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Prediction of College Students' Grade Four Grades by Support Vector Machine and Deep Neural Network

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Abstract: Grade prediction is one of the key research contents of educational big data. It predicts students' future academic performance through the existing grade data and related educational information. It can provide valuable decision-making basis for education-related workers. In order to solve the deficiencies in the existing research on college students' grade 4 achievement prediction, this paper discusses the function equation of support vector machine and deep neural network and the concept of college students' grade 4 grades. The parameter settings and datasets implemented by the model are briefly introduced. And the structure of the four-level achievement prediction model designed in this paper is designed and discussed, and finally the accuracy rate of the four-level achievement prediction model designed in this paper is tested against the MMG prediction model for the classification accuracy of the four different college students' grades. In the comparison, the experimental data show that the accuracy of the four-level grade prediction classification of the support vector machine and the deep neural network is not much different, both in the range of 0.85% to 0.91%, and higher than the MMG model's four-level grade prediction classification. The accuracy rate is about 0.5%, so it verifies the use value of the support vector machine and deep neural network for college students' grade-4 grade prediction application.

1. Introduction

With the rapid development of educational informatization and the sharp increase in the emphasis on the prediction of college students' CET-4 English achievement, how to use computer technology to find favorable information from a large number of educational data, so as to help students improve CET-4 English achievement has become a lot of educational work. focus of

attention.

Nowadays, more and more scholars pay attention to the research of various technologies and platforms in the fourth-level achievement of college students, and through practical research, they have also achieved certain research results. Hsu C C In order to ensure that college students scientifically use learning methods. Through data analysis, the recent grades and course selection bias of all students can be obtained, and the influence degree and factors of historical grades and course selection bias on future grades can be found. The predicted grades can let students know their own learning level, and provide reference meaning and learning style judgment support for the improvement of students' future grades, so as to improve students' academic performance [1]. Emir E believes that in higher education institutions, future grade prediction is an important research area, and teachers predict students' future grades in learning by paying special attention to learning performance and grades at historical and current stages. And machine learning technology can compare students' grades in different courses to make predictions. Therefore, Emir E evaluated different state-of-the-art machine learning techniques for college student achievement prediction in the study. Eventually Emir E discovered that restricted Boltzmann machines could more accurately predict student grades. These techniques are used to visualize the uncertainty of student performance, thereby enhancing students' learning confidence and enabling teachers to help potential students by predicting the results of students' future grades [2]. Rosso AC believes that predictive analysis of student performance can help educators help students improve their academic performance. Rosso AC uses predictive analytics to design an effective predictive model to predict students' future grades to avoid students dropping out and improve students' motivation to learn. Therefore, Rosso AC aims to propose a predictive model using machine learning methods that is able to predict the future grades of students. Rosso A C compares the prediction effect of random forest and BNN research classification in predicting student grades through experiments. The results show that decision tree has the best predictive analysis effect, reaching 99.6% [3]. Although the existing researches on the grade 4 grades of college students are very rich, the research on the grade 4 grades prediction of college students by support vector machines and deep neural networks is still insufficient.

Therefore, in order to enrich the existing research on support vector machines and deep neural networks for the prediction of college students' grade four grades, this paper first introduces the functional equations implemented by the algorithm and the concept of the concept of college students' grade four grades. The parameter settings and data sets of the grade prediction application, and finally design the four-level grade prediction model architecture about support vector machine and deep neural network, and through the specific application effect of the college student grade four grade prediction model designed in this paper. Experiments show the effectiveness of the four-level achievement prediction model for college students proposed in this paper.

2. Support Vector Machine and Deep Neural Network for the Prediction of College Students' Grade Four Grades

2.1. Support Vector Regression Machine

Regression machine has two forms of linear regression and nonlinear regression to study the four grades of college students' performance prediction [4].

Linear Support Vector Regression Machine The mathematical description of the four-level grade prediction is given below, and the training samples are set as formula (1):

$$H = \{(u_1, v_1), ..., (u_x, v_x)\} \in (U \times v)^i \tag{1}$$

Among, $u_x \in U = J^m, v_x \in V = J, x = 1,...i$.

Construct the four-level grade prediction function, such as formula (2):

Among them, $\delta \in J^m$ is the English test score for admission, $d \in J$ is the college entrance examination English score, and $(\delta \cdot u)$ is the mid-term English test score [5].

$$k(u) = (\delta \cdot u) + d \tag{2}$$

In order to satisfy the above formula to predict the minimum real risk, according to the basic idea of the maximum interval method, the optimization problem formula (3) is constructed:

$$\min J(\delta, d) = \frac{1}{2}\|\delta\|^2 + F\sum\left[\hat{f}(t_x) + \hat{f}(t_x^*)\right] \tag{3}$$

In formula (3), f is the number of English test scores, t_x, t_x^* is the average score, and f explains the degree of punishment of the abnormal sample data predicted by the algorithm for college students' Grade 4 scores [6].

2.2. Deep Neural Networks

At present, there are three typical deep learning network structures: deep belief network, stack autoencoder network, and convolutional neural network [7]. These three models are introduced below [8].

(1) Deep Belief Network

This technique is a deep neural network algorithm in machine learning [9]. It is a directed connection network model, which can be applied not only to supervised learning, but also to unsupervised learning. [10] To extract higher-order features of the data by building the probability distribution of the input data.

(2) Stacked self-encoding network

Stacked autoencoder network is a deep learning network model with multiple hidden layers [11]. The training process maps the input variables through the activation function to obtain the expression of each layer, and then decodes the expression of each layer through the function [12]. In order to make the training model fully match the real data generation process [13].

(3) Convolutional Neural Network

Convolutional neural networks improve deep neural networks [14] from two aspects: local connections and weight sharing. It can realize parallel learning of data features, and its structure greatly reduces the parameters in the network, making it have great advantages in feature extraction [15].

2.3. Grade 4 Results of College Students

The College English Test is a national-scale standardized test with a large number of participants. The CET-4 has experienced a history of more than 30 years, and the reform of the question type has also been carried out [16]. As of 2022, CET-4 will cover listening, reading, writing and speaking.

The listening part of the CET-4 question types includes news listening, long dialogue and text listening [17]. The reading comprehension questions in CET-4 include paragraph information matching questions, word choice fill-in-the-blank questions, and careful reading. The writing part includes a 120-word composition and a 140-160-word Chinese-English paragraph translation [18].

3. Investigation and Research on the Prediction of College Students' Grade 4 Grades Based on Support Vector Machines and Deep Neural Networks

3.1. Application Data Set of College Students' Grade Four Grade Prediction Model

In order to verify the performance of the CET-4 grade prediction model designed in this paper, this paper collects the relevant information of students from four colleges in the 2021 and 2022 grades of a university. Its data information is mainly from the entrance English test scores, the college entrance examination English scores, the mid-term English test scores, the number of final English test scores, the average score and the highest and lowest scores. There are a total of 2821 pieces of data, and the specific data are shown in Table 1:

Table 1. Data distribution

Category	Entrance English Test Score	College Entrance Exam English Score	Mid-term English test scores	Final English Test Score
Quantity	1021	1124	1245	1128
Average Score	78.256	86.234	75.241	80.245
STD	19.245	28.354	15.268	18.254
MIN	12	45	56	62
MAX	98	138	96	95

3.2. Parameter Setting of the Four-Level Achievement Prediction Model for College Students

According to the data set in this paper, the technology proposed in this paper is used to predict the grade 4 grades of college students. A DNN model with three hidden layers and 60, 30, and 30 neurons is trained. The support vector machine In C=300, the specific parameters of the $\gamma = 2^{-5}$ deep neural network model are shown in Table 2:

Table 2. Parameter settings

Number of neural network layers	Activation function	N=Number of neurons	Learning rate	Loss rate	Number of iterations
Input layer	/	30	0.02	0.1	250
Hidden layer1	Taht	6			
Hidden layer2	Rert	4			
Output layer	Soth	2			

4. Application Research of Support Vector Machine and Deep Neural Network in the Prediction of College Students' Grade Four Grades

4.1. Design of the Four-Level Achievement Prediction Model for College Students Based on Support Vector Machines and Deep Neural Networks

(1) The structure of the four-level achievement prediction model of college students based on support vector machine

According to the functional equation of the algorithm and the data set of college students' grade 4 grades extracted in this paper, the following support vector machines are designed to realize the algorithm steps for the prediction of grade 4 grades of college students. The specific steps are shown in Figure 1.

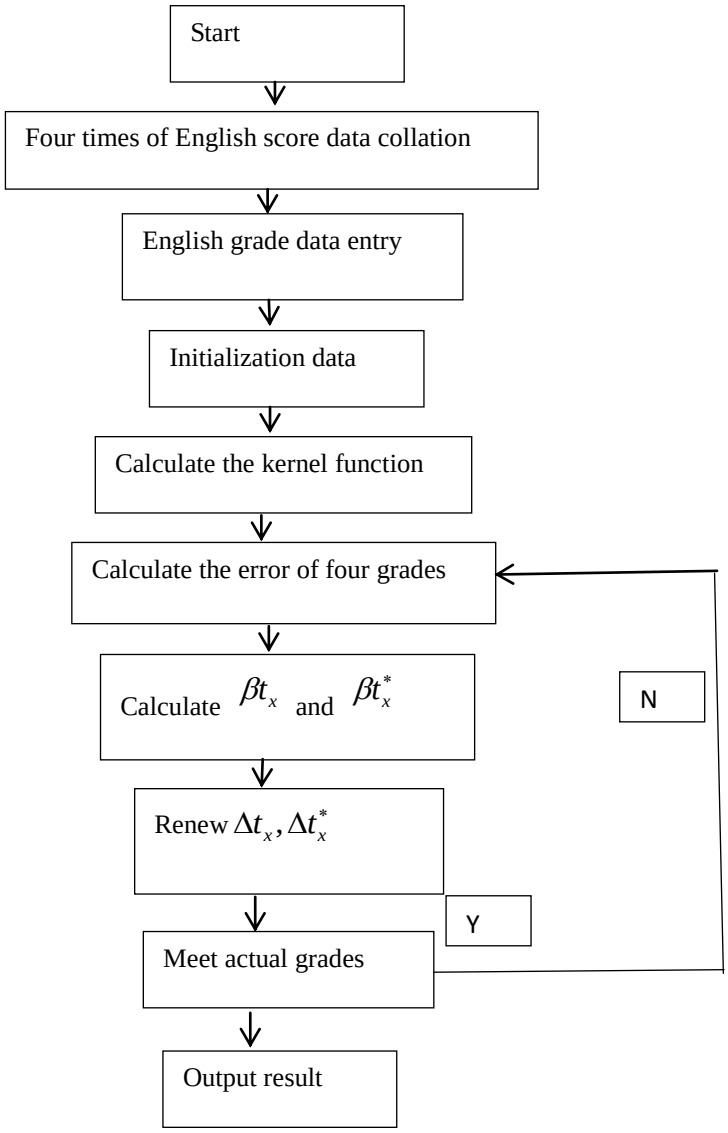

Figure 1. The structure of the four-level achievement prediction model of college students based on support vector machine

The steps to implement the algorithm for the fourth grade of college students using support vector machines are as follows:

1) After sorting out the data of grade 4 results, input it into the regression machine of support vector.

2) Initialize the constant, namely A, the kernel function matrix B.

3) Calculate the regression machine kernel function of the support vector.

4) Construct and solve the optimization problem, ie formula (3).

5) Judge whether the conditions for iterative stop of the actual grade can be met. If so, the optimal solution is obtained, and the grade-4 grade result is output, otherwise, go back to step 4.

(2) Prediction model of college students' grade four grades based on deep neural network

In this paper, the neural network model is established from three aspects of the technology's structure, activation function and grade-4 achievement, and the number of hidden layers is determined according to experience, and the Sigmoid function and the Delta rule are used. The Delta rule is used to calculate the weight change of sample data. Generally speaking, it can be divided into two steps:

1) Input mode, calculate forward, and calculate the actual output for each neuron.

2) Return to realize the error return, first calculate the error of the output layer, then calculate the error of the penultimate layer, and calculate in turn. up to each layer.

The input of the BP neural network is 4-dimensional data, including the scores of the entrance English test, the college entrance examination English test, the mid-term English test, and the final English test. There are 6 hidden layers, and each hidden layer has 30 neurons. , an output layer is the student's grade, and its specific prediction model is shown in Figure 2:

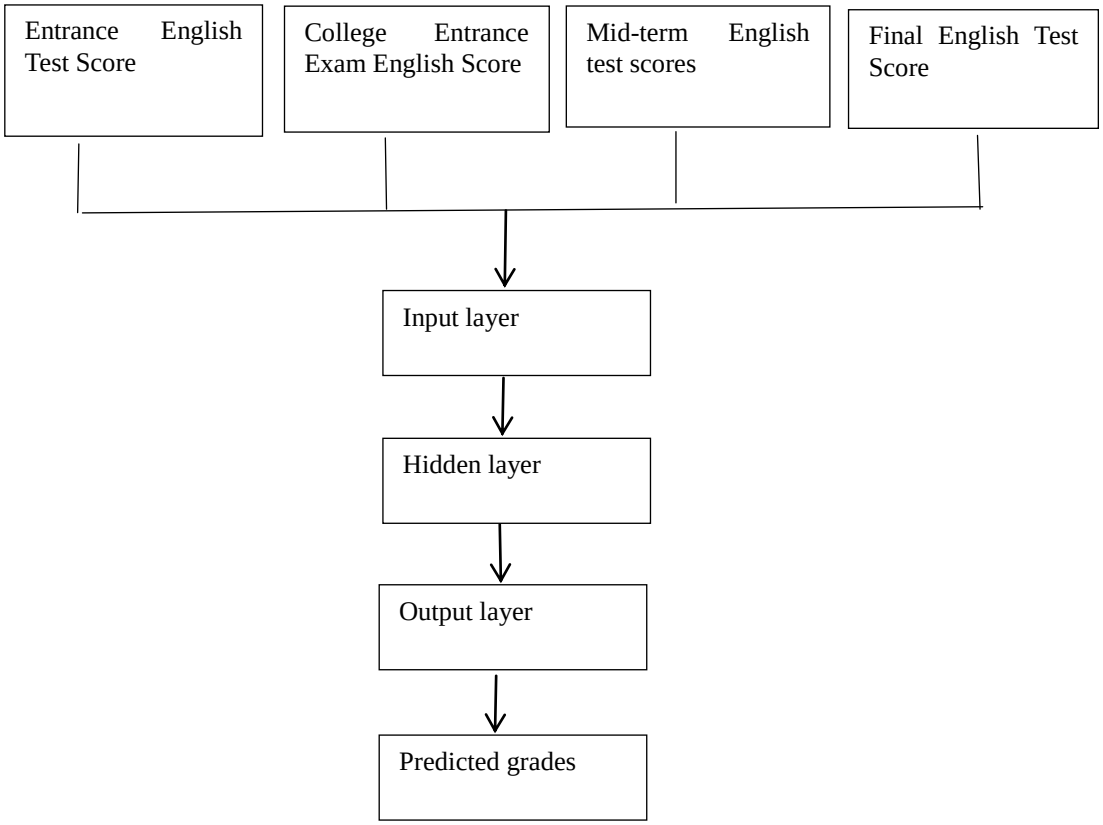

Figure 2. The four-level achievement prediction model of college students based on deep neural network

4.2. Application of Support Vector Machines and Deep Neural Networks to Predict the Grades of College Students

In order to better evaluate the performance of the two models designed in this paper for predicting the grades of college students, we still take the entrance English test scores, college entrance examination English scores, mid-term English test scores, and final English test scores as input vectors to calculate the results of the two models. The accuracy of the classification and prediction of the grade-4 grades of college students from different colleges, and the two models in this paper are compared with the MMG prediction model. The specific experimental comparison data is shown in Figure 3:

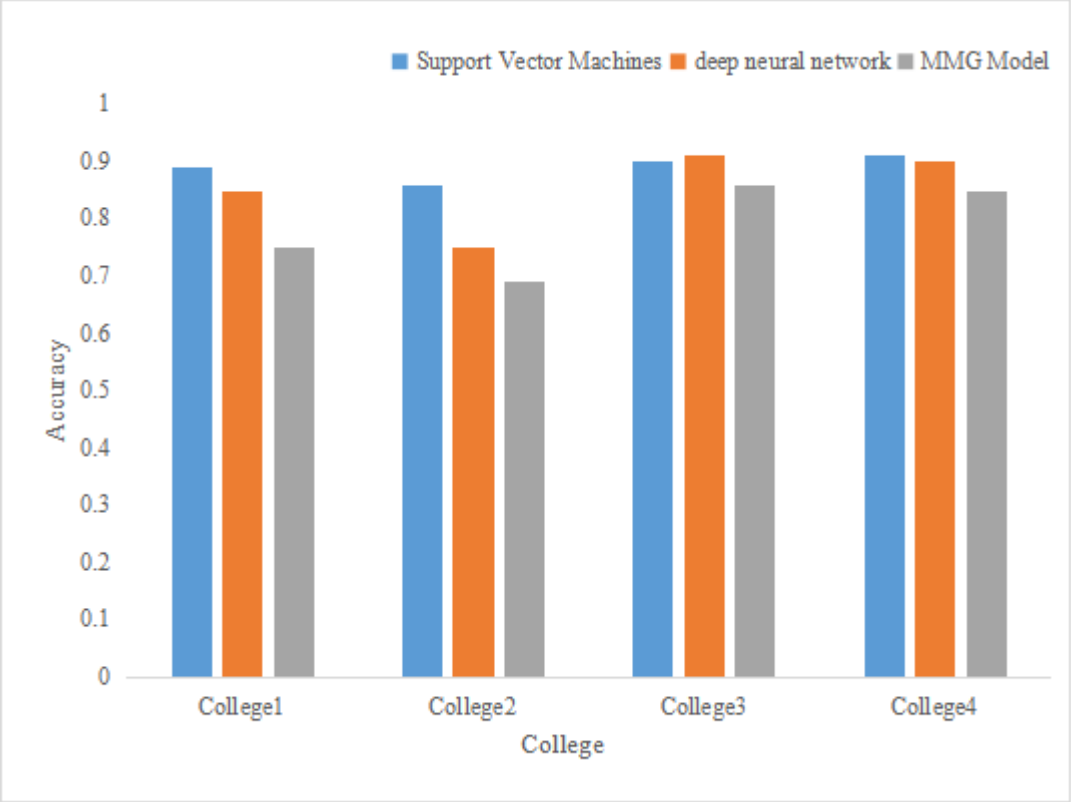

Figure 3. Comparison of the prediction accuracy of the three models

It can be seen from the above data that in the data comparison of the accuracy rates of the three models for predicting and classifying the grade-4 grades of college students in four different colleges, the accuracy rates of the grade-4 grades prediction and classification of the support vector machine and the deep neural network are basically similar, and there is no significant difference. Variety. The MMG prediction model's four-level grade prediction classification accuracy is 0.45 lower than that of the support vector machine and the deep neural network on average. The prediction and classification effect of the support vector machine and the deep neural network is significantly higher than the MMG prediction model. The accuracy rate of grade 4 grade prediction and classification is higher than 0.85, even reaching 0.91, so it verifies that the two models proposed in this paper have good stability and performance in predicting grade 4 grades of college students.

5. Conclusion

Therefore, in order to enrich the research on the four-level achievement prediction of college students based on support vector machines and deep neural networks, this paper first briefly introduces the functional equations of the two technical models and the concept of college students' four-level achievement, and then discusses the two types of college students designed in this paper. Based on the analysis and discussion of the construction technology of the four-level achievement prediction model, the parameter settings and data sets of the two college students' four-level achievement prediction models are investigated and designed. Secondly, it designs and analyzes the architecture of the four-level achievement prediction models for college students with the two technologies. Finally, it analyzes the experimental data for the application of the two types of college students' four-level achievement prediction models designed in this paper. The final

experimental results verify the support vector machine and depth the superiority of the neural network's four-level achievement prediction model for college students.

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Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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