of the IEEE-CS Computer Science & Engineering Practice Board, a program co-chair of the ACM Intl. Workshop on Advances in Geographic Information Systems (1996), and a technical advisor to United Nations Development Program (UNDP), Environmental Systems Research Institute (ESRI). His research projects have been sponsored by the NSF, NASA, Army Research Laboratories, USDOT, FHWA, MN/DoT etc. He has co-authored a textbook on Spatial Databases (ISBN 0-13-017480-7) and published over 200 research papers in peer-reviewed journals, books, conferences, and workshops. He received a Ph.D. degree in Computer Science from the University of California (Berkeley, CA).