SPATIOTEMPORAL DATA ORGANIZATION AND APPLICATION RESEARCH

Chengguo Tan [a], Suiyu Yan [b]*

[a] Big Data Innovation Center, State Key Laboratory of Information Engineering in Surveying, Mapping and Remote Sensing,Wuhan University, Wuhan, China - tchg@geostar.com.cn
[b] Wuda Geoinformatics Co.,Ltd., Wuhan,China - lucya@geostar.com.cn

Commission IV, WG IV/3

KEY WORDS: Spatiotemporal Data, Smart City, Information Fusion, Spatiotemporal Data Mining, Spatiotemporal Object

ABSTRACT:

Organization and management of spatiotemporal data is a key support technology for intelligence in all fields of the smart city. The construction of a smart city cannot be realized without spatiotemporal data. Oriented to support intelligent applications，this paper proposes an organizational model for spatiotemporal data, and details the construction of a spatiotemporal big data calculation, analysis, and service framework for highly efficient management and intelligent application of spatiotemporal data for the entire data life cycle.

1. INTRODUCTION

With the development of E-government infomationization in China, generally "two networks, one website, four databases, and twelve finance systems" have been gradually established and improved. All levels of E-government administration information systems have been promoted, while abundant data resources have accumulated through government duties and public services. However, data isolation is still a disadvantage. Different data resources do not interact so the value of these data can not be fully exploited. The State Council issued a "big data development promotion action plan" in August 2015 and "government information resources sharing management interim measures" in September 2016, in order to speed up the promotion of government information systems and public data sharing, enabling government information resources sharing to come inti full play for deepening reform, functional changes, and management innovations. The deep integration of existing urban management resources and urban information sharing has become one of the main tasks in smart city construction.

In the era of smart city and big data, spatiotemporal information permits an optimal allocation of urban resources, providing decision support to reduce the consumption and waste of urban resources. Spatiotemporal data mining facilitates traffic management, crime analysis, disease monitoring, environmental monitoring, public and medical health delivery and supports many other fields. All in all, there are a myrad of fields and practical motivations for analyzing massive and high-dimension spatiotemporal data and exploing the value of this data.

Guided by smart applications, this paper starts by addressing the problems of city and society information resources management, city operation system departmental collaboration and sharing. By analyzing the features of spatiotemporal data, this paper defines the organization and analytical models of spatiotemporal data, constructing a spatiotemporal big data frame based on advanced techniques, such as smart network, cloud computing, and the Internet of Things（IoT）, aiming at "full perception, interoperability, integration and sharing, business collaboration, on-demand services" . This orientation lays a conceptual foundation for data integration, management, service and application of city operation systems, that provide basic support for building a widely interconnected,deep application, and information service based smart city system.

2. THE ORGANIZATION OF SPATIOTEMPORAL DATA

Along with the development of urban informatization, sensor networks, mobile Internet, radio frequency identification, global positioning systems and other equipment have rapidly developed and become widely used, with explosive growth across time and space. The inherent time and space, properties of spatiotemporal data, are revealed in cubic dimensions, semantics, and dynamic landscapes with complex spatiotemporal correlations, which are time-variant, space-variant, dynamic and multi-dimensional.

2.1 Spatiotemporal data model

The core of spatiotemporal data is a geographic object. with a certain geographic meaning and uniqueness in space, corresponding to a complete equivalent in the real world, and also connected to related social economic information and featured with time dimension (T), space dimension (S) and property dimension (D).

A spatiotemporal model (table 1) includes a geographic object, event and procedure. A geographic object contains space, property and time information. Its changes in time and space can be measured, and described by events; the monitor monitors the change of the geographical object in space, attribute and

* Corresponding author