

# Preface

Recent advances in the information and communication technologies, especially the rapid development of wireless communication, sensor networks, mobile computing technologies, global navigational satellite systems (GPS, GLONASS, COMPASS, Galileo), RFID, wireless sensor networks and spatially enabled devices are leading to an exponential growth in the amount of available data produced continuously at high speed. Due to the advancements in recent years, a new class of applications has come to the forefront: sensor networks, moving objects tracking, homeland security, fleet management, real-time intelligent transportation systems, etc. Applications in these novel domains process huge volumes of continuous streaming data, i.e. data that is produced incrementally over time, rather than being available fully before processing. According to the type of processing, data stream processing could be broadly classified into two categories: *data stream management* and *data stream mining*. Data stream management systems (DSMS) have been developed to querying and summarization of continuous data streams for further processing. Usually based on pure relational paradigm, they have rudimentary spatio-temporal capabilities.

An orthogonal issue to data stream management is data stream mining and knowledge discovery. Spatial and spatio-temporal knowledge discovery from data streams (KDDS) is based on premise that information is hidden in data streams in form of interesting spatial and spatio-temporal *patterns*. Among many kinds of spatio-temporal data, moving objects data are especially interesting and important, because they perfectly fit with the data stream concepts. Mining movement patterns of multiple moving objects is a motivating and challenging topic. These patterns include, but are not limited to, moving clusters, trajectory patterns, periodic patterns, group movement patterns (flock, convoy), etc. Knowledge discovery is a set of several processes, of which data mining is merely a crucial one. For that reason, our focus is limited to data mining algorithms, particularly to redesigning and adapting traditional clustering data mining algorithms for spatio-temporal data streams.

This book is an overview of the young, fast-growing and emerging fields of *spatio-temporal data stream* processing: management and data mining, and knowledge discovery. It evolved from the class notes of a postgraduate course “Spatio-Temporal Databases and Data Streams” at the University of Zagreb. Researchers and students both within and outside the Faculty of Electrical Engineering and Computing found the course very interesting and useful in their work. The book provides an introduction to the spatio-temporal stream processing, presents fundamental concepts and discusses design of prototypes to make the book useful for a diverse audience. Emphasis on the conceptual framework reflects the organization of the book.

The book can be used for teaching graduate or advanced undergraduate students, since it provides clear and concise presentation of major concepts and results in the field. This is a book also for computer science researchers and researchers from other disciplines and application, such as complex event processing, intelligent transportation engineering, telecommunication and environment, who desire to obtain an overview on the emerging spatio-temporal data streams field. It would be of interest to computer professionals, software developers and domain experts from industry (GIS experts, spatial data analysts, data scientists, real-time and big data analysts, BI analysts). Furthermore, experts in these disciplines could profit from the spatio-temporal data stream vision when designing and building innovative systems.

This book should be accessible to anyone with a general background on the concepts of weather database systems or complex event processing. A deeper knowledge of the spatio-temporal database systems and big data technologies would be an advantage. A background on data stream processing is useful but not needed—brief introduction is provided in Chap. 2.

I hope this book provides a useful overview of the young and evolving field of spatio-temporal data streams.

Zagreb, Croatia and Vienna, Austria  
June 2016

Zdravko Galić



<http://www.springer.com/978-1-4939-6573-1>

Spatio-Temporal Data Streams

Galic, Z.

2016, XIV, 107 p. 28 illus., Softcover

ISBN: 978-1-4939-6573-1