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Review Article

Traffic Big Data in the Development of Intelligent Transportation System

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Abstract: With the continuous development and advancement of computer technology, big data guarantee the establishment of an urban intelligent transportation system, a solid environmental basis to reform its application, and the construction of a deeply integrated data mechanism for big data-driven traffic management. This review paper briefly elaborates on the basic characteristics and sources of traffic big data as well as expounds on the problems and application mechanisms of big data in intelligent transportation systems.

Keywords: *big data; intelligent transportation system; problem; application development*

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0 Introduction

The collection and application of basic data in intelligent transportation systems are of critical significance as it forms the basis for the overall in-depth reform and innovation, as well as key guidance for its transformation. Relevant departments of big data technology management should create an in-depth analysis mechanism to provide the rational and integrated application structure of traffic big data as well as understand problems caused by big data so as to promote the sustainable development of reform using appropriate measures.

1 Basic characteristics and sources of traffic big data

1.1 Basic characteristics of traffic big data

Traffic big data can better estimate differences for the following year based on traditional data. The new traffic big data highlight the large volume of traditional data and, using high-speed processing efficiency and other features, present them in a new format. Its specific features are shown in Table 1.

The combined data are not difficult to identify the traffic data system. As the diversified forms of data become more prominent, any subsequent problem can be immediately forwarded to the respective relevant department.

1.2 Big data sources in intelligent transportation systems

In addition to the actual situation and specific requirements of the data, it is necessary to comprehensively determine the source of the distribution system and application mechanism so as to effectively establish the supervision and management of big data in intelligent transportation systems. The specific data divisions are presented in Table 2.

First, the traffic flow data are divided into fixed monitoring and mobile monitoring. On the one hand, the data aggregated by the fixed detector is a relatively traditional detection system that provides basic values for the intelligent transportation system. This is mainly by constructing a traffic data collection and processing center system using microwave radar, ultrasonic, and other basic equipment, thereby integrating data and traffic flow forecasting system[1]. On the other hand, the mobile detector mainly aggregates relevant data on fixed detection and motion detection to obtain more comprehensive traffic data. In the process of collecting a comprehensive analysis of traffic flow and data evaluation, the integrity of multivariate data processing and research is guaranteed, comprehensively optimizing traffic data quality.

Second, the location data are mainly based on mobile detection equipment. It can systematically expand the mobile detection process and application scope

Table 1. Basic features of traffic big data

Basic feature	Application
Large volume of data	The coexistence of structured and unstructured data
High-speed processing	Traffic flow time change is variable, requiring prompt corresponding traffic management and services
Modal diversity	Extensive range and types of data
Visualization	Visual analysis of urban road network features
True and false coexistence	Possible redundancy and errors in the data
Abundant features	Time, space, and history are additional features

Table 2. Data division in intelligent transportation system

Type of data	Monitoring method (s)	Parameter (s)
Fixed monitoring of traffic flow data	Induction coil and geomagnetic equipment	Speed, flow, and occupancy
Mobile monitoring of traffic flow data	Buses and taxis with GPS function	Instantaneous speed and travel time
Location data	Smart cards and vehicle terminal	GPS location map
Unstructured video data	Video detection equipment	Video surveillance images

using advanced mobile communication technologies. It is reasonable to construct a wide-ranging service concept, operation framework, as well as relevant data of the bus smart card. Passenger behavior can also be systematically analyzed to ensure the integrity of public transport infrastructure construction and service operations management models. In addition, the data terminal for taxis can also constrain travel route selection, travel distance, travel time, and road preference. The effective integration of urban traffic information, its acquisition capability, and management efficiency can initiate the optimization of traffic data source management and route releases.

Third, the unstructured video data mainly set up a monitoring process for macroscopic situations. This can be used to build a high-altitude, high-definition video surveillance system, thus effectively establishing a comprehensive and improved traffic system with macromanagement mechanism to ensure that the video processing module can provide smooth traffic flow. The parameters and reasonable maintenance of the management process can also recognize the state and type of traffic flow[2].

The fourth and final data division concerns the development of big data in the multi-Internet and government networks. Here, internet technology should fully integrate with the government network to provide intelligent security for the transportation system to guarantee that the data source and source routing can meet the data processing and control requirements. In addition, there should be a mandatory video data system for intelligent traffic events based on social networks.

2 Problems of big data in intelligent transportation systems

Although intelligent transportation systems provide convenience for travelers, there are certain problems regarding big data that require urgent solutions. These problems are pertinent to the relevant departments that must comprehensively analyze and manage the related technical problems to better optimize system management and intelligent systems[3].

2.1 Data security

When researching data in intelligent transportation systems, it is known that data transmitted across public security network present privacy concerns regarding personal information. Among them, the vehicle trajectory data detected by the bayonet system are very important. In other words, traffic safety and data security issues have become crucial to the data collection of intelligent traffic systems. The operations of the intelligent transportation system itself are founded by depending on the private network of intelligent transportation. If the data exchange cannot be processed according to the standardized process and procedures, it will cause network security risks. In addition, any lag in protection mechanism will also cause leaks in data streams and affect data security.

Furthermore, since the data itself retain the phenomenon of authenticity, a large amount of redundant information and erroneous data will occupy much of the storage space. If the data management mechanism cannot be effectively integrated, a large amount of storage space

will be wasted. To conserve resources, the abnormal data should be identified and managed while the missing data should be promptly inserted for corrections.

2.2 Network communication

In the process of traffic big data processing, the data should satisfy the stability of large-capacity transmission, especially images and video data. Therefore, if a functional network communication mechanism cannot be established, the data will be abnormal and the data management structure cannot be integrated. Therefore, the development of network communication technology will directly determine the integrity of the data management and data collection.

2.3 Data storage

Due to the voluminous amount of traffic data during actual data management, it is necessary to use long sequence for unstructured data processing and accumulation, which may cause pressure on the data storage. If the storage technology cannot meet the efficiency of data growth, there should be additional storage devices that occupy the floor area of the data center. It should be noted that the time limit of data retention in current intelligent transportation systems is a work in progress. Although the method of reducing data storage capacity can reduce the storage cost, it can seriously affect the value of big data. Therefore, it is necessary to create a more comprehensive and functional data management structure[4].

3 The application of big data in intelligent transportation systems

To improve the integrity of the application process of big data in intelligent transportation systems, it is crucial not only to establish a more efficient cloud storage mechanism and application system but also to integrate data management and intelligent transportation systems. This is performed by computing its efficiency so as to ensure the proper management of intelligent data systems as well as to provide security to the transportation system. Moreover, any work for the traffic system management should be completed in accordance with the standardized process.

3.1 Determining the perceived object

In the big data system, it is crucial to integrate the intelligent transportation systems, to analyze and process each massive monitoring object according to specific needs, to effectively integrate the data objects, and to classify and manage the objects. Currently, the more common intelligent traffic systems perceive objects and categorize them into people, vehicles, road conditions, and environment, among others. However, the four basic categories should be analyzed and determined centrally[5]. An in-depth analysis of users' travel status, information on commercial vehicle operations, structure of traffic management, and static systems is required to ensure a clear understanding of big data in the application process and operational structure of intelligent transportation systems.

3.2 Comprehensive awareness of information

The big data system should be used as an all-encompassing detection tool and management mechanism for intelligent transportation systems. It can perform data management functions for intelligent transportation systems such as: Utilizing the distribution mechanism for urban traffic data management; effectively improving the fixed detection and mobile detection processes to ensure the systematic upgrade of mechanism for data collection of traditional traffic; and maintaining effective management process that indicates subsequent upgrading of the system management and control system. It is noteworthy that comprehensive awareness of information can improve the application value and integrity of the integrated service system.

To create an advanced application mechanism, it is first necessary to supervise the traffic information, control, and guidance systems followed by a special service system and apply the corresponding data in real traffic situations. In addition to that, it is necessary to integrate the inspection and control systems as well as the emergency rescue system to maintain the integrity of the shared management process and affect the smooth development of the system management.

Secondly, to create a basic application management model, it is necessary to analyze the multisource data fusion and integration system. This will improve the management structure of the traffic video surveillance system, integrate traffic flow forecasting supervision and management, maintain vehicle monitoring and management, and operate and maintain equipment, all of which impact the overall development of the control system[6].

3.3 Establishing a network communication system

The network communication mechanism is of great significance to the establishment of management structure and control system. Based on the functions of the big data system, it is necessary to create a fast network communication mechanism that meets the requirements of real-time transmission and secured wired communication, data source processing, and intelligence. The interaction centers such as the transportation system management must ensure that the Internet, government network, and traffic public security network can form good data interaction, improve the security of network communication, and bring about the comprehensive upgrading of follow-up supervision and management projects.

3.4 Constructing a central platform

Combined with big data application, it is necessary to establish a comprehensive data processing, data storage, and data sharing mechanism. Currently, the central platform of intelligent transportation systems has the basic functions of data mining, data storage, and data sharing, which can guarantee the optimizing effects of data mining processing. It should be noted that, on the basis of the structure of traffic management and the upgrading of its theoretical management system, cloud computing, cloud storage, and cloud sharing systems should be integrated to ensure that the data processing effect is suitable for practical needs[7].

3.5 Optimizing comprehensive services

After improving the structure of service quality and application management, it is necessary to establish an integrated business supervision and service management model to ensure that the comprehensive functions and social influence of intelligent transportation systems can be improved, paving the way for the joint construction of transportation systems.

4 Conclusion

The construction of big data in intelligent transportation systems must conform to current development trends, integrate data management processes, and safeguard data that are derived from service demand. All of these will subsequently promote the harmonious development and progress of China's Intelligent Transportation Systems.

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