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Intelligent Transport Decision Analysis System Based on Big Data Mining

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Abstract. With the accelerating increase of traffic flow data in the field of intelligent transport organization optimization and illegal road facility information, traditional database technology can no longer meet the demand for huge data in data storage and business processing performance, but big data processing platform well solves this issue. First, this paper designs the intelligent transport organization optimization schemes and analyzes the types of data processed on big data platform. Then, architecture is designed for the intelligent transport data analysis platform system, including the overall architecture design, data storage design, application layer design and presentation layer design. Finally, the software design and application of intelligent traffic data analysis platform system based on large data technology are analyzed.

Introduction

Ever since the 1980s, information technology has ushered in rapid development and gradually came into the public life, and because of the overall upgrading of the social and economic development, more and more attention is paid to the issue of transportation. The development speed of the transportation industry directly affects the prosperity of a country. And the rapid development of transportation can facilitate people in travelling and material transport, which can both reduce the public's travel load and effectively increases the quality of work. However, the overall improvement of the entire industry's level can also bring various problems, especially in transportation. For countries at whatever level of economic development, this issue is of great importance and plays a key role in economic development. In the past, traffic signals control the operation of the system only in terms of vehicles and roads, and scientific management is implemented. Thus, the form is single with certain limits and weakens the system. In terms of the current socio-economic situation, traditional means of road traffic management can no longer adapt to the speed of current global information technology development. Intelligent traffic management conforms to the practical needs of intelligent transport management history and it is an imperative reform initiative.

Overall Structure of Intelligent Transport System

Intelligent Transport System is referred to as ITS. It is a real-time, accurate and efficient integrated transport management system. It is mainly used in the transportation management system with the usage of advanced scientific information, data communication transmission, electronic control and other computer processing technology. This system is established in a wide range of the traffic management and plays a full range of roles.

Intelligent transport management system should take intelligent information as the core, and then an intelligent management system such as video monitoring, intelligent communication such as wireless communication, such as adaptive control, and the like, which can be used for intelligent information processing, such as variable information, can be used for intelligent information applications such as video monitoring. Its basic system, which generally includes an integrated command center, two switching platforms (used to integrate information exchange and non-public security data exchange) and four management modules (including monitoring and control, emergency management, traffic management and traffic information).

Hierarchical Structure of Intelligent Transport Management System

According to the characteristics of each business management, the typical intelligent transport management system architecture can be divided into decision-making, management and monitoring three. The decision-making layer is mainly composed of the command of the command center and the corresponding decision analysis. The management layer is composed of various departments' accident handling, alarm processing and police dispatching. The monitoring layer is composed of various roads and regional video surveillance. These are also the core business of intelligent traffic management system. As shown in Fig. 1, for the intelligent transportation system hierarchical model.

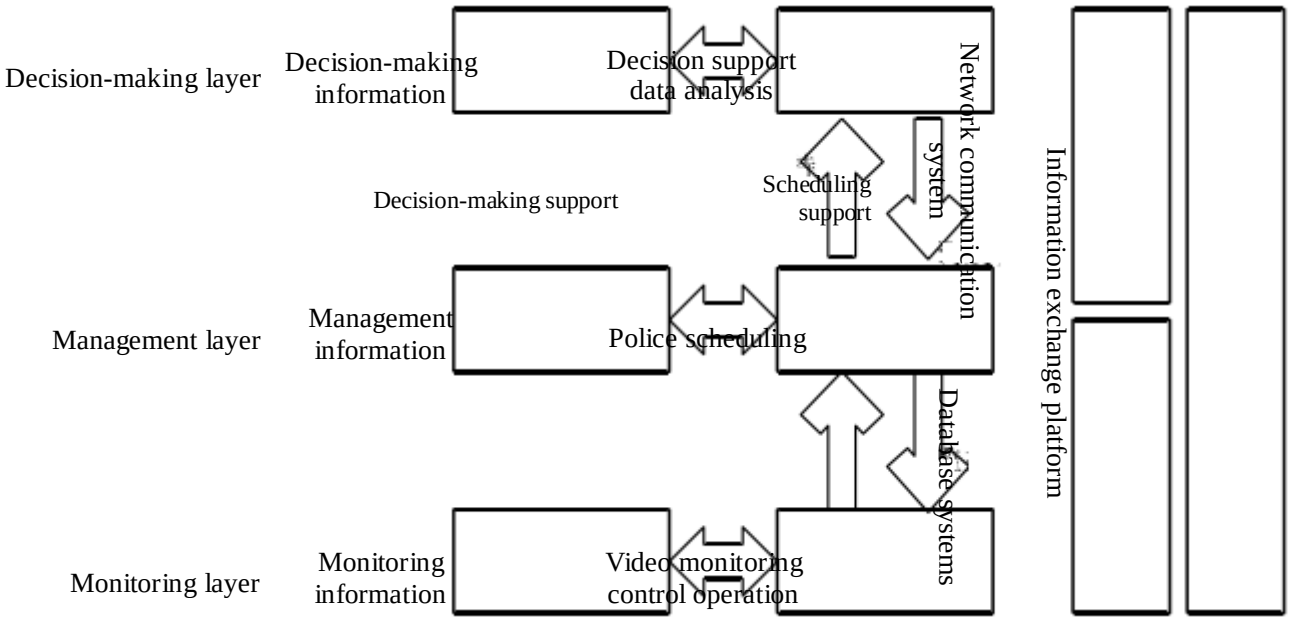

Figure 1. Hierarchical Structure Model of Intelligent Transport System

The above figure is the console operating system to complete the main work of system monitoring. This layer is mainly to provide real-time, accurate information for management to do, most of these data from the other electronic police system, high-definition video surveillance system can receive control commands and some operational status of the feedback. Once the management layer information into the management layer, the system management will be based on information to achieve the relevant business management functions, these business systems include the electronic police, GPS positioning, video surveillance, road signals, traffic flow monitoring and public information services. The formation of the data plays an effective supporting role for the decision-making.

Data Mining Algorithm Applied to Intelligent Transport System

As a key component of intelligent traffic management system, road traffic flow forecasting is not only the core of the system, but also the important basis of traffic information service, inspiration and road control. First, it is necessary to realize the real-time traffic information and accurately analyze the information.

This paper will split the traffic flow based on the flow clustering method, so K-Means cluster algorithm is chosen as the basic algorithm, and the basic idea is as follows:

（1）According to the different size of the traffic flow value, K-Means algorithm is used, set K=7, and Euclidean distance is used as the distance function;

（2）The result of the step is to generate three clusters S 1, S 2, and S 3. Assuming that S 1> S 2> S 3, the first cluster is clustered again into two clusters using cluster algorithm, S 2 is aggregated into three clusters, and S 3 is aggregated into two clusters. It should be noted that this step is

clustering according to the size of the time to cluster, not according to the size of the traffic flow value. The final step is to combine S1 and S2 into five clusters.

（3）After the above two steps, the road traffic value of one day will be aggregated into seven clusters. Some data will overlap between clusters and clusters. However, according to the time conditions, the order of succession can be inquired.

（4）Next, calculate the center of mass and mass of each cluster, the time coordinate is placed on the abscissa of the center of mass, and the ordinate shows the average of the flow. The number of objects in the cluster is the mass of the cluster. Q, Q3, Q4, Q5, Q6 and Q7, and the qualities are Q1, Q2, Q3, Q4, Q5, Q6 and Q7.

（5）The values of the times T1 *, T2 *, T3 *, T4 *, T5 *, T6 *, T7 * are calculated according to the following formula.*()

$$T_1^* = T_1 + \left|\frac{Q_1}{Q_2 - Q_1}\right| \times (T_2 - T_1)$$

In the above algorithm, according to the vehicle traffic and time two dimensions, the clustering algorithm is used to divide the traffic flow pattern, which is in full compliance with the actual traffic flow distribution. And from the figure, we can see that traffic flow has two peaks: early peak and late peak. In order to separate the peak of the flow, it is necessary to use the size of the flow of value clustering traffic classification.

Intelligent Transport Management System based on Data Mining Technology

ITMS system is a comprehensive intelligent transport management system based on data mining technology. It realizes the cleaning of traffic data from different sources, the real-time discrimination of traffic road conditions, and the demand for some public systems based on road traffic accident hotspots, correlation analysis and so on. At the same time, it also achieves the excavation function of traffic flow forecasting, traffic flow congestion event, traffic flow distribution pattern and so on. Fig. 2 shows the functional model of the system. ITMS system from the geographic information, traffic flow, road accidents and other databases to obtain static and dynamic information, after cleaning, conversion and other means to deal with the data information, and ultimately build a more appropriate data warehouse, to distinguish between business data and want Analysis of data; on this basis, continue to use data mining technology to build a variety of mining models in order to meet more application needs.

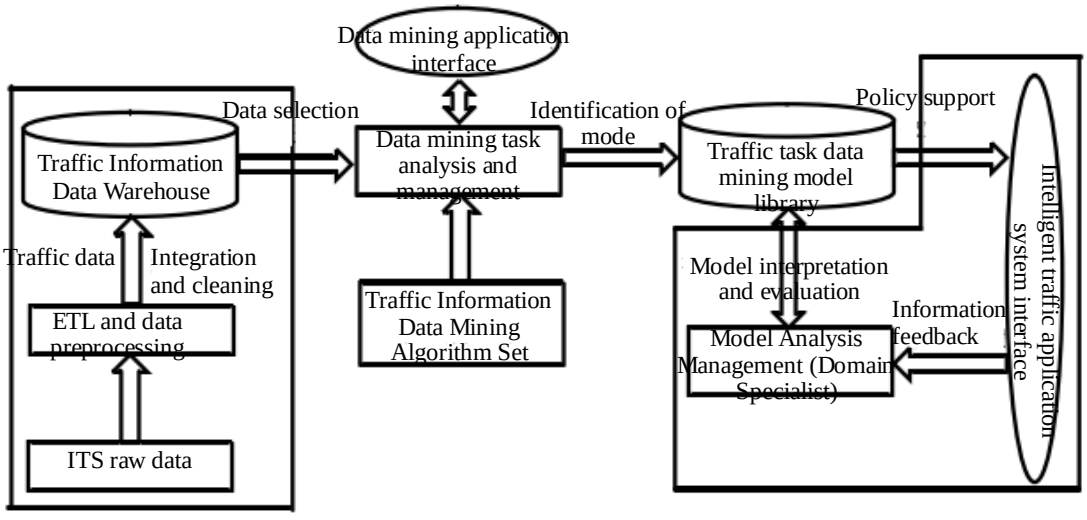

Figure 2. ITMS Functional Model

Through the analysis of intelligent transport data and according to its features and demands, ITMS system's data mining application platform's architecture is composed of four structures, which can further reflect the functions of data mining and be completed through the preparation of programs so that users can use data mining technology according to their needed results. Therefore, intelligent transport management system in this structure has independent module and good expansion ability, which is conducive for the upgrading of further development. The structure is as shown in Fig.3 and is divided into four layers: data layer, algorithm tool layer, analysis logic layer and application layer.

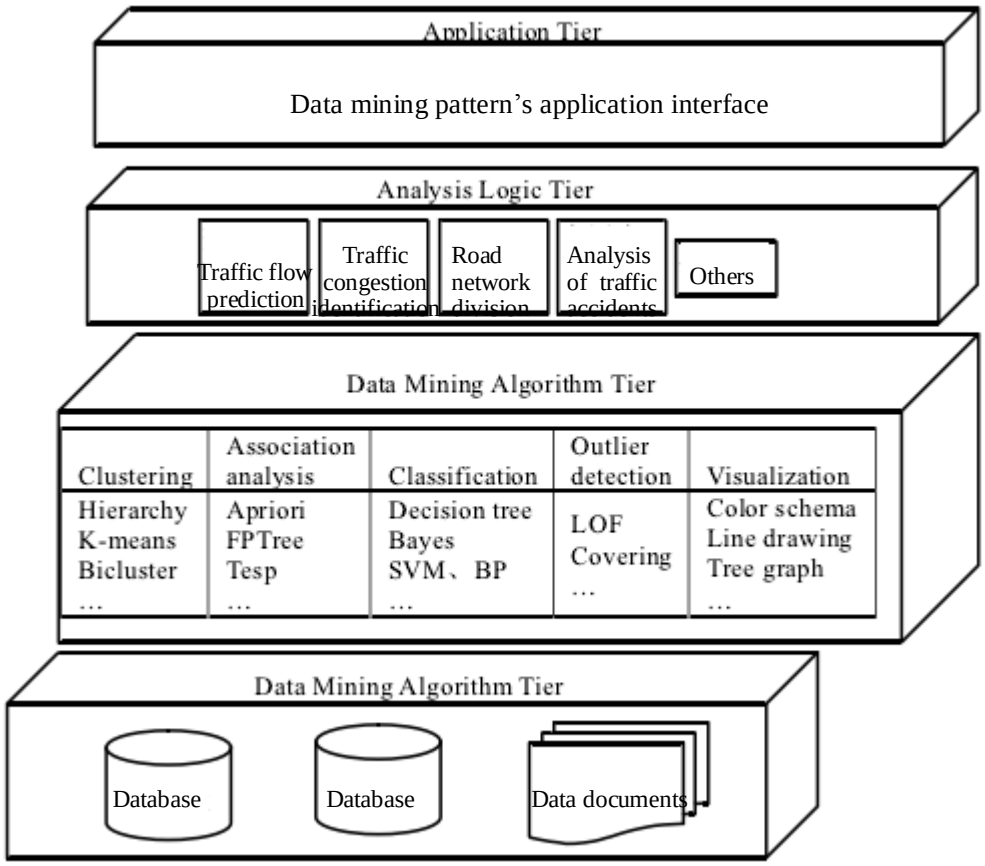

Figure 3. Intelligent Traffic Data Mining Application Platform Architecture

Conclusion

Based on the research and summary of intelligent data mining, relevant researches are carried out in this paper on traffic flow prediction, traffic jam mining and road network and traffic distribution model. First of all, this paper analyzes and studies traffic flow prediction and proposes the mining algorithm based on multi-model combination. There are two peak periods in traffic flow data: the early peak and late peak. After the traffic flow curve is divided, each model is predicted so as to improve accuracy of the prediction result. Second, traffic flow model library is constructed and mining algorithm to solve traffic jam is proposed to improve the efficiency of solving traffic jam. Then, time and spatial relevance analysis is carried out in this paper, and for timely and dynamic regional division of the traffic network, road traffic flow spatial clustering algorithm is proposed. Finally, according to the actual development and system requirements, the above data mining algorithm is used in system design and development, and the design realizes the intelligent transport management system based on data mining technology.

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References

[1]. Carminati M, Caron R, Maggi F, et al. BankSealer: An Online Banking Fraud Analysis and Decision Support System[J]. 2014, 428:380-394.
[2]. Ângelo Márcio Oliveira Sant'Anna. Framework of decision in data modeling for quality improvement[J]. The TQM Journal, 2015, 27(1:135-149.
[3]. Mistikoglu G, Gerek I H, Erdis E, et al. Decision tree analysis of construction fall accidents involving roofers[J]. Expert Systems with Applications, 2015, 42(4.:2256-2263.
[4]. Kou G, Wu W. Multi-criteria decision analysis for emergency medical service assessment[J]. Annals of Operations Research, 2014, 223(1.:239-254.
[5]. Ze-Heng F U. Application of the Decision Tree Data Mining in the Analysis of Student Achievement[J]. Journal of Guangdong Polytechnic Normal University, 2015.
[6]. Shie C L, Kempler S J. An Analysis of Earth Science Data Analytics Use Cases[C]// AGU 2015 Fall Meeting. 2015.
[7]. Yang D, Rundensteiner E A, Ward M O. A Shared Execution Strategy for Multiple Pattern Mining Requests over Streaming Data.[C]// International Conference on Formal Engineering Methods. 2014:430-445.
[8]. Bue B, Rebbapragada U, Wagstaff K, et al. Using Machine Learning to Enable Big Data Analysis within Human Review Time Budgets[C]// AGU Fall Meeting. AGU Fall Meeting Abstracts, 2014.
[9]. Li F. Data mining model based on rough set theory[C]// International Conference on Information Management, Innovation Management and Industrial Engineering. IEEE, 2013:627-630.
[10]. Nan S, Zhang B, Li L I. Applied Research on Data-mining Technology in Performance Analysis of the Cost for Medical Equipment Based on the Decision Tree[J]. Journal of Changsha University, 2014.