

Construction of Traffic and Transportation Engineering Innovation Lab Based on Artificial Intelligence

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Abstract: Big data will accelerate the innovation of transportation industry, how to cultivate innovative talents in transportation, it is the opportunity and challenge for universities. Relying on the data and technology accumulation of Inspur Group[®] in the field of transportation big data, big data analysis and mining was applied as the carrier to establish the traffic and transportation engineering innovation lab based on artificial intelligence, innovative experiment method was designed, and students' ability was cultivated. The experiment can be applied in the transportation innovation course, the daily teaching of warehousing/ transportation/ supply chain course, and the daily teaching of data analysis and mining course. It is also beneficial to scientific research project approval, research, achievement formation, and achievement promotion.

1. Introduction

With the extensive use of cloud computing, Internet of things, big data and artificial intelligence technology in recent years, the transportation industry is experiencing a new stage of process innovation, technology innovation and mode innovation from traditional transportation to modern transportation, and the transportation innovation become the new normal of the development for transportation industry^[1-2]. The transportation industry will be an innovative industry based on the combination of knowledge and technology intensive. Transportation companies will eventually become technology companies, data companies and innovative companies. If big data was just a concept a few years ago, it has been widely used in the transportation industry nowadays. With the application of big data analysis and mining technology, some giants as Alibaba Group[®] and JD.com[®] turned data into knowledge and innovative services, which were used to solve practical problems, such as purchase and sales forecasting, intelligent warehousing, intelligent distribution and terminal logistics optimization in the transportation supply chain.

In the future, big data will accelerate the innovation of transportation industry. Modern transportation talents need not only basic transportation knowledge and skills, but also comprehensive ability in the fields (Operation management, analysis and decision-making, innovation and optimization, etc.) based on internal and external data. How to cultivate innovative talents in transportation, how to produce high-level innovative scientific research achievements, and how to play the role of social innovation service, are opportunity and challenge for universities. Therefore, it is necessary to design innovative experimental projects that suitable for the cultivation of innovative talents in transportation to explore innovative experimental methods. According to setting up open subject research, the innovative experimental project required students to be able to comprehensively use transportation knowledge and principles, discover laws and problems by themselves, put forward ideas and methods to solve problems based on innovative thinking, and make speculative explanation for corresponding schemes, to form the thinking habit of innovative design and obtain the ability to solve problems independently^[3-4].

Based on the above background, relying on the data and technology accumulation of Inspur Group® in the field of transportation big data, transportation big data analysis and mining was applied as the carrier to establish the transportation innovation experimental base from artificial intelligence, accelerate the training of innovative, high-end, complex and skilled transportation talents, improve the level of transportation scientific research, and actively play the role of serving the economy and society.

2. Teaching Objectives

Big data analysis and mining innovation experiment of transportation was based on transportation big data analysis and mining, to set up transportation innovation experiment project, design innovative experiment method, cultivate students' ability to apply multidimensional data to insight knowledge, innovate service on practical problems. The construction objectives of the transportation big data analysis and mining innovation experimental project included building the transportation big data resource platform, establishing the transportation big data analysis and mining experimental platform, developing the transportation big data innovation experimental project and exploring the transportation innovation experimental methods.

3. Experimental Basis

3.1. Big Data Resource Platform

Transportation big data resource platform was the important guarantee for the effective implementation of transportation big data analysis and mining innovation experiment. Massive TB data resources can be integrated by this platform in transportation logistics, e-commerce, transportation engineering, social public and other fields.

3.2. Big Data Analysis and Mining Experimental Platform

Transportation big data analysis and mining experimental platform was a tool set which can provide support for data cognition, insight, analysis, mining and visualization. It was important for business analysis and operation decision-making of transportation data. This platform included big data OLAP, big data multidimensional analysis platform, big data visualization platform and big data mining platform. With the help of these big data analysis experimental tools and the data set of transportation big data resource platform, abundant innovative experimental project of transportation big data analysis and mining could be promoted.

3.2.1. Big Data OLAP

Big data OLAP was a data warehouse system established on Apache Kylin and Hadoop, it can not only support super large-scale data, SQL query interface and OLAP capability, but also provide standard SQL query capability, simple and fast big data analysis capability for business users, analysts and engineers. Apache Kylin had been applied by many companies in the industry to solve various big data analysis challenges. Students can learn the construction of the platform, and rapid analysis capability of large-scale data sets that achieved by the constructed platform, then realize the basic support of real-time multi-dimensional analysis, visualization and mining on this platform.

3.2.2. Big Data Multidimensional Analysis Platform

Big data multidimensional analysis platform was a lightweight multidimensional analysis engine, which can be easily extended, embedded and configured. REST API was connected with big data OLAP platform to provide friendly interface and realize intuitive data analysis. Indicators and dimensions can be selected to realize multi-dimensional analysis based on the big data multidimensional analysis platform, and data can be cut and sliced to drill into the details and reveal data relations, thus OLAP and memory engine could be used to drill down, filter, classify, sort and generate charts in a friendly interface. Students can realize in-depth analysis and insight of data based on large-scale data sets.

3.2.3. Big Data Visualization Platform

Big data visualization platform can generate any type of visualization graphics by dragging data based on big data OLAP platform. The system can be divided into five functional modules: visual interactive interface, data acquisition and editing, organization structure and authority management, chart drag and zoom, visual analysis.

Visual interface. This function module can provide quick data query, compute engine for charts, graphs and various tables as needed, provide visual interactive user interface (UI) for dozens of possible types and styles of charts and tables, support for mobile applications of mainstream tablet and smartphone devices in the market.

Data import and edit. It can import external database and big data resource platform database.

Organization structure and authority management. It can carry out multi organization, multi-level management, association (internal connection, external connection, cross connection) analysis, which is convenient for users to operate the data.

Drag and zoom the chart. The chart can be automatically generated in the dashboard after saving. In the dashboard (multiple charts can be saved), the chart can be dragged and zoomed.

Visual analysis. In the visual analysis part, the data to be processed can be deeply analyzed and visualized, which can realize chart analysis of data, user-defined analysis of data, and export chart data to different forms of documents, it is convenient for operators to use and form text reports.

3.2.4. Big Data Mining Platform

The big data mining platform was applied to provide big data machine learning algorithm and tool set, and support for the experiment and scientific research practice of big data analysis. The data was processed in a specific way in this platform to find the hidden problems and rules from the data, including the whole process from pre-treatment, processing, mining and analysis of the original data to discovery of rules and the visualization of results. This platform had main functions to process and analyze the data and find problems and rules from the data, support data description and understanding, data acquisition and organization, and data mining modeling, provide a variety of algorithms for classification, clustering, association rules, recommendation and supports the expansion of the algorithm.

4. Implementation Plan

4.1. Big Data Innovation Experiment Project

Big data has become one of the innovation engines in transportation industry. The setting of the innovation experiment project of transportation big data analysis and mining aims to cultivate students' innovation ability of obtaining knowledge and transformation of application from data, so that they have the ability to use data and knowledge to solve practical problems of enterprises for further innovation. According to the transportation big data analysis and mining experiment, several innovative experimental directions in the fields of warehousing, transportation and supply chain were developed, the three-level experiment project were formed based on the progressive relationship of big data application path.

Level 1 - data cognition: preliminary cognition and statistics

Students will be able to use tools to realize data cognition, basic data statistics, understand the basic rules of data, and make basic visual charts.

Level 2 - business analysis: rule discovery

Students will be able to use data mining methods such as classification, clustering and association rules to understand the logical relationship between complex data, analyze the potential rules of business operation, put forward problems and innovate solutions.

Level 3 - operation decision: complex system decision

Students will be able to use independent innovation model and algorithm to solve problems of the optimization and decision of complex system.

4.2. Explore Innovative Experimental Methods of Transportation

4.2.1. Innovative Experimental Form

The innovation experiment set by the transportation big data and mining innovation experiment project aims to train students' overall thinking ability, analysis ability, problem-solving ability, critical learning and innovation ability, focus on cultivating students' innovative thinking. It is suggested to complete the whole experiment by group discussion, creative design, defense display and other links, and students are encouraged to create innovative results.

4.2.2. The Arrangement of Innovative Experiment

According to the difficulty of the experimental level, it is suggested to arrange a single innovative experiment by the following class hours. In the case of multiple experimental combinations, the overall schedule can be adjusted appropriately.

Transportation big data analysis and mining experiments include experiments in multiple fields, directions and levels. According to the actual class schedule and students' level, the following multi experiment combination ideas can be selected.

Select multiple experimental modes according to the levels: for example, set up "transportation data cognition experimental course", students can join in multiple level 1 experiments to form a complete course, or set up "transportation data business analysis Experimental Course" to form a complete course.

Choose a series of experimental mode according to the direction: for example, set up "logistics terminal distribution optimization course", students can add all the corresponding experiments in level 1 ~ Level 3 to the course, forming a progressive experimental mode from easy to difficult in the same experimental direction.

Free setting mode: according to the actual situation, students can freely choose experiments in multiple fields, directions and levels to form a complete experimental course as needed.

5. Conclusion

In the innovation experiment of transportation big data analysis and mining, it aims to train students' ability of data cognition, business analysis and complex decision-making based on the actual data in transportation operation. It is a comprehensive training of students' overall thinking ability, analysis ability, problem-solving ability, critical learning and innovation ability, focusing on improving students' ability to solve practical transportation problems by data, and training students to creating and optimizing ability through innovative thinking. In another way, this experiment can be applied in three fields: the experiment of transportation innovation course, the daily teaching experiment of warehousing/ transportation/ supply chain course, and the daily teaching experiment of data analysis and mining course.

Transportation big data analysis and mining innovation experiments were the top topics in the field of transportation. Data sources were selected from real cases of enterprises. In addition to meet the needs of students' innovation experiments, the following three types of scientific research services could be realized.

Teachers can lead students to achieve in depth research of innovative experimental projects, and finally form scientific research results; teachers can conduct the research of innovative experimental projects by themselves, and finally form scientific research results; teachers cooperate with Inspur Group® and make industry and enterprise research based on advantages of both sides.

In general, support and service for scientific research project approval, research, achievement formation, achievement promotion and other fields will be performed on the basis of Inspur Group's accumulation in data and technology.

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