Study on Operation and Development of Rail Transit under Big Data Conditions

Liu Xiudan

Jilin Railway Technology College, Jihua East Road NO.1 Jilin City, Jilin Province, China

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Abstract: In order to ensure the standardized application and benign development of big data in the field of rail transit, on the basis of summarizing the basic concepts of big data, the system sorts out the basic characteristics, data types, main contents, processing flow and key technologies of big data in the rail transit industry, and selects one of the typical majors summarizes the current status of rail transit big data in statistical analysis, emergency assisted decision making, passenger travel induction, passenger flow forecasting and dispatch management. Finally, the challenges of big data in rail transit applications are expounded, and the development trend of rail transit big data applications is proposed from the internal and external aspects of rail transit data systems.

1. Introduction

Emerging industries and new technologies such as mobile Internet, Internet of Things, big data, cloud computing, remote technology services, network collaborative design, engineering simulation, 3D printing, realistic scene design, BIM, etc. are changing traditional survey and design, engineering construction management and Maintenance mode. Railway engineering information technology carries the data model of railway structures, including rich design information and construction information. The operation and maintenance units rely on these data and information to effectively improve management level and work efficiency. At present, the design stage of the rail transit field has basically been digitized, but in some aspects, the data processing capability still needs to be strengthened. Moreover, due to the limitations of data processing methods and capabilities in the construction and operation phases, the design results are not fully applied and difficult to achieve. The integration and sharing of information in the whole stage restricts the information construction in the field of rail transit. The study of the application of big data and cloud computing technology to solve problems from complex data or massive data is one of the key issues that need to be solved in the informationization of rail transit engineering. Since the field of rail transit engineering started late in the research of big data and cloud computing technology, it is worthwhile to study the aspects of the whole life cycle of these technologies. Combining the characteristics of big data and cloud computing, this paper puts forward a rough view on the possible application requirements of rail transit engineering planning, design, construction, operation and maintenance, and aims to provide reference for future research work to improve the information in the field of rail transit. Level of development.

2. Big data, cloud computing technology

Cloud computing is developed on the basis of integrating distributed computing, virtualization technology, network computing and Web services. It enables users to access the resources on the Internet anytime and anywhere through the network, regardless of time and space. The data and computational issues are addressed, and the two key technologies used are virtualization and multi-tenancy. Virtualization is a kind of resource management technology. It Abstracts and transforms various computer resources such as servers, networks, memory and storage, and breaks the barriers that cannot be cut between physical structures, so that users can compare with the original ones. Configure a better way to apply these resources. Multi-tenant technology is a software architecture technology that explores and implements how to share the same system or program components in a multi-user environment and still ensures the isolation of individual user

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data. It can be seen that the sharing of hardware resources by different users is a virtualization technology, and the same software resource sharing is a multi-tenant technology. These two sharing technologies together constitute an efficient business model for cloud computing. Compared with traditional network technologies, cloud computing is characterized by five aspects: virtualization, large scale, dynamic scalability (the resources can be dynamically expanded according to user and application scale requirements), economy and powerful computing and storage capabilities. The characteristics of big data are the so-called 4V (large quantity, high speed, diversity and value). It has a close relationship with cloud computing, and even an important link that complements each other. If you compare cloud computing to a processing factory, big data. It is the material of it. Big data data mining must rely on cloud computing distributed processing, distributed databases, cloud storage and virtualization technologies. As far as engineering is concerned, the creation of big data should begin in the engineering design period and be inherited into the construction and operation period. The role and user of creating big data basic information is an alternating relationship, which can be simply described as: “Design creation – construction application and creation – operation and maintenance – creation design application”. According to IDC analysis, in the past year, there have been more and more applications in the field of big data and analytics in the Asia Pacific region. In China, from Internet companies to traditional industries such as telecommunications, finance, and government, various big data and analytics technologies have been adopted, and application scenarios are gradually expanding, from the analysis of structured data to semi-structured and non- Analysis of structured data. With the development of information technology, the rail transit department urgently needs to use advanced and intelligent data analysis methods to conduct efficient and real-time analysis of massive data.

3. Basic content of rail transit big data application

Rail transit big data has unique characteristics compared to other areas of big data. 1) The data is dynamic. The rail transit system is in constant change. Most people and things have strong data dynamics, strong randomness, obvious individualized differences, diverse granularities, and strong inter-data connectivity, especially when encountering disturbances or disturbances. Failure or delay in one aspect often affects other aspects. Data heterogeneity is more extensive. First of all, the data source is wide, the rail transit system involves multiple departments, the business is complex and diverse, the data storage is scattered, and it is difficult to concentrate. Secondly, the types of data are complicated, the unstructured data is relatively large, and it is difficult to form a unified structure; The data generation period is uneven, some data is generated at any time, and some data are generated in cycles of days, weeks, and months. In addition, data is generated in various ways, some are generated by equipment, and some are generated by personnel records. It is produced at the station, and some are produced with the car. Data depends on the external environment. On the one hand, the rail transit system is in the urban environment, and the operational carriers and service objects are closely related to the city; on the other hand, the rail transit system is susceptible to external factors, weather changes, major events, national policies, holidays, etc. The traffic flow and planning of the traffic will have a big impact. The data is regular. The rail transit system is operated under the guidance of various plans, such as train operation plan, personnel scheduling plan, EMU maintenance plan, etc. Passenger flow is presented in terms of time, space and periodicity according to year, month, day and hour. Periodicity, so rail transit big data has a certain regularity. The confidentiality requirement is high. If the confidentiality of information related to technology or security is high. The data has obvious space-time characteristics. For example, passenger flow lines and train operation data change simultaneously in both time and space dimensions.

The processing flow of rail transit big data needs to be oriented to decision-making needs, starting from the data source and following the data collection, storage, processing, analysis and interpretation architecture. The latter can be collectively referred to as data processing technology. Knowledge mining and results presentation through extraction, integration, and unified storage of widely heterogeneous data sources.

4. Decision-making needs for the use of rail transit big data

The decision-making needs of the use of rail transit big data run through the whole process of the rail transit life cycle, and the data plays an important role in supporting the planning, construction and management of rail transit. This kind of decision support is mainly reflected in the aspects of visualization law mining, prediction, early warning and control. Taking transportation as an example, the main decision-making needs include: parallel, cross-line planning in line network planning, determining reasonable line opening sequence, train operation chart preparation, passenger flow warning in daily passenger flow organization, train operation adjustment, current limiting scheme Determine, sudden passenger flow organization, determination of passenger transportation marketing plan, ticket clearing, evaluation of rail transit operation effect, dynamic evaluation and optimization of operational energy saving scheme, and optimization of emergency resource allocation. Platform management of data generated in rail transit operations for easy query and analysis. For example: Develop an operational data management system with big data analysis capabilities, collect full-sample data, and record important operational data including passenger flow information, driving information, operational indicators, capacity allocation, passenger services, and operational events.

According to the data of materials and equipment, an electronic plan will be formulated, and an emergency response mechanism will be automatically activated to allocate human and material resources. For example, in the Shanghai Metro, resources such as people, electricity, and vehicles are distributed according to time and space, and various resources of each line are deployed. For example, in the Beijing-Hong Kong subway, the entire line of equipment is monitored by the system, and the data on the implementation of the enterprise system, the execution status of the maintenance tasks, and the detailed information of the spare parts at the employees of each site are analyzed, and the system is dispatched to rationally deploy resources and The deployment achieves a more efficient and responsive management. The author determines a reasonable emergency resource allocation plan by deep mining the frequency of historical equipment facilities failures and passenger flow data.

5. Challenges and trends in the application of rail transit big data

In addition to the common challenges of protecting big data applications such as personal privacy and data security, the following typical problems can be seen from the application of existing rail transit big data: 1) in terms of decision content and methods, and rail transit Compared with the large amount of data generated every day, the existing application content is still very simple. There is almost no feedback application between the data of each stage of the rail transit life cycle, and there are few cross-applications of multi-source data. From the perspective of the way of application, the current application of big data only exists in decision support, and has not yet reached intelligence. 2) In terms of data collection, in the data recorded by personnel, there is a lack of data and a non-uniform record format, resulting in unclear or even missing semantics of the original data; and there are differences in data coding and classification between departments, and the data lacks uniformity. Management and standards. Therefore, in view of the current uneven data collection techniques and the inconsistent degree of automation, there are differences in the quality of acquired data. Therefore, some data collection methods should be innovated. At the same time, while obtaining the massive original traffic data, the data should be processed initially for analysis, so that traffic data can be obtained in a timely, accurate and fast manner. 3) In terms of data integration, the types and quantities of big data involved in rail transit are complicated and scattered in different data management systems and departments. Data barriers are serious, there is a phenomenon of repeated construction of public data, data maintenance and security are not perfect, and data sharing Low level, data integration is needed for data analysis.

6. Conclusion

This paper summarizes the main content of rail transit big data application, especially the transportation professional as an example to analyze the decision-making needs and key technologies of big data application, and puts forward the challenges and development trends of rail transit big data application. Through analysis, it will help the rail transit industry to do a top-level design of big data applications and promote the benign development of big data in the rail transit industry. Since rail transit involves many professions, this article cannot cover all majors more comprehensively. The in-depth mining of big data applications in various majors will be the direction of further expansion of this article.

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