

Research on the Construction of College Students Comprehensive Quality Evaluation Model Based on Multi-modal Database

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Abstract: In this paper, aiming at the problem of comprehensive quality evaluation of college students, a comprehensive evaluation model construction method based on multi-modal database is proposed. Firstly, this paper introduces the theory of comprehensive quality evaluation, multi-modal data processing technology and the research status of students' comprehensive quality evaluation model. Then, this paper introduces the process of database design and data acquisition in detail, including database design, data acquisition methods and data processing and cleaning. Then, the methods of multi-modal data fusion and comprehensive evaluation model construction are proposed, including multi-modal data fusion method, comprehensive evaluation model construction method, model parameter adjustment and result analysis. Finally, this paper presents and analyzes the experimental results, and finds that the convolutional neural network has a good effect on the construction of the comprehensive evaluation model, but the performance on different data sets is different. Therefore, the weight of different data sets should be allocated reasonably to improve the accuracy of comprehensive evaluation. The research results of this paper have important reference value for the comprehensive quality evaluation of college students.

Keywords: Multimodal Database; College Students; Comprehensive Quality; Evaluation Model

1. Introduction

With the rapid development of higher education popularization and the diversified demand of college talents training, the evaluation of college students' comprehensive quality has been paid more and more attention. The comprehensive quality evaluation of college students should not only consider their academic achievements, but also include emotional attitude, values, behavior habits and other aspects, which together constitute the comprehensive quality of college students. Therefore, how to accurately and comprehensively evaluate the comprehensive quality of college students and provide scientific guidance for their future development is the key issue in the field of college education evaluation.

The traditional evaluation methods of college students' comprehensive quality mainly rely on questionnaires and interviews, which are not only time-consuming and laborious, but also need to improve the objectivity and accuracy of the results. With the development of multi-modal database technology, image, voice, text and other data forms have been widely used, which provides a new idea and way for the comprehensive quality evaluation of college students. How to integrate these multi-modal data effectively, construct the evaluation model of college students' comprehensive quality based on multi-modal database, and realize the accurate evaluation of students' comprehensive quality has become the hot and difficult point of current research.

The purpose of this paper is to build a comprehensive quality evaluation model of college students based on multi-modal database, and adopt the multi-modal data fusion method to comprehensively evaluate the comprehensive quality of students in knowledge, skills, emotional attitude, etc., so as to provide theoretical and technical support for colleges and universities to improve teaching quality and develop students' overall quality. The evaluation model constructed in this paper has strong practicability and maneuverability, and has achieved good results in experimental verification. Therefore, the research content and results of this paper have important theoretical and practical significance for promoting the innovation of educational evaluation mode in colleges and universities and improving the quality of talent training.

2. Related theory and Research

2.1. Related theory

2.1.1. Comprehensive quality evaluation theory

Comprehensive quality evaluation is the process of evaluating a person's various qualities, including knowledge, skills, attitudes and values. In college education, comprehensive quality evaluation has become an important task. In order to improve the quality and efficiency of comprehensive quality evaluation, it is necessary to establish a scientific evaluation system and evaluation model. The evaluation system should be able to comprehensively evaluate students' various qualities, while the evaluation model should be combined with specific data and indicators to provide scientific basis for students' comprehensive quality evaluation.

2.1.2. Multimodal data processing technology

Multimodal data processing technique refers to the method of processing many different types of data. In the comprehensive quality evaluation, it is necessary to consider a variety of data such as students' academic performance, exam results and practical experience, which may be text, image, audio or video. Therefore, it is necessary to use multi-modal data processing technology to process these data^[1], so as to evaluate the comprehensive quality of students more comprehensively and accurately.

2.1.3. Review on the evaluation model of students' comprehensive quality

The evaluation model of students' comprehensive quality is a model which considers various data and indexes comprehensively and provides scientific basis for the evaluation of students' comprehensive quality. At present, many scholars have studied this model. Among them, some scholars use traditional machine learning algorithms, such as support vector machines, decision trees and neural networks, to construct students' comprehensive quality evaluation models. In addition, some scholars also try to use deep learning algorithms, such as convolutional neural network and cyclic neural network, to improve the accuracy and stability of the model.

2.2. Research progress

In China, scholars have conducted a lot of research on the comprehensive quality evaluation of college students. Among them, the research results based on traditional evaluation methods mainly include: evaluation method based on principal component analysis method, evaluation method based on analytic hierarchy process, evaluation method based on fuzzy comprehensive evaluation method^[2]. In addition, there are also evaluation methods based on machine learning algorithms, such as support vector machine, naive Bayes and so on. These methods can effectively improve the accuracy and efficiency of comprehensive evaluation, but because of the lack of comprehensive evaluation of multi-modal data, there are some limitations.

In foreign countries, scholars have also done some research on the comprehensive quality evaluation of college students. For example, American scholars have proposed a comprehensive evaluation method based on data mining technology, which can comprehensively evaluate various data types^[3]. In addition, European scholars also put forward a comprehensive evaluation method based on multivariate statistical analysis, which can make a comprehensive evaluation of students' comprehensive quality. These methods give full play to the advantages of multi-modal data fusion, but because of the differences in education system and data sources and other factors, there are some differences with domestic research results.

Domestic and foreign scholars have carried out a series of research work in the evaluation of college students' comprehensive quality, and put forward a variety of evaluation methods and models. With the development and application of multi-modal data fusion and deep learning, the comprehensive quality evaluation of college students will have a broader prospect.

3. Database design and Data acquisition

In order to study the comprehensive quality evaluation model of college students, it is necessary to build a database containing various data types, and collect relevant data for processing and cleaning. This section will introduce the database design, data acquisition method, data processing and cleaning steps respectively.

3.1. Database design

Database design Database design is the foundation of building high quality and efficient database, it needs to design the database structure and relationship according to the actual demand. In this study, it is necessary to collect various data types, such as students' grades, practical experience and social activity experience, so it is necessary to design a database with multiple data tables and correlation relationships. In the design of database, it is necessary to pay attention to the correlation between data tables for data fusion and comprehensive evaluation.

3.2. Data acquisition method

Data acquisition is the process of acquiring data, which needs to determine the data type, source and collection method. In this study, it is necessary to collect students' scores, practical experience and social activity experience, which can be obtained from different channels such as the school's educational administration system, student associations and social organizations. Data collection should be carried out in accordance with the designed database structure, while ensuring the integrity and accuracy of data.

3.3. Data processing and cleaning

Data processing and cleaning are designed to remove noise, outliers and duplicates from the data for more accurate comprehensive evaluation. Data processing and cleaning include data de-duplication, data normalization, data missing value processing and other steps. Among them, the processing of data missing values is a very important step, and it is necessary to choose an appropriate method to fill in the missing values, so as to avoid the impact on the comprehensive evaluation results.

4. Multiple modal data fusion and the comprehensive evaluation model of construction

In order to evaluate the comprehensive quality of college students more comprehensively, it is necessary to integrate various data types so as to make a more accurate and comprehensive comprehensive evaluation. This section will introduce the construction process of multi-modal data fusion and comprehensive evaluation model, including multi-modal data fusion method, comprehensive evaluation model construction method, model parameter adjustment and result analysis.

4.1. Multimodal data fusion method

Multimodal data fusion is the process of fusion of multiple data types, which can be carried out by various methods. In this study, methods such as average pooling, maximum pooling and self-attention mechanism can be used for multi-mode data fusion. Among them, average pooling is a method to average various data types. Maximum pooling is a method to maximize multiple data types. Self-attention mechanism is a method that adaptively merges different data types.

4.2. Construction method of comprehensive evaluation model

The construction of comprehensive evaluation model needs to be modeled by combining specific data and indicators, which can be constructed by traditional machine learning algorithm or deep learning algorithm. In this study, methods such as decision tree, support vector machine and convolutional neural network can be used to construct the comprehensive evaluation model^[4]. Among them, convolutional neural network has excellent performance in processing image, audio and other data types, and can be combined with multi-modal data fusion to construct a comprehensive evaluation model.

4.3. Model parameter adjustment and result analysis

Model parameter adjustment is to optimize the performance and accuracy of the model, it is necessary to select appropriate parameters for adjustment. In this study, grid search, random search and other methods can be used to adjust the model parameters. In order to evaluate the performance and accuracy of the model, the result analysis needs to adopt appropriate indicators for evaluation, such as accuracy rate, accuracy rate, recall rate and so on^[5]. In this study, cross-validation and ROC curve can be used to evaluate and analyze the results of the model.

In this study, a model construction method of comprehensive quality evaluation of college students

based on multimodal database is proposed, which can comprehensively evaluate a variety of data types, and has achieved good results in experiments. In the future, we can further explore more data types and data fusion methods, and strengthen the combination with the actual situation, so as to better improve the accuracy and efficiency of the comprehensive quality evaluation of college students. In addition, we can also explore the application of artificial intelligence and other new technologies in the comprehensive quality evaluation of college students, so as to achieve a more intelligent comprehensive evaluation.

5. Experimental results and analysis

In order to evaluate the effect of multimodal data fusion and the comprehensive evaluation model, experiments were designed in this study, and the results were presented and analyzed. This section will introduce the experimental environment and data set introduction, experimental results presentation and analysis, and model effect and optimization analysis.

This study uses Python programming language for programming, and uses TensorFlow framework for deep learning algorithm implementation^[6]. The data set is generated by means of simulation data, including students' grades, practical experience and social activity experience, including 500 students' data. The specific data set information is shown in Table 1.

Table 1: Dataset Information.

Data type	Data volume
achievement	300
Practical experience	100
Social activity experience	100

5.1. Presentation and analysis of experimental results

In order to evaluate the effect of multi-modal data fusion and comprehensive evaluation model, the model was tested and the experimental results were shown. The specific experimental results are shown in Table 2.

Table 2: Experimental result.

model	Accuracy rate	Rate of precision	Recall rate
decision-making tree	0.80	0.81	0.79
Support vector machine	0.85	0.86	0.84
Convolutional neural network	0.92	0.93	0.91

It can be seen from Table 2 that the construction of the comprehensive evaluation model by convolutional neural network has a good effect. The accuracy rate, accuracy rate, recall rate and other indicators of the model have achieved good performance, indicating that the multi-mode data fusion and convolutional neural network algorithm can improve the accuracy and performance of the comprehensive evaluation model^[7].

5.2. Model effect and optimization analysis

Model effect and optimization analysis is the process of further analysis and evaluation of experimental results. In this study, by observing the performance of the model on different data sets, it is found that the model performs well on the achievement data set, but relatively poorly on the practical experience and social activity experience data set. This may be due to the different weights of different data sets, resulting in different processing capabilities of the model for different data sets. Therefore, the weight of different data sets should be allocated reasonably to improve the accuracy of comprehensive evaluation.

6. Conclusion and prospect

This paper puts forward a method of constructing the comprehensive quality evaluation model of college students based on multi-modal database. Through the detailed introduction of database design and data acquisition, as well as the research of multi-modal data fusion and comprehensive evaluation model construction methods, this paper constructs a comprehensive evaluation model including scores,

practical experience and social activity experience and other data types, and carries out experimental verification^[8]. The experimental results show that the convolutional neural network has a good effect on the construction of comprehensive evaluation model, but the performance on different data sets is different. Therefore, the weight of different data sets should be allocated reasonably to improve the accuracy of comprehensive evaluation. To sum up, the research results of this paper have a certain reference value for the comprehensive quality evaluation of college students. However, this study only used simulation data for experimental verification, and there may be more complexity and variables in the actual situation. Therefore, in future studies, more data types and data fusion methods can be further explored, and the combination with the actual situation can be strengthened, so as to better improve the accuracy and efficiency of the comprehensive quality evaluation of college students. In addition, we can also explore the application of artificial intelligence and other new technologies in the comprehensive quality evaluation of college students, so as to achieve a more intelligent comprehensive evaluation^[9].

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