Construction of Smart City Cloud Platform Based On Multi-Mode Data Fusion Model

Bingzhao Shi¹,*
¹City University of Macau, Macau, 362000

*Corresponding author e-mail: chinaedu2014@cityu.edu.mo

Abstract: Smart cities rely on new information technology to combine artificial intelligence and human wisdom, integrate core city resources, and achieve the best configuration for city operations and smart development. The purpose of this article is to study the construction of a smart city cloud platform under the multi-module data Fusion model. This paper proposes a city multi-modal data fusion model, and explains the model from three levels. First of all, in view of the characteristics of multi-directional data, the focus is on the characteristics of multi-source, heterogeneous, temporal fluctuation and high-dimensionality. Secondly, considering the characteristics of multivariate data, a basic three-layer model from bottom to top is established to complete the process of multi-modal data fusion. Finally, based on the three-layer model, a multi-mode data fusion model suitable for smart city construction is proposed. The experimental results of this paper show that building a cloud platform system for a smart city based on a multi-mode data fusion model has significantly improved all aspects of the city. Among them, the efficiency of the smart city’s safety management has increased by 14%.

Keywords: Multi-Mode Data Fusion, Smart City, Cloud Platform Construction

1. Introduction

"Urbanization" has slowly entered people's lives and work, and its process is accelerating [1]. In the process of rapid urban population growth, the pace of urban management and service construction is relatively slow, gradually causing certain contradictions and problems. In order to solve the urban management and service problems that are compatible with the construction of new urbanization, it is particularly important and urgent to accelerate the construction of smart cities [2-3].

Smart city refers to a new generation of urban system that combines information and communication technology and urban management through the sustainable development of human society and urban economic, social and ecological innovation [4]. Cloud computing, Internet of Things, mobile communications, and the Internet are the technical foundations that support smart cities, allowing people to feel that smart cities make life better through intelligence [5-6].
Xu H Y introduced multi-source data fusion (MSDF), and comprehensively outlined the composition and challenges of MSDF in scientometrics [7]. Compared with the MSDF method in the sensor and other fields, combined with the characteristics of scientometrics, the application model and procedure of MSDF in scientometrics are proposed [8]. The model and process can be divided into three parts: data type integration, data relationship fusion and set clustering. In addition, the integration of data relationships can be divided into cross integration of multi-modal data and matrix fusion of multi-relational data. However, there are some errors in the fusion process, resulting in inaccurate results [9].

The innovation of this paper is that on the basis of defining the basic connotation of smart city information security risks, taking into account the rationality of data collection and indicator setting, a set of smart city information security risk assessment index system is constructed [10].

2. Construction Method of Smart City Cloud Platform

2.1 Features of Smart City

(1) Adopt a differentiated business model. In the early days of smart cities, blindly monitoring trends were a serious phenomenon. The construction and operation of smart cities are mainly carried out by the government, with large investments and small results. The current concept of smart city construction is gradually changing, the introduction of social forces is getting more and more attention, and its mode of operation is gradually changing. For example, using PPP operation mode, public service market, professional enterprise operation, joint participation and joint construction.

(2) Create an open information platform. Data on transportation, environment, population, industry, etc., in smart cities, the amount of data is large and requires effective collection and analysis, which puts forward higher and higher requirements for big data technology. At present, due to information security issues and management system requirements, general data have not yet been released for some sections of the smart city. At the same time, the data of each city is also a relatively isolated and closed "information island". With the development of information technology, the construction of smart cities will use open information platforms to systematically disclose relevant common information and promote the development of truly integrated smart cities.

(3) The construction concept that pays attention to practice. "People-oriented" is the ultimate goal of smart city construction. Whether it can provide people with a more comfortable and affordable life is the basic positioning of a smart city. In August 2014, the seven ministries and commissions jointly issued the "Guiding Opinions on Promoting the Healthy Development of Smart Cities", which clearly emphasized the need to adhere to the principle of "people-oriented, seeking truth from facts", emphasizing serving the people, serving the people's comfort, and benefiting the people. The construction of a smart city is integrated into the development of the industry, and most importantly, it is integrated into the needs of people's lives. Human needs are the embodiment of customer value in the construction of smart cities. Therefore, the content of smart medical care, the transportation and communities involved in smart city construction must fully consider actual needs, give full play to the city's resource advantages and development characteristics, adjust measures to local conditions, and avoid repeated imitation construction.

2.2 Cloud Computing Technology

Cloud computing platform is the core system of smart city. After collecting a large amount of data through the Internet of Things, its realization requires a powerful computer storage platform. Through the cloud computing platform to process and distribute city data, the massive storage and shared use of resources are realized, making services more convenient and faster.

(1) Storage technology

Conventional storage uses a central storage server to store data, but such a storage server system cannot provide public space. Unlike previous network data storage, cloud computing uses
decentralized data storage technology. Decentralized data storage technology can combine various types of different storage servers with hierarchical systems to allocate appropriate storage devices, decentralized storage devices, parallel processing, rapid response, and shared storage space resources.

(2) Virtual technology
Virtual technology destroys the physical layer between computer application materials, realizes the centralized management of natural resources and a flexible structure, satisfies the needs of resource virtualization and network infrastructure virtualization, and enables platform visualization and application realization shell visualization. Cloud computing uses virtual technology to integrate many scattered unused computing functions, dynamically allocate computing resources and perform integrated management, which greatly improves resource utilization. The application of cloud computing virtualization technology not only increases resource utilization and reduces costs, but more importantly, it makes the system of transmission, storage, computing and other computer components more efficient, and makes the system of cloud computing and other computer components more efficient. The computing system provides powerful computing efficiency.

(3) Network technology
Cloud computing has greatly promoted the development of networks. The traditional network is mainly the user's interactive operation of the server and the user. The network under the cloud platform has been completely improved the integrated functions of network software and hardware, realizing dynamic expansion and new technologies for the development of resource super-computing functions. The development and standardization should take into account the facts. This process realizes global mutual visits and information interaction. However, with the rapid increase in users, excessive expansion of information, and substantial increase in application technology investment, the network environment has become complex and diverse, and many problems have emerged. Therefore, the operation of the network requires stronger technical support.

3. Experiments on Building a Smart City Cloud Platform System under a Multi-Mode Data Fusion Model

3.1 Multi-Mode Data Fusion Model Construction
The multi-source, heterogeneous, time-varying, and multi-dimensional characteristics of city information have brought great difficulties to data fusion. Therefore, it is necessary to study and establish a multi-modal data fusion model to improve people's understanding of the common views of urban participants, create high-dimensional and more valuable data, and be aware of the interconnection of data. To this end, this paper proposes an integrated multi-mode development model, the framework of which is shown in Figure 1. This model has three levels: service information description model, metadata model and interface model. The basic idea is that, first of all, in order to integrate the data of multiple action modes, it is necessary to explain various data and services and their related relationships. On this basis, the second model is to process metadata, perform data ethics modeling and metadata. Finally, we propose the data interconnection model and the interconnection between entities based on the service information description model and the metadata model. The data is generated using virtual label technology.
3.2 Construction of Smart City Cloud Platform System

City information system is the display of the composition and content level of smart city big data, which records the formation, operation, development and structure of smart cities. Figure 2 shows the architecture of the smart city information system.

(1) The main information items of the urban planning development management system are urban planning concepts, spatial planning layouts, urban planning layouts and other data to realize the overall planning of urban resource allocation and population.

(2) The main information items of the urban infrastructure data system are the overall land design, urban planning, road traffic layout and other data, in addition to fire safety control and the construction of ports and airports.

(3) The main information items of the environmental information system are data related to the urban ecosystem, environmental regulations, the prevention and control of urban pollution, and the sustainability of natural resources.

(4) The main information items in the socioeconomic data system are enterprise trade data, social
structure data, population survival index, economic resource allocation and social equity;

(5) The main information items of the city evaluation system are data on the city's innovative competitiveness and citizens' participation in the construction of smart cities.

4. Smart City Management Analysis Based on Multi-Mode Data Fusion Model

4.1 Security Risk Analysis of Smart City Information Management

In the empirical research, the first need to organize the data is the expert questionnaire. After three rounds of surveys in 15 cities, three expert score sheets on the security risk of smart city information management are obtained. After the survey results are sorted, the scores of each indicator are extracted based on the last round of scores. The median is the final score. Taking Wuhan as an example, the statistical data is imported into the table, as shown in Figure 3.

![Figure 3. Smart city information management security risk score](image)

It can be seen that after three rounds of experts reiterated their disputes, it has a certain impact on the scores outside the upper and lower quarters of each indicator data. On the other hand, as the research progresses, the standard deviation between the expert scores gradually decreases, indicating that the controversial indicators gradually converge after understanding different scoring viewpoints, reflecting the rationality of the Delphi method.

4.2 Urban Multi-Mode Data Fusion Model

City interconnection and multi-mode data fusion is a system engineering. In addition to relying on the above models to achieve data exchange, the most important thing is that it can achieve true integration, especially independent data merging and development. To this end, this paper proposes a framework for data fusion and interconnection. Only in the four aspects of the framework can the integration and activation of data really happen.

(1) Data representation

In order to achieve data interconnection and integration, the representation of data also needs to undergo major changes. It is no longer only the data itself, but more importantly, in the fusion scenario, the content of the data will be richer, and it is necessary to be able to represent all the content included in the data, including the representation of the data association relationship and the virtual label of the data. Said.
(2) Data link
The data association here not only refers to the basic relationship and extensive relationship between the above data, but also refers to how to establish the relationship between the data, that is, the research and practical work related to the data link, including especially the enhancement of the data link relationship, the data link representation of road relationship and development of data link relationship.

(3) Data interconnection
The purpose of the data link is to establish a data communication channel and form a data network. In order to achieve this goal, from the perspective of data interconnection, in addition to unique data identification through virtual data tags, issues such as data management and data interconnection access should also be solved.

(4) Data metabolism
Data metabolism refers to how interrelated data can achieve its own changes and development on the basis of changes in other related data. There are three levels of problems that need to be solved here: one is how the data knows when to change, that is, the rules and methods of metabolism perception; the second problem is how to know how to change when the data knows that the rules need to be changed, that is, how to change the rules. Metabolism. The third is how to execute the metabolic process when the data knows when and how to modify, that is, the language of metabolic execution.

5. Conclusions
Smart city is a high-level stage of urban informatization developed with the advent of the network society. Smart cities use a new generation of information technology to build wide-area resource integration, detailed understanding, and comprehensive interconnection to achieve the highest results in resource allocation and optimized operation of urban systems. The construction of smart cities will make future life better.

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