Application of Big Data Information System in the Field of Public Utilities Management

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Abstract. With the continuous development of information technology, the management of social issues has entered a new era, and a series of management activities in the field of public service management are also facing new issues. Based on the above background, the purpose of this article is the application of big data information system in the field of public utilities management. This article first describes the relevant theories of public information resources, including the concepts of public information resources, public information resource integration, public information big data platform, etc., and summarizes and summarizes them; secondly, it focuses on the current status of the integration and application of public information resources and the existing problems, and analyzes the advantages of using big data technology to promote the integration and application of public information resources; then, combining the current status of the integration and application of public information resources and the actual needs of the construction of public information big data platforms, the positioning of the public information big data platform is explained. And the construction content, built the overall construction framework of the public information big data platform, and carried out the functional analysis and design of the various subsystems of the platform; finally, discussed the performance evaluation index system of the public information big data platform, using the analytic hierarchy process and fuzzy comprehensive evaluation method builds a public information big data platform performance evaluation model. When the number of folds is 2, its prediction accuracy is the highest, reaching 96.91%, which evaluates the construction and operation of the platform.

Keywords: Big Data, Information Systems, Public Utilities, Information Resources

1. Introduction
With the rise of technologies such as the Internet of Things, big data and cloud computing, as well as the continuous improvement of the application level of urban informatization, the concept of "smart city" came into being [1-2]. In the exploration and practice of smart cities in many regions of my country, the integration and application of public information resources are the primary task, and the construction of public information big data platforms is an important starting point [3]. Information
resources are undoubtedly important factors of production, intangible assets and social wealth in cities. Only the latest technologies such as the Internet of Things, cloud computing and big data can be used to actively perceive information in various aspects of the economy, transportation, resources, and public places, and timely. The integration and application of information resources can gradually realize the vision of a smart city and continuously improve the level of urban management and service [4-5].

In the era of big data, the competition between countries is shifting from the traditional competition for population, land, capital and energy to the competition for data resources and information resources [6]. There is no doubt that big data is subversively changing the way of resource allocation, national governance model and world economic form [7-8]. As a public information resource as a basic and strategic asset, how to comprehensively improve its application level and use value through big data technology is an urgent topic [9]. The development of big data is closely related to the integrated application of public information resources. The society's demand for commercial application of public information resources is the driving force to promote the development of big data, and the key to the development of big data is to integrate and share the many public information resources it has mastered with the public [10]. In the context of big data, countries all over the world have included data integration and opening into their national development strategies, and actively promote the integration and application of public information resources.

This paper conducts research, analysis, generalization and summary of basic theories such as public information resources, integrated application of public information resources, and public information big data platforms by consulting some domestic and foreign documents, so as to provide the necessary theoretical basis for the research of this thesis. Combined with the design principles of the evaluation model, the performance evaluation system of the public information big data platform is constructed. Considering the vagueness of the evaluation of the public information big data platform, the fuzzy comprehensive evaluation is selected to evaluate the performance of the public information big data platform, and Use analytic hierarchy process to determine the weight of factors.

2. Management Information Systems

2.1 Big Data Management Information System
Big data management information system is a human-machine system that uses computers, network communication equipment and other office equipment for information collection, transmission, processing, storage and maintenance. Its purpose is to provide enterprises with necessary strategic information resources to help them make the best at the same time; the information system can provide great convenience for enterprise management. From the current widely used management information system composition, it is mainly composed of decision support systems, industrial control systems, office automation systems and various types of huge databases, which can communicate with the outside world. For enterprises, the application of management information systems can help enterprises reduce the large amount of human and material resources used in the process of information collection and sorting, and relying on advanced computer and network communication technology staff can realize the "fast and precise collection and sorting of information resources., Quasi", its application plays an important role in promoting enterprise development. Public utilities refer to things related to the basic life of the public, including specific public products and services, education, medical care, transportation, and water and electricity services provided to the public. In our country, public utilities management is a process of management, regulation, and control of public utilities involved with public power. Its purpose is to promote the coordinated development of the overall interests of society; because once the management of public utilities falls into chaos, it will inevitably affect People's normal life order will pose a serious threat to the stable development of society.

2.2 Public Information Resources
Public information resources and material resources belong to the category of economic resources, so they have the general characteristics of economic resources, such as scarcity and selectivity; they also have the knowledge, sharing, timeliness, dynamics, and dynamics that are common in general information resources. Accumulation and other characteristics; at the same time as an information resource, it also possesses the characteristics of authority and decision-making. In the new situation, especially in the context of big data, public information resources have the following characteristics.

(1) Publicity
Public information resources only limit the producers of information, but they have not substantially changed the basic attributes of public information resources. Therefore, publicity is still the first attribute of public information resources, and public information resources are still public goods and have a public interest. The characteristics of it are owned by the whole society and serve the whole society. It is the publicity of public information resources that promotes the open sharing of various information resources to the public.

(2) Interactivity
Traditional information resources flow in one direction. Information resources flow from the information source to the information receiver, and the information receiver can only passively receive all kinds of information. However, with the development of e-government, the interaction of public information resources has become more and more obvious, and the rapid development of modern communication technology has realized the relationship between (Government-Government), with enterprises (Government-Business), and with the public (Government-Citizen).

In the process of collecting, integrating and processing public information resources, not only can the information resources be integrated and shared between various functional departments to serve the public management functions of the departments, but also through open sharing, third-party social organizations, enterprises and institutions Units and other types of information service enterprises carry out targeted topic-oriented development to meet the public's demand for information resources and enhance the value of public information resources in order to better serve and develop the society. This reflects the value-added nature of public information resources.

(3) Security
The security of public information resources mainly refers to the integrity and availability of public information resources. Since the functional department is to complete the data collection work carried out by a certain task, its collection purpose and collection scope are relatively clear, and will not affect the work due to the lack of data collection, so the collected data is relatively complete, and its availability is also obtained.

3. Management System Experiment Design

3.1 Data Collection
The data collection function is mainly to provide a data exchange service system with information exchange as the core, which can traverse the heterogeneous systems, applications and database resources inside and outside the department, and support different businesses and different platforms for different structured data interaction requirements, and finally realize the seamless exchange of data between each application system. In addition, the data exchange service system can also collect all kinds of data generated by social activity participants, and supports smart phones, WeChat, Weibo, website submission information and other methods to obtain information and data submitted by users.

3.2 Determine the Index Weight
Determine the weight of each indicator through the analytic hierarchy process. After establishing the hierarchical model, the first step is to construct a judgment matrix for pairwise comparison. The second step is to determine the eigenvector and maximum eigenvalue of the weight of each indicator, and finally make consistency test.
According to the obtained judgment matrix $A$, the relative weight of each element to the criterion layer $C$ is obtained. The weight vector $W = (W_1, ..., W_n)$ under a single criterion layer, its component vector is:

$$W_g = \overline{W} g / \sum_{i=1}^{n} \overline{W} g_i$$

(1)

among them: $\overline{W} g_i = \left( \prod_{j=1}^{n} a_{ij} \right)^{1/n}$

(2)

From this, calculate the maximum eigenvalue:

$$\lambda_{max} = \frac{1}{n} \sum_{i=1}^{n} \left( \frac{AW_i}{W_i} \right) = \frac{1}{n} \sum_{i=1}^{n} \left[ \frac{\sum_{j=1}^{n} a_{ij}W_j}{W_i} \right]$$

(3)

Find the corresponding average random consistency index $RI$, as shown in Table 1, where $n$ is the matrix order, and calculate the consistency ratio $CR = CI / RI$.

| n  | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 |
|----|----|----|----|----|----|----|----|----|----|----|----|
| RI | 0  | 0  | 0.58 | 0.90 | 1.12 | 1.24 | 1.32 | 1.41 | 1.45 | 1.49 | 1.51 |

4. Application Analysis of Big Data Information System in the Field of Public Utilities Management

4.1 Function Analysis of Public Information Big Data Platform

The main functions of the public information big data platform include three aspects. One is the entry and exit channel of public information resources, which can realize the exchange, comparison, cleaning, integration and processing of various public data; the second is to realize the cataloging, organization and management of public information resources; the third is to realize the public information resources. The sharing and openness of the company provides data support for various applications. To this end, the functions of the public information big data platform mainly include data collection, data storage and integration, data management and support, interface services and platform interconnection, as shown in Figure 1.

**Figure 1.** Function analysis of public information big data platform
Metadata is the core and foundation of data exchange and integration. It mainly provides support for data tracking and description methods, and is used to describe the content, representation, management, quality and other characteristics of data; data exchange is the process of data exchange. The information generated in the shared exchange node includes data, parameter management information, process management information, monitoring management information, etc.; catalog data is mainly the catalog information of public basic data, public business data, and public service data; management data is operational. The various management information generated by the maintenance management service system generally includes data operation information, data storage information, database operation information, and database management information, etc.; safety data is the security status and guarantee information of the platform, mainly including the possibility of accidents, Analysis data, failure frequency information, system safety analysis data, reliability analysis data, etc.

The samples that meet the screening are divided into training set and test set at a ratio of 3:1. The training set is used to establish the model, and the test set is used to verify the correctness of the model. Using related classification algorithms, a decision tree model, OneR model and Naive Bayes classification model are established to predict the test results. As shown in Table 2.

**Table 2.** Accuracy and modeling time corresponding to different fold numbers of decision tree

| Number of folds | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  |
|-----------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Accuracy        | 96.91% | 96.31% | 96.59% | 96.52% | 96.52% | 96.48% | 96.59% | 96.40% | 96.52% |
| Time            | 0.45 | 0.45 | 0.47 | 0.43 | 0.46 | 0.45 | 0.45 | 0.41 | 0.44 |

It can be concluded from Table 2 that when the number of folds is 2, its prediction accuracy is the highest, reaching 96.91%.

### 4.2 Application of Big Data Management Information System in the Field of Public Utilities Management

The big data management information system can manage all aspects involved in the management of public utilities, relying on powerful computer software and hardware processing technology to accurately integrate, analyze, filter and process huge social data in a timely and accurate manner, greatly reducing labor. The workload has improved the efficiency and accuracy of work. Figure 2 shows the application market pattern of my country's big data management information system.

![Figure 2. My country's big data management information system application market structure](image)

Secondly, the application of the management information system can be broken down into parts to follow up and record changes in public information in a timely manner, especially the current frequent population flow, information in the medical and health field can use the network communication
technology adopted by the system to achieve remote information entry and dealing with it not only facilitates the public to enjoy the benefits of public utilities management, but also improves the efficiency of public utilities management and makes the people more satisfied.

5. Conclusion

The management of public welfare undertakings in modern society is related to the daily lives of thousands of people, and all aspects of management must be effective. Otherwise, it will hinder people's basic survival of food, clothing, housing, transportation, leisure and entertainment. The application of management information system can effectively improve the level and efficiency of public welfare management and provide strong technical support for residents' lives. From the point of view of operation and service, the operation of public welfare undertakings also needs to rely on many high-tech means. It is not only promising in the field of public welfare management, but also exerts great effects in all aspects of social development.

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