Research on road traffic intelligence based on big data analysis

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Abstract: *Under the condition of big data, high-dimensional feature selection and intelligent understanding of road traffic are the key to road traffic management and service based on road traffic big data. Starting from the research on the characteristics of road traffic big data, this college student project intends to study the high-dimensional feature selection and intelligent understanding method of road traffic big data, and carry out innovative research on the scientific problem of seeking the intelligent solution of road traffic big data. This paper studies the spatiotemporal correlation, redundancy and structure characteristics of road traffic big data, forms the high-dimensional feature selection method of road traffic big data, constructs the intelligent understanding mechanism of road traffic big data, and lays the foundation for solving the intelligent solution of road traffic big data.*

Keywords: *dynamic target, mobile sensor networks, tracking algorithm.*

1. Introduction

The real-time and accurate acquisition, transmission and processing of road traffic data is the basis of the construction of intelligent transportation system and road traffic management. It plays a fundamental and key role in the operation management and control of traffic system, and is the core issue of improving urban traffic safety and traffic operation efficiency. A variety of traffic detection technologies have been applied to the acquisition of road traffic state data. The road traffic data collected by different road traffic detectors increasingly present the 4V characteristics of big data: large volume, complex structure, high speed and low value.

Big data refers to the data set that grows rapidly and is difficult to be stored, queried, shared, analyzed and displayed by common data management software within an acceptable time range. Big data is one of the important development directions of information technology in the future. Big data will greatly drive the development and innovation of future productivity. The timeliness and value of road traffic big data can effectively improve the level of road traffic management, traffic operation efficiency and traffic safety. However, how to fully extract the value of road traffic big data in an effective time is a difficult problem in road traffic big data processing. On the one hand, the increasing number of road traffic data has posed further challenges to the real-time transmission, storage and processing of road traffic big data; On the other hand, how to extract the value information of road traffic data from the massive value density sparse road traffic big data, and use it for road traffic management and service, is also a problem in traffic big data processing and application.

Therefore, this project tries to start from the characteristics of road traffic big data to study and discuss the scientific problem of seeking the intelligent solution of road traffic big data.

(1) High dimensional feature selection method for road traffic big data

High dimensional feature selection of road traffic big data mainly refers to the realization of sparse representation based on high-dimensional feature transformation of road traffic data, and obtaining the most representative high-dimensional features of road traffic big data through effective selection. The high-dimensional feature selection method of road traffic big data is the time guarantee of road traffic big data analysis and processing. The spatiotemporal correlation of road traffic big data leads to the redundancy and structure characteristics of road traffic big data. In the case of meeting the application requirements, effectively reducing the redundant information in road traffic big data, realizing the

high-dimensional feature transformation and feature selection of road traffic big data is the primary way to seek the intelligent solution of road traffic big data.

(2) Intelligent understanding method of road traffic big data

The intelligent understanding of road traffic big data mainly refers to the establishment of a knowledge base for intelligent understanding of road traffic big data through data mining, computational intelligence and other methods for specific road traffic needs, and can express the interpretation results of road traffic big data in a given time and in a language that is easy for people to understand. The intelligent understanding method of road traffic big data can provide theoretical basis and technical support for improving the management and service efficiency of road traffic system. Road traffic big data has the characteristics of large amount of data, complex structure, high real-time and low value density, so the calculation and solution of road traffic big data has a strong complexity. Based on the high-dimensional characteristic information of road traffic big data, the fusion, knowledge acquisition, fuzzy logic expression and reasoning methods of high-speed, high-precision and low-cost road traffic big data are established, which can not only effectively improve the performance and efficiency of road traffic big data computing, but also seek the necessary way of intelligent solution of road traffic big data.

2. Research contents

In the research of road traffic data feature extraction and understanding methods, some algorithms have been relatively mature, and some results have been applied. However, the increasing scale of road traffic data poses new challenges to the feature extraction and intelligent understanding of road traffic big data. This project attempts to study the effective selection method of high-dimensional features of road traffic big data from the spatial-temporal correlation characteristics, redundancy characteristics and structural characteristics of road traffic big data, and finally build the intelligent understanding mechanism of road traffic big data.

(1) Construction of reference sequence of road traffic operation characteristics;

By analyzing the road traffic data collected by all kinds of traffic detectors, this project intends to design a template suitable for the road traffic data obtained by different detectors, so as to realize the complete and unified access of road traffic information such as time, location, road traffic data information, detector type, etc. The representative road traffic data covering different road traffic operation modes are extracted, and the data is analyzed and preprocessed.

(2) Characteristic analysis of road traffic data;

The time variation characteristics of road traffic data in the same section are analyzed; The spatiotemporal correlation characteristics of road traffic data of each link are studied; This paper studies the redundancy characteristics of road traffic data and its efficient de duplication and de redundancy mechanism; This paper studies the internal structure characteristics of road traffic data and the internal distribution characteristics of value information of road traffic data.

(3) This paper studies the high-dimensional feature selection method of road traffic big data;

This paper studies the universal expression method of multi-dimensional and multi granularity road traffic data, studies the feature transformation method of road traffic big data under different dimensions and granularity, and transforms road traffic big data into high-dimensional feature space; This paper studies the high-dimensional feature selection method of road traffic big data, and selects the high-dimensional features that can best represent the value of road traffic big data.

(4) Build the intelligent understanding mechanism of road traffic big data.

Based on the high-dimensional feature selection method of road traffic big data, the fuzzy set of road traffic service level index and the fuzzy rules of road traffic big data interpretation are studied to form a knowledge base for intelligent understanding of road traffic big data; Based on computational intelligence, the process of fuzziness, reasoning and defuzzification in the intelligent understanding of road traffic big data is studied. The road traffic big data is expressed as a language that people can easily understand, and finally the intelligent understanding of road traffic big data is realized.

3. Key issues to be solved

(1) How to realize high dimensional feature transformation and feature selection of road traffic big data

The feature transformation of road traffic big data is the basis of sparse representation of road traffic big data, which transforms road traffic big data into high-dimensional feature space and retains as much feature information as possible; The feature selection of road traffic big data is the premise to realize the intelligent understanding of road traffic big data. It selects the feature information which can best represent the road traffic big data in the high-dimensional feature space of road traffic big data. The high-dimensional feature transformation and feature selection of road traffic big data is to provide timely guarantee for the interpretation of road traffic big data, and is the basis of building the intelligent understanding mechanism of road traffic big data.

(2) How to build a knowledge base for intelligent understanding of road traffic big data

The ultimate goal of intelligent understanding of road traffic big data is to provide evaluation of road traffic service level in understandable natural language, and the knowledge base of intelligent understanding of road traffic big data is the premise of intelligent understanding of road traffic big data. The fuzzy set of road traffic service level evaluation index constructs its membership function, which realizes the fuzzy input of road traffic service level evaluation index; The fuzzy rules of road traffic big data interpretation construct the rule base of road traffic big data interpretation, and define the reasoning process of road traffic state evaluation based on different fuzzy road traffic service level index inputs; The definition of semantic description of road traffic service level realizes the intelligent understanding of road traffic big data.

4. Road traffic intelligence based on big data analysis

Road traffic state information has strong correlation characteristics in time and space, so the obtained road traffic data has strong redundancy and structure characteristics, so it can realize the effective selection of high-dimensional features of road traffic big data.

Set the collection period of traffic data as Δt. The selected time granularity is $(m)*\Delta t$) That is, the data period of the selected road traffic data set is $(m)*\Delta t$). Set a total of N road sections, that is, the spatial dimension is n. Define the link R ($1 \leq R \leq n$, $I \in n *$) at time $(T)*\Delta t,(t+1)*\Delta t$ $(0 \leq t \leq (m-1))$, then a traffic data matrix (XR, t) m can be obtained $\times$ n. Mark it as X. The R column of matrix X represents the road traffic status of the r-th road section in the selected data period, and the T row represents all road sections in the same data collection period $(T)*\Delta t,(t+1)*\Delta t$ The state of road traffic in the city.

Based on the analysis of spatial-temporal characteristics of road traffic data, the high-dimensional feature transformation of road traffic data matrix is carried out to realize the sparse representation of road traffic data matrix.

According to the different dimension m and granularity n of road traffic data set, the feature transformation of road traffic data can be divided into three cases

That is to transform the characteristics of the road traffic data of the same road section in n collection periods. Firstly, the reference ARIMA model of road traffic data is established based on the reference sequence of road traffic characteristics; Then we get the road traffic data in n collection periods, and get the characteristics of the data set: the key time data points and the parameters in ARIMA model.

That is to transform the characteristics of traffic data of m road sections in a single collection period. At this time, the data is the traffic data of different road sections at the same time, so firstly, the spatial association model between each road section is established based on the reference sequence of road traffic characteristics of each road section; Then the traffic data of m road sections are obtained, and the characteristics of the data set are obtained: key spatial data points and parameters in the spatial association model.

That is to transform the characteristics of traffic data of m road sections in n collection periods. At this time, the data is traffic data in a long time series of multiple road sections. At this time, the method of principal component analysis or singular value decomposition can be used to realize the feature selection

of road traffic data. The singular value decomposition method is taken as an example to illustrate.

Firstly, the road traffic data is mapped to the high-dimensional feature space by the feature transformation method of the road traffic data, and a new feature space is obtained. Then, the best feature subset is selected from the feature space by using filtering, encapsulation and embedded feature selection methods, which can effectively represent the original road traffic data.

The knowledge base of intelligent understanding of road traffic big data is composed of the fuzzy set of road traffic service level indicators on the high Vitter collection of road traffic big data and the fuzzy rules of road traffic big data interpretation.

Based on the classic evaluation index of road traffic service level and the reference sequence of road traffic operation characteristics, the effective mapping between the reference sequence of road traffic operation characteristics and the evaluation index of road traffic service level is established. Based on the high-dimensional feature selection method of road traffic data, the high-dimensional features of road traffic operation feature reference sequence are extracted, and the effective mapping between the high-dimensional feature space of road traffic operation feature reference sequence and the evaluation index of road traffic service level is established.

Through the statistics of subjective feeling evaluation of road traffic service level corresponding to different road traffic big data, the mapping between membership function corresponding to high-dimensional characteristics of road traffic big data and subjective feeling evaluation can be obtained. Based on this mapping, the fuzzy rules of road traffic big data interpretation are constructed.

5. The Summary

This project mainly adopts the method of combining theoretical research and numerical verification. Firstly, the complete and normative design of road traffic template is realized, and the reference sequence of road traffic characteristics is established based on historical road traffic data; Then, the spatial-temporal correlation, redundancy and structure characteristics of road traffic big data are analyzed, and an effective method for selecting high-dimensional features of road traffic big data is proposed; Finally, based on artificial intelligence and other methods, the knowledge base of intelligent understanding of road traffic big data is constructed, and the fuzzy reasoning interpretation algorithm of road traffic big data is constructed, and finally the intelligent understanding of road traffic big data is realized.

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