Retraction

Retracted: Predictive Model and Analysis of Psychological Depression Based on College Students' Behavior Data Mining

Wireless Communications and Mobile Computing

This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

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[1] D. Qu and Q. Guan, "Predictive Model and Analysis of Psychological Depression Based on College Students' Behavior Data Mining," *Wireless Communications and Mobile Computing*, vol. 2022, Article ID 5352283, 10 pages, 2022.

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Research Article

Predictive Model and Analysis of Psychological Depression Based on College Students' Behavior Data Mining

Dongchen Qu [ORCID] **and Qinghua Guan**

Jilin Agricultural University, Jilin 130000, China

Correspondence should be addressed to Dongchen Qu; qudongchen@jlau.edu.cn

Contemporary college students face all kinds of pressure and are easy to cause psychological problems. In order to make students and schools do a good job in preventing psychological depression, this paper proposes a student depression prediction model based on college students' behavior data mining. Due to the shortcomings of large error and low reliability of prediction results in the traditional psychological depression prediction model, it is impossible to carry out large-scale psychological depression data analysis. In order to solve the defects of traditional psychological depression prediction model and improve the reliability of psychological depression prediction results, a psychological depression prediction model based on data mining technology is proposed. Firstly, the sensor is used to collect the signals related to psychological depression, and the signals are denoised to obtain high-quality psychological depression signals; then, the features are extracted from the psychological depression signals, and the support vector machine in data mining technology is used to train and learn the relationship between the features and the types of psychological depression, so as to construct the prediction model of psychological depression; finally, the simulation experiment of psychological depression prediction is carried out on MATLAB platform. The results show that the prediction accuracy of psychological depression of the traditional model is less than 85%, the prediction accuracy of psychological depression of the proposed model is more than 90%, and the time of psychological depression prediction modelling is reduced, which can meet the development trend of modern psychological depression prediction and analysis.

1. Introduction

Campus life is a key period for the rapid development and maturity of students' psychology and a key stop for the formation of students' healthy psychology. School educators and parents should pay attention to the guidance and education of students and help them shape healthy psychology during this period. Unhappy campus life will have a lot of adverse effects on students' psychology and even affect their inability to correctly integrate into social life in the future [1]. College students in today's era have more burdens to bear, even if they find that their psychology is abnormal, they dare not confide in others and think that the existence of psychological diseases will make others taboo; therefore, the purpose of this research is to obtain students' psycholog-ical state information without causing students' psychological burden as much as possible, so as to assist psychologists to carry out their work better. As the main body of the campus population, students produce the largest amount of data, among which the most valuable data is students' online behavior data records [2]. These data records are generated by students according to their own wishes, which can reflect the differences between different students to the greatest extent. These have laid a solid data foundation for the research of this subject, the traditional collection method of psychological methods is based on the concept of random sampling, and its analysis method adopts the way of hypothesis test. Both methods have their disadvantages, which affect the accuracy of the results, while the psycholog-ical research of big data adopts the way of full data analysis,

which completely extracts the value contained in the data and greatly improves the accuracy of the experimental results.

Nowadays, the topic of students' mental health has attracted more and more social attention. For example, the incidents of college students' crime and suicide caused by college students' psychological abnormalities have also frequently aroused heated discussion in social public opinion [3]. At present, most students have insufficient understanding of mental diseases and even have an attitude of neglect and neglect, which makes these students with psychological abnormalities unable to get timely discovery and effective treatment. Therefore, for colleges and universities, whether they can find these students and intervene in time is the top priority in student management. With the advent of the era of big data and the development of data mining technology, the method of real-time perception of college students' psychological state through data mining model has become possible [4].

Based on the students' online behavior data collected in the university campus, combined with the psychological evaluation scale indicators, this paper constructs a perceptual prediction model of students' psychological state, which is used to capture students' psychological state information, so as to help psychological counsellors make psychological intervention in time. Using the method of data mining, this paper constructs the classification models of internal and external tendencies of personality, depression, and anxiety, realizes the prediction of psychological state based on students' school behavior data, and warns students with psychological abnormalities, so as to assist psychologists to better carry out psychological intervention.

The rest of this paper is organized as follows: the related work is discussed in Section 2. Section 3 analyzes the prediction model of psychological depression based on data mining technology. In Section 4, the simulation test analysis is carried out. Section 5 summarizes the full text.

2. Related Work

Data mining technology has been tried to be applied in many fields of prediction and early warning at home and abroad. In terms of college students' psychological depression, relevant theoretical ideas have been put forward for many times, but there is relatively few practical research. In recent years, with the decline of Chinese mental health, the importance of mental health in colleges and universities has become more and more obvious. Therefore, using big data analysis and mining method to early warning and monitoring, the psychological depression of college students is a very meaningful and feasible research work [5]. In recent years, there has been a lot of progress in the prediction and analysis of psychological depression using data mining, some of which are as follows:

Relevant scholars began to make in-depth research on crisis early warning indicators, crisis early warning objects, crisis early warning levels, and crisis early warning mechanisms. After a detailed analysis and comparison of various commonly used classification algorithms, the decision tree

C4.5 algorithm is used to build a model to predict whether college students have some symptoms of psychological problems and explore the early warning methods of college students' psychological crisis [6]. Use data mining to find relevant relationships that do not need theoretical guidance and discover the laws hidden behind a large amount of data by collecting the emotional trend and behavior dynamics of postgraduates in different stages in real time, so as to predict individual future behavior, find possible crises in time and intervene, and try to explore the application of data mining technology to the analysis of college students' emotional quality and explore whether the decision tree classification algorithm can use influencing factors to predict and classify college students' emotional quality and their subordinate emotions, so as to provide new ideas for educators to carry out educational planning and decision-making. Researchers explore using the knowledge discovery function of data mining to serve the potential data relationship and behavior model in psychology [7]. The innovation path of psychological crisis early warning in colleges and universities, based on the method, content, technology, and management of big data can timely find the psychological crisis through the collection, screening, and evaluation of student data [8]. Collect the data of graduate students' individual development status, social environment indicators, interpersonal indicators, and negative emotion indicators and use big data to predict and evaluate the factors that may lead to the crisis, so as to master the law and dynamics of crisis events and effectively seek benefits and avoid harm [9].

Some researchers focus on the relationship between psychological states such as depression and anxiety and individual personality. Through the structural equation model and four evaluation data of more than 800 students, it is found that self-esteem has a direct impact on individual depression, and gratitude has an indirect impact on individual suicide, depression, and self-esteem [10]. The results show that the students who are ashamed of depression do not communicate with school psychological teachers or friends. The traditional psychological depression prediction model adopts the traditional mathematical modelling methods, such as multiple linear regression, analyzes the historical data of psychological depression, finds the corresponding multiple linear regression coefficient, establishes the corresponding psychological depression prediction model, estimates and forecasts the psychological depression in the future, and simplifies the problem of psychological depression [11]. Therefore, the prediction results of psychological depression are not reliable and cannot meet the requirements of modern prediction and modelling of psychological depression. Modern psychological depression prediction models mainly include artificial intelligence technology, nonlinear control technology, and automation technology [12]. At present, there are mainly psychological depression prediction models of various artificial neural networks and psychological depression prediction models of grey theory [13]. They usually have intelligent learning function and fit the change law of psychological depression according to the historical data of psychological depression, and the prediction results are better than the traditional psychological depression prediction model.

3. Prediction Model of Psychological Depression Based on Data Mining Technology

3.1. Collect Psychological Depression Signals. In the prediction of psychological depression, we should first collect the signals related to psychological depression. Due to a person's psychological disorder, his language will change accordingly, such as anxiety and impatience. Therefore, this paper collects the language signals of people with psychological depression for psychological depression prediction [14]. Through the collection of voice signals, the collected voice signals are analogy signals. Since the prediction of psychological depression is realized by computer, it is necessary to generate digital signals from analogy signals through digital to analogy conversion devices. The acquired signal can be described in Figure 1.

3.2. Pretreatment of Psychological Depression Signals. In the process of collecting psychological depression signals, it is inevitable that some noise will appear, which will have an adverse impact on the subsequent processing of psychological depression signals. Therefore, wavelet transform is introduced to preprocess psychological depression signals in this paper. Set up an integrable function, then its Fourier transform satisfies the condition of equation, the wavelet generating function.

In this paper, the wavelet threshold algorithm is used to denoise the psychological depression signal. The basic principle is as follows: wavelet transform the noisy psychological depression signal to obtain many wavelet coefficients. In this way, the wavelet coefficients can be divided into the wavelet coefficients of clean psychological depression signal and the wavelet coefficients of noise and then select the optimal threshold to compare with all wavelet coefficients; if the wavelet coefficient is less than the optimal threshold, it indicates that it is noise, then set the wavelet coefficient to 0, and finally reconstruct the wavelet coefficient through the inverse wavelet transform to obtain a clean psychological depression signal [15]. Usually, we want the selected wavelet to meet the following conditions: orthogonality, high vanishing moment, compact support, symmetry, or antisymmetry. An important factor that directly affects the denoising effect is the selection of threshold. Different threshold selections will have different denoising threshold functions, which are the rules for modifying wavelet coefficients. Different inverse functions reflect different strategies for processing wavelet coefficients. The signal-to-noise ratio (SNR) of the signal and the root mean square error (RMSE) between the estimated signal and the original signal are often used to judge.

The so-called data cleaning is used to solve the problem of poor data quality of some useful data after data screening due to some accidental factors. The main means are as follows: missing value processing: when the data set with missing data accounts for a relatively low proportion of the whole data set and the data volume of the sample is relatively large, in this case, the deletion method can be used, that is, the data items with missing values can be directly discarded; another common processing method is the filling method.

This method is used to fill in the missing value according to the average value of the data near the dimension where the missing value is located when there are not too many missing samples. If the value of an item in the data outlier is far greater than the value of other items in the data outlier, it is also called outlier processing. If the value of an item in the data outlier is far greater than the value of other items in the data outlier, it is also called outlier processing. When outliers appear, they cannot be discarded directly [16]. It is necessary to analyze them to judge whether they are reasonable and then decide the processing strategy. For example, in real life, the age range of people is greater than 0 and less than 150. When the value in the data item exceeds this range, it can be regarded as the abnormal value. This method is a simple analysis method, de reprocessing: when the data values of several dimensions are the same or there is an addition and subtraction operation relationship, they can be considered to represent the same data meaning. Eliminating duplicate data dimensions plays a certain role in data downsizing and model burden reduction. It ensures the uniqueness and representativeness of data dimensions. In noise data processing, the random error or variance of the measured data caused by some reasons is the so-called noise, which is the interference to the data. The commonly used methods are box method and regression method; the box division method forms a small group of nearby ordered values, namely "box", and then smoothens these ordered data values with the mean, median, or boundary of the data in the box to make these data locally smooth. The regression rule is to use a regression function to fit these noisy data and play the role of smoothing data denoising.

3.3. Data Mining Technology. Support vector machine is a new data mining technology, which mainly aims at modelling some complex problems and has certain intelligent decision-making ability. For a problem data set $\{(x_1, y_1), (x_2, y_2), \cdots (x_i, y_i), \cdots (x_n, y_n)\}$, n is the number of samples, and the mapping function is used $\phi(.)$. Map the data set, and then establish the optimal classification hyperplane. The schematic diagram of support vector machine is shown in Figure 2.

The dual form is obtained by Lagrange algorithm:

$$L(w, b, \xi, \alpha, \beta) = \frac{1}{2}\|w\|^2 + C\sum_{i=1}^{n} s_i \xi_i - \sum_{i=1}^{n} \alpha_i[y_i(w \cdot \varphi(x_i) + b) - 1 + \xi_i]$$
$$- \sum_{i=1}^{n} \beta_i \xi_i. \tag{1}$$

When the training set is linearly separable, in order to construct the optimal hyperplane in the case of linearly separable data, it is necessary to introduce a nonnegative relaxation variable $\xi_i \geq 0 (i = 1, \cdots, n)$. For the nonlinear classification problem, SVM maps the sample space to Hilbert space by introducing kernel function $\kappa(x_i, x)$, so that it is linearly separable in the feature space, and then applies the method of linear learning machine to find the optimal hyperplane. Thus, the nonlinear classification problem is
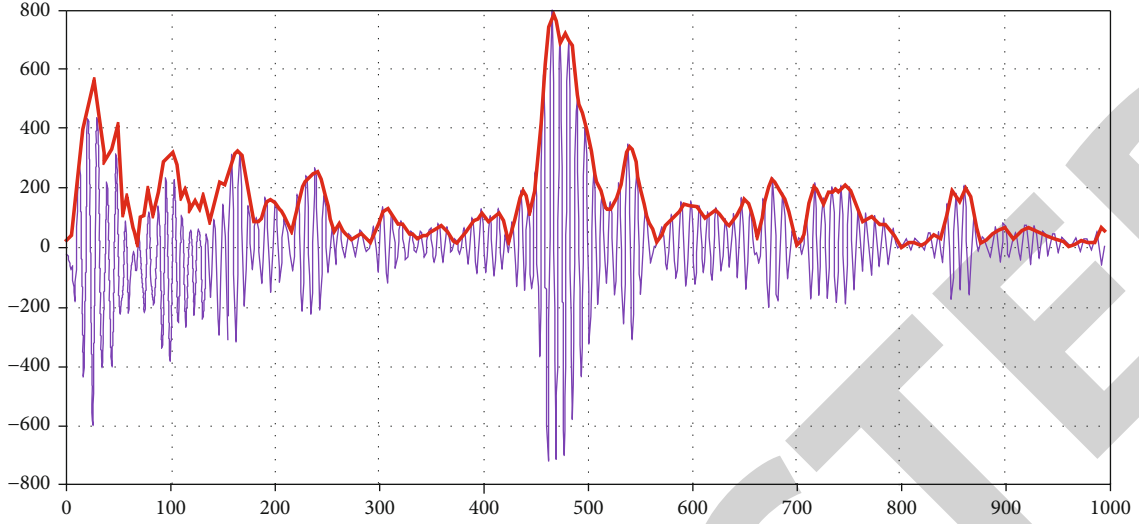
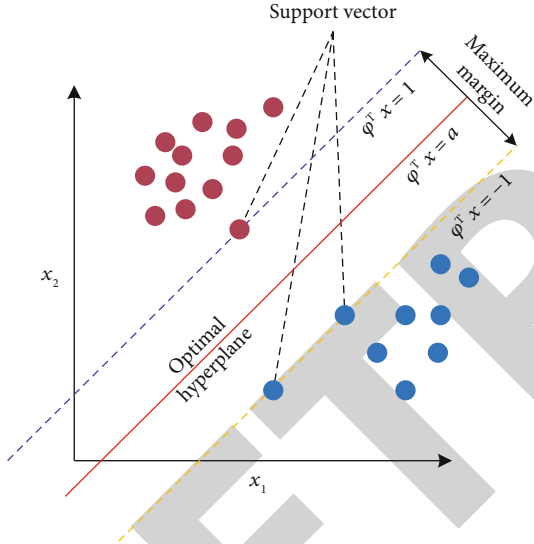Figure 1: Collected signals of psychological depression.

Figure 2: The schematic diagram of support vector machine.

transformed into a linear classification problem. At this time, by introducing kernel function $\kappa(x_i, x)$, the optimization function becomes

$$Q(a) = \sum_{i=1}^{n} \alpha_i - \frac{1}{2} \alpha_i \alpha_j \kappa(x_i, x_j). \quad (2)$$

The corresponding decision function becomes

$$f(x) = \text{sgn} \left[\sum_{i=1}^{n} \alpha_1^* y_i \kappa(x_i, x) + b^* \right]. \quad (3)$$

Different kernel functions can be used to construct different types of nonlinear decision surface learning machines in input space. When the sample data set is linearly separable, support vector machine divides the data set by using the

method of low-dimensional hyperplane. When the data set is nonlinear separable, the processing method of support vector machine is opposite to that of linear separable. It maps the data set to high-dimensional by using the method of kernel function, in order to find the existence of hyperplane that can divide data sets in high-dimensional space [17]. The schematic diagram of the optimal classification hyperplane is shown in Figure 3.

3.4. Prediction Steps of Psychological Depression Based on Data Mining Technology. The steps of psychological depression prediction of data mining technology are as follows: (1) collect voice signals through TMS and generate digital signals through digital to analogy conversion device. (2) The original speech signal is preprocessed by wavelet transform to remove the noise and get a clean speech digital signal. (3) The short-term energy and short-term zero crossing rate are extracted from the denoised speech signal, and they are used as the feature vector of psychological depression prediction. Because their units are different, they are preprocessed. (4) The psychological depression value and eigenvector are combined to obtain the learning sample of psychological depression prediction. (5) Set support vector machine parameters, such as penalty parameters and kernel function parameters. (6) Support vector machine is used to train the learning samples of psychological depression and establish a prediction model of psychological depression. The specific process is shown in Figure 4.

The psychological depression model is to perceive students' psychological state information according to students' network behavior data, so as to achieve the purpose of psychological prediction. The output result of the model is the judgment and classification of psychological state information, that is, the students' psychological state is classified according to the network behavior data [18]. The classification form is binary classification, and the content is students' mental health and unhealthy. Therefore, the psychological state perception model essentially belongs to the category
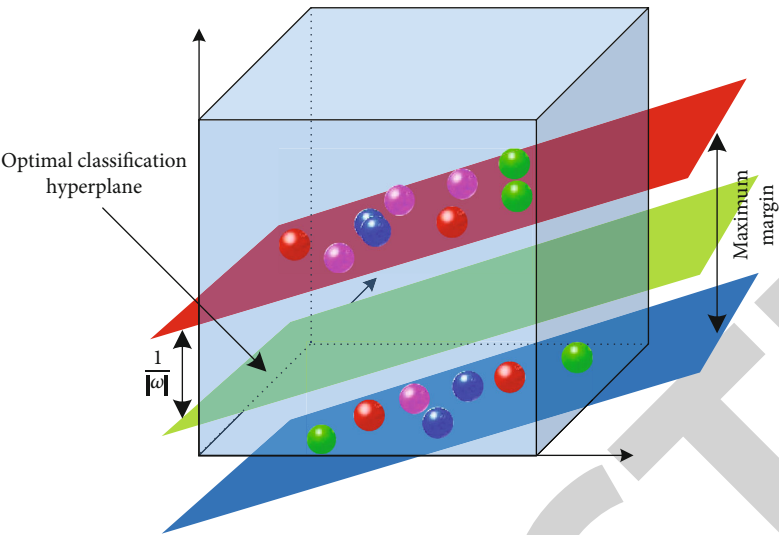
Figure 3: The schematic diagram of the optimal classification hyperplane.
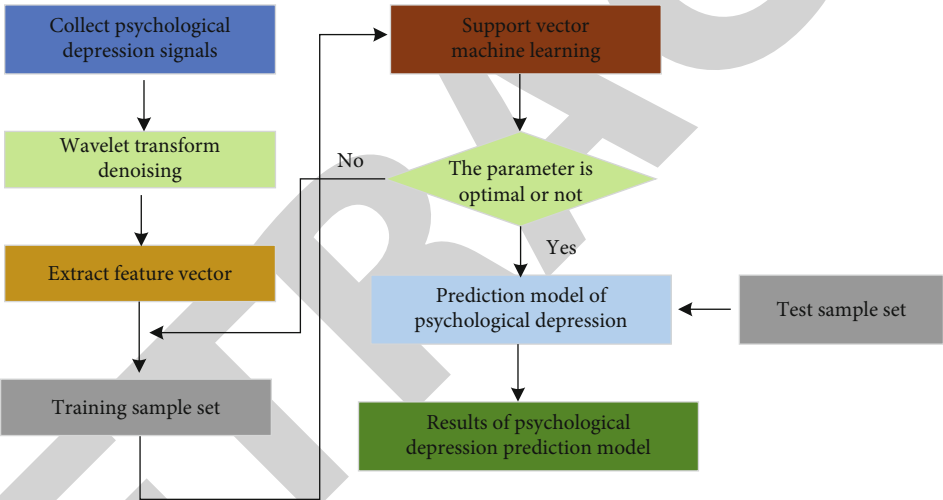

Figure 4: Prediction process of psychological depression based on data mining technology.
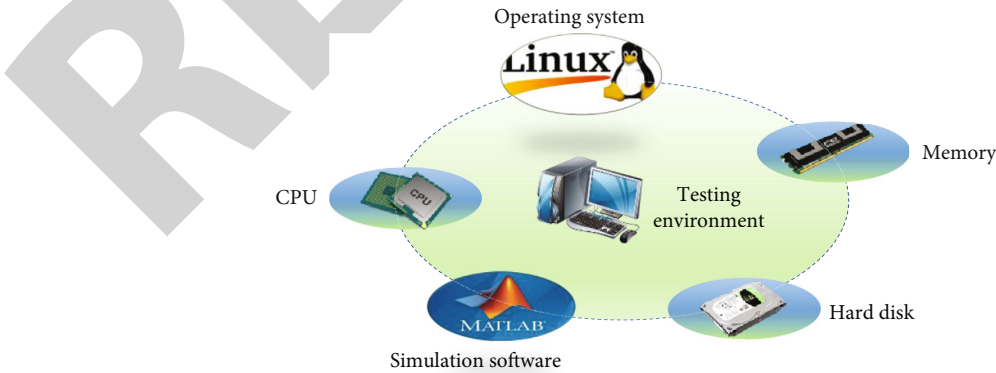

Figure 5: Construction flow chart of psychological depression prediction model based on data mining technology.
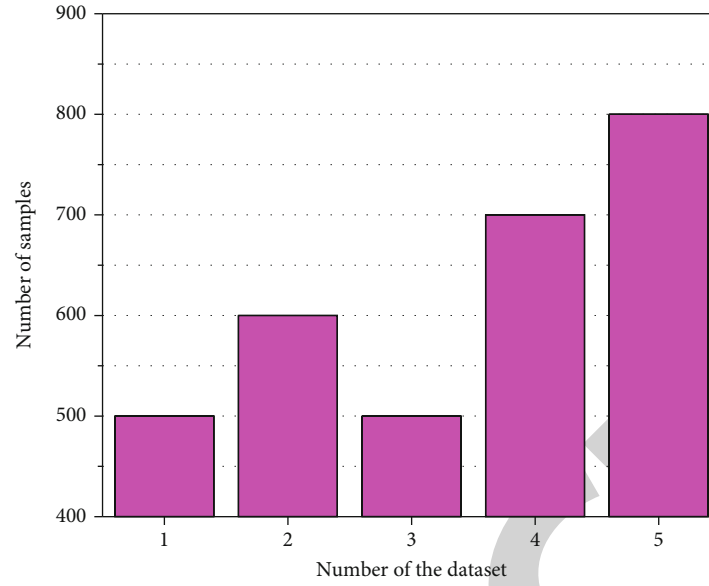
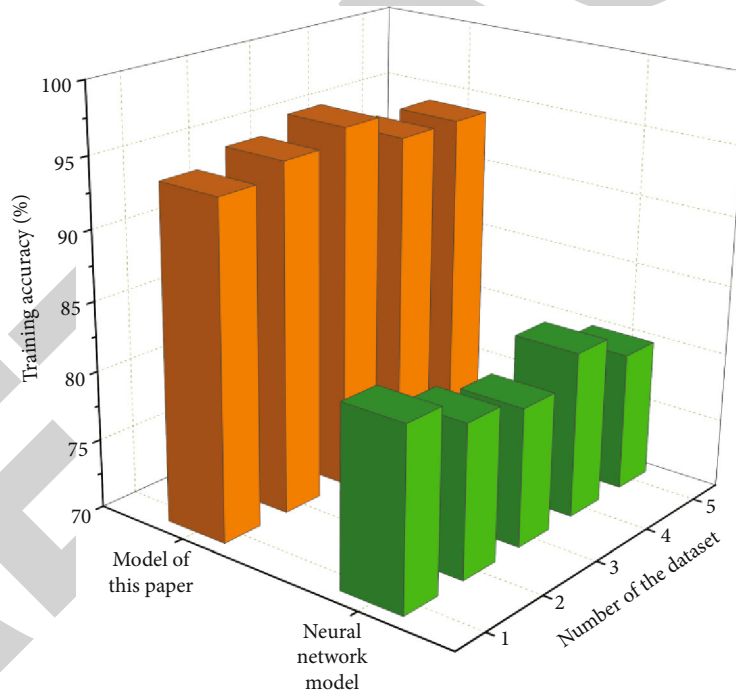Figure 6: Test data set of psychological depression simulation experiment.

Figure 7: Comparison of the accuracy of two methods in mental depression training.

of the binary classification model in supervised learning [19]. The preselection elimination mechanism is used to construct the psychological state perception model. Preselection is to select several different types of classification models with classification ability and give them the same training data set for training. Finally, according to the average results of many experiments, the optimal output model is selected as the final perception model, and the other models are eliminated [20]. The reason for choosing this method to build

the model is that the network behavior data used in this paper is a kind of data that has not been studied and applied, so it is necessary to pre select some models to compare and analyze the advantages and disadvantages of different models for this data and finally determine the depression model [21].

The purpose of the psychological depression prediction model is to realize the classification and judgment of students' psychological state information according to their
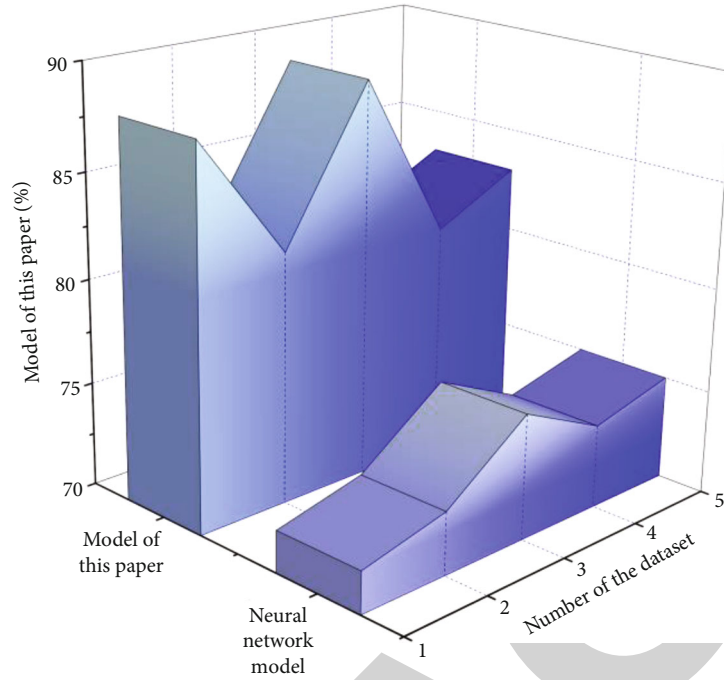
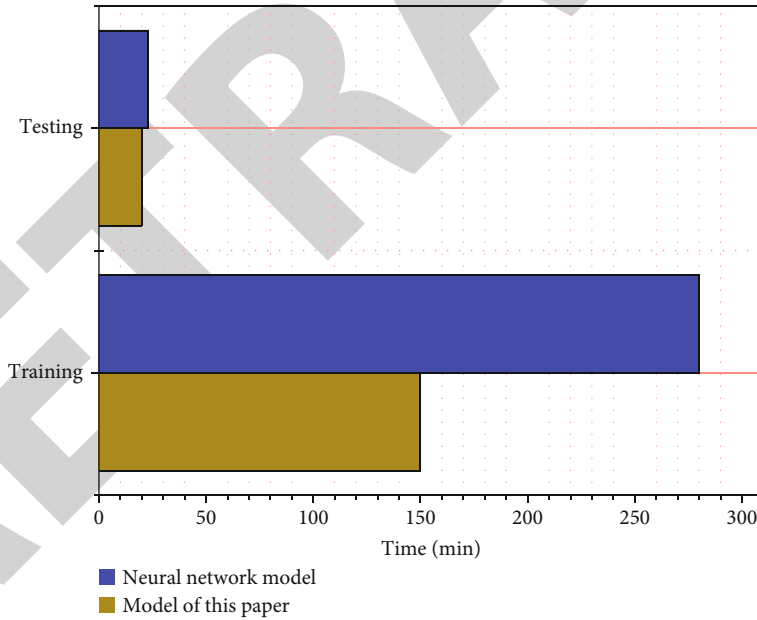FIGURE 8: Comparison of test accuracy of psychological depression test set.

FIGURE 9: Comparison of training and testing time of psychological depression between the two methods.

network behavior data. The construction process of the model includes the following steps:

(1) Preparation of training sample data set: the preparation stage is divided into several parts: the first is the acquisition of label data. Because the target model of this paper is the classification model, it is necessary to label the sample data set with label data [22]. The acquisition of label is extracted according to the score of psychological evaluation scale and psychological meaning; secondly, the feature dimension of the sample data set is constructed, and the construction method will be described in detail in the following chapters; finally, the sample data set is formed by combining the label data and the processed feature dimensions, and the optimal feature dimension composition is selected according to the feature selection method based on genetic algorithm [23]

(2) Division of sample data sets: after obtaining the processed sample data set, in order to avoid over fitting of the model and dependence on data set division, the k-fold cross-validation method is adopted. In this study, $k = 10$ is set. Firstly, 10 samples of the sample data set are selected as the test data set of the model each time, and the other 9 constitute the training data set; thus, 10 groups of training data sets and test data sets with different data contents are formed. The final experimental results can be expressed according to the mean value of the model results under the training of these 10 groups of data, which avoids the influence of accidental factors on the model to a great extent [24]

(3) Preselected model algorithm: in the preselection model algorithm stage, three model algorithms are used to establish the classification model, namely, the decision tree algorithm (decision tree), support vector machine algorithm (SVM), and random forest algorithm (RF). At the same time, in order to compare the impact on the model output after using genetic algorithm to select features, a control group model will be established [25]. The model algorithm of the control group is the same as that of the original model group, but the data dimensions used for training the model are different

(4) Training model: with the specific training data set and model algorithm, we can start training the psychological depression prediction model based on network data. Finally, we trained two groups of six mental state classification models, namely, the original model group: decision tree, SVM, and RF and the control model group: GA decision tree, GA-SVM

4. Simulation Test

4.1. Testing Environment. In order to test the performance of the psychological depression prediction model of data mining technology, a simulation experiment is carried out. The specific test environment is shown in Figure 5.

The prediction model of psychological depression based on BP neural network is selected for comparative test, and the prediction accuracy and modelling time of psychological depression are selected as the evaluation indexes of the simulation results of psychological depression prediction.

4.2. Test Data Set of Psychological Depression Simulation Experiment. In order to make the simulation results of psychological depression more convincing, five test data sets are selected for the simulation experiment. The number of psychological depression samples contained in each test data set is shown in Figure 6.

5. Prediction and Analysis of Psychological Depression

The test data set of the psychological depression simulation experiment in Figure 6 is divided into two parts: one part is the training set, which is used to establish the psychological depression prediction model and test the fitting ability of psychological depression prediction; the other part is the test set, it is used to analyze the generalization ability of psychological depression prediction model, their ratio is 3 : 1.

5.1. Accuracy Analysis of Psychological Depression Training. The accuracy of two kinds of psychological depression training is shown in Figure 7.

By analyzing Figure 7, it can be found that the average value of psychological depression training accuracy of the neural network is 81.49%, and the average value of psychological depression training error is 18.51%, which is lower than the requirements of practical application. This is mainly because although BP neural network has strong learning ability, there are often some points with large fitting errors, and the prediction results of overfitting psychological depression appeared. The average value of depression training accuracy of this method is 93.34%, the average value of depression training error is 6.66%, the accuracy of depression training is much higher than 85% required by practical application, and the accuracy of depression training is higher than the BP neural network, which shows that this method overcomes the defects of BP neural network and can better describe the changing characteristics of depression. The fitting effect of the prediction results of psychological depression is better.

5.2. Test Accuracy Analysis of Psychological Depression Prediction. The test accuracy of the two psychological depression prediction results is shown in Figure 8. According to the test accuracy analysis in Figure 8, it is normal that the test accuracy of the two methods is lower than the training accuracy, the training data set is too small, and the model regularization is too much. The data of the training set has been preprocessed, such as rotation, affine, blur, and adding noise. Too much preprocessing leads to the change of the distribution of the training set, so the accuracy of the training set is lower than that of the verification set, but the test accuracy of the method in this paper is higher than that of the BP neural network, because this method is a more effective data mining technology, which can more deeply and comprehensively describe the change trend of psychological depression, The ideal prediction results of psychological depression were obtained.

5.3. Efficiency Analysis of Predictive Modelling of Psychological Depression. The training time and test time of psychological depression modelling of the two methods are shown in Figure 9. It can be found from Figure 9 that the training time of psychological depression modelling is much longer than the test time, because it takes a long time to find the optimal parameters of psychological depression prediction model through the training process. For the same data set, the training time of psychological depression modelling in this method is less than that of BP neural network, which speeds up the efficiency of psychological depression modelling. Therefore, the total time of psychological depression modelling in this method is significantly shorter than that

of the BP neural network, which improves the efficiency of psychological depression prediction modelling.

6. Conclusions

(1) Psychological depression is the focus of social attention. The existing prediction models of psychological depression have the disadvantages of low prediction accuracy and low prediction efficiency, which are difficult to meet the actual requirements of psychological depression analysis. This paper proposes a prediction model of psychological depression based on data mining technology, which is significantly better than other psychological models

(2) The average accuracy of depression training is 93.34%, the average error of depression training is 6.66%, and the accuracy of depression training is much higher than 85% required by practical application. Compared with this, the average accuracy of psychological depression training of neural network is 81.49%, the average error of psychological depression training is 18.51%, and the accuracy of depression training is higher than that of the BP neural network

(3) Based on the behavior data of college students, this paper makes an in-depth study on the model of college students' psychological depression and has achieved some results, but there are still many works that are not perfect and need to be further discussed and studied. The next research focus is how to build students' psychological state perception model based on network behavior data and other school behavior data, such as library borrowing records and meal card consumption flow records, and explore new feature dimension construction methods and feature dimensions of data sets

Data Availability

The figures used to support the findings of this study are included in the article.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Acknowledgments

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