

Research Article

Evaluation and Analysis of College Students' Mental Health from the Perspective of Deep Learning

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College students are easily affected by the outside world, which leads to mental health problems, so it is particularly important to accurately evaluate and analyze the mental health status of college students. At present, the evaluation and analysis model of college students' mental health is inaccurate and inefficient, which cannot analyze the mental health problems of college students. In order to evaluate and analyze the mental health problems of college students more accurately, this paper designs an evaluation and analysis model of college students' mental health from the perspective of in-depth learning. The accuracy of model evaluation and analysis is improved, and a better comparison result is obtained. Firstly, the BP neural network model was compared with the logistic model and ARIMA model, and the results showed that the accuracy of the BP neural network model was more than 70% in five comparisons and was higher than that of the logistic model and ARIMA models. Second, the BP deep learning method is compared with several conventional methods (KNN, MF, NCF, and DMF) in the comparison phase of the model. The RMSE, MAE, and MAPE of the BP method are lower than those of the other four traditional methods. Finally, in the comparative experiment, the precision and AUC of the BP model are improved by 2%, and the three indicators of precision, recall, and F1 are also higher than those of other models. Through the specific evaluation of the five indicators of the four college students, from the five indicators of psychological adaptability, frustration, emotional stability, temperament, and personality, the mental health of the four college students is better.

1. Introduction

Psychological health education is an important part of college students' ideological education. In recent years, with the continuous development of society, the increase in college students has different psychological features in learning, life, interpersonal relationships, etc. after entering the university. This article mainly explores the psychological health assessment and analysis of college students from the perspective of deep learning, using deep learning to better assess and analyze the mental health status of college students. Mental health has constituted a major challenge for the well-being of college students [1]. Using deep learning-based models can better solve the challenges of college students' mental health assessment and get rid of traditional task methods. Using neural networks and depth learning methods can more accurately assess

college students' mental health status [2]. We use data from China Weibo to study the depth learning method of college students' mental health [3]. Teaching makes the main channel of college students' mental health education [4]. Deep neural network performance in the same task is superior to that of other machine learning-based standard classifiers [5]. Deep learning methods can screen the mental health status of college students more accurately and timely, and significantly reduce the consumption of money and energy. Use depth learning images; the study of text can improve the recognition rate [6]. Deep learning is a machine learning method [7]. A number of attractive technologies were promoted. The depth learning model can be used as a supplementary tool for detecting individual mental health status of social media [8]. College students' mental health is divided into mental illness, paranoia, horror, hostile, depression, anxiety, interpersonal

TABLE 1: Features of deep learning.

Based on real and complex problem situations	Deep learning emphasizes the testing of the mental health of college students in many aspects. Only when students are based in a real and complex situation will they show the truest mental state, so as to more accurately evaluate the mental health of college students
Based on dialectical thinking	Deep learning emphasizes that when evaluating and analyzing the mental health of college students, it is necessary to link the previous mental health problems of the students and to maintain a dialectical thinking about the mental health problems of the students and form their own knowledge system and logic structure
Emphasize the integrated processing of information	Deep learning emphasizes that when evaluating and analyzing college students' mental health data, it is necessary to combine multiple indicators, multiple information data, and in-depth processing to grasp the structure and diversity of mental health as a whole. It is helpful to cultivate students' holistic view and connection view, and the results are more accurate when evaluating and analyzing the mental health of college students
Pointing to a higher-order state of mind	Deep learning emphasizes that the evaluation and analysis of college students' mental health problems should not only focus on the surface of the results but also pay attention to the reasons behind the results, identify the root of the problem, and break through to a higher level of thinking
Transfer of intentional knowledge	Deep learning emphasizes the need to learn the transfer of knowledge when evaluating and analyzing the psychological problems of college students. When facing students with mental health problems, it is necessary to combine a variety of knowledge for analysis and apply the learned knowledge to solve problems in different situations. Cultivate the ability to link theory with practice, to learn from one another, and to be flexible and creative

sensitivity, stress, and nine dimensions of somatization [9]. Mental health is one of the factors affecting life aspects [10]. This issue is especially important for college students' education. Mental health is defined as a state without psychological barriers and happiness [11]. University courses must meet physical and mental health needs, so that students can prevent future issues [12]. Excavation results help to learn more about students' mental health issues [13]. College students' mental health is the focus of public and universal attention [14]. Mental health education is an important part of higher education [15].

2. Basic Theory

2.1. Deep Learning

2.1.1. Connotation of Deep Learning. Deep learning is a process for understanding of learning relative to mechanical, scattered fragmentation [16]. Deep study points to deep information processing, knowledge migration, and problem solving in the real and complex learning situation.

2.1.2. Deep Learning Features. The characteristics of deep learning are shown in Table 1.

2.2. Mental Health of College Students

2.2.1. Concept of Mental Health of College Students. College students' mental health refers to college students as a special group [16]. Many characteristics of youth performance have a psychological manifestation, but it is not completely equally equal to youth.

2.2.2. Mental Health Standards for College Students. The specific contents of the mental health standards for college students are shown in Table 2.

2.3. BP Neural Network. This article will use the BP neural network to evaluate and analyze the mental health of college students. The BP neural network contains three parts: input layer, hidden layer, and output layer [17]. It can improve the accuracy of the model and is more accurate when evaluating college students' mental health issues and is more accurate and faster when analyzing.

Suppose that the input layer includes a node, the hidden layer includes a node, and the output layer includes a node [18]. The structure diagram of the BP neural network is shown in Figure 1.

where $i = 1, 2, \dots, n$; $j = 1, 2, \dots, m$; $k = 1, 2, \dots, l$.

The number of neurons in the hidden layer is

$$Y = \sqrt{X + Z} + a. \quad (1)$$

The activation function is a unipolar sigmoid function:

$$f(x) = \frac{1}{1 + e^{-x}}. \quad (2)$$

Because the sigmoid function is continuously differentiable, we get

$$f'(x) = f(x)(1 - f(x)). \quad (3)$$

The neuron input information of the j hidden layer is

$$A_j = \sum_{i=1}^n v_{ij}x_i. \quad (4)$$

TABLE 2: Mental health standards for college students.

Normal intelligence	Normal intelligence mainly refers to the ability of college students to learn and understand through experience, the ability to acquire and maintain knowledge, the ability to respond quickly and accurately to new situations, and the ability to use reasoning to solve problems effectively. Mentally healthy college students have a strong thirst for knowledge and a strong interest in exploration and can overcome difficulties in the learning process, maintain a certain degree of learning efficiency, and experience happiness and satisfaction from learning
Emotional health	The main signs of emotional health are emotional stability and a happy mood. Mentally healthy college students are mostly optimistic, cheerful, energetic, confident, full of hope in life, good at regulating emotions, able to attract reasonable methods of catharsis, and able to properly express their emotions in different situations
Sound-willed	Sound-willed refers to college students showing a high level of consciousness, determination, tenacity, and self-control. Mentally healthy college students have a certain ability to control their behavior, can correctly understand the purpose and meaning of their actions, have a certain degree of decision-making ability in case of accidents, can persevere, and have a good ability to respond to emergencies
Personality integrity	Personality is the sum of various psychological characteristics. Personality integrity means that an individual has a sound personality, balanced development of temperament, abilities, beliefs, and outlook in life. Mentally healthy college students can maintain the coordination of thinking, speech, and actions, have a correct self-awareness, have a positive outlook in life, and be able to unify their needs, goals, and actions
Self-awareness	Self-consciousness improvement mainly refers to knowing oneself correctly, evaluating oneself, and accepting oneself. Mentally healthy college students can fully understand themselves, put themselves in a correct position, evaluate themselves objectively, and are not arrogant, and they can face reality squarely in the face of setbacks and difficulties, be positive and enterprising, and show self-esteem, self-improvement, and self-control and self-love
Interpersonal harmony	Interpersonal relationship can reflect the situation of college students interacting with others. Mentally healthy college students are willing to interact with others, can get along with others with respect, trust, friendship, tolerance, and understanding, can maintain an independent and complete personality in interactions, evaluate themselves and others objectively, and can maintain a coordinated relationship with the collective, know how to share, and maintain a positive attitude towards communication
Normal social adjustment	Adaptability is an important characteristic of measuring mental health. Mentally healthy college students can maintain good contact with the society and have a clear and correct understanding of the current social situation, and their thoughts and actions can keep up with the pace of development of the times and meet the requirements of society. When you find that your own needs and desires are in conflict with social needs, you can quickly adjust yourself, adapt to social changes, and stay in harmony with society
Mental behavior conforms to the age characteristics of college students	College students are at a specific age, and their psychological behaviors should be adapted to their age and roles, and their cognition, emotions, words and deeds, and behavior should all conform to the characteristics of their age. Mentally healthy college students are usually energetic, hardworking, and quick-responsive and like to explore. Being too old, too naive, and too dependent are all signs of being mentally unhealthy

The neuron output information of the j hidden layer is

$$y_i = f\left(\sum_{j=1}^m v_{ij}x_i - b_j\right). \quad (5)$$

Among them, b_j represents the threshold of the connection between the input layer and the hidden layer.

The neuron input information of the k output layer is

$$B_k = \sum_{j=1}^m w_{jk}y_j. \quad (6)$$

The neuron output information of the k output layer is

$$z_k = f\left(\sum_{k=1}^l w_{jk}y_j - b_k\right). \quad (7)$$

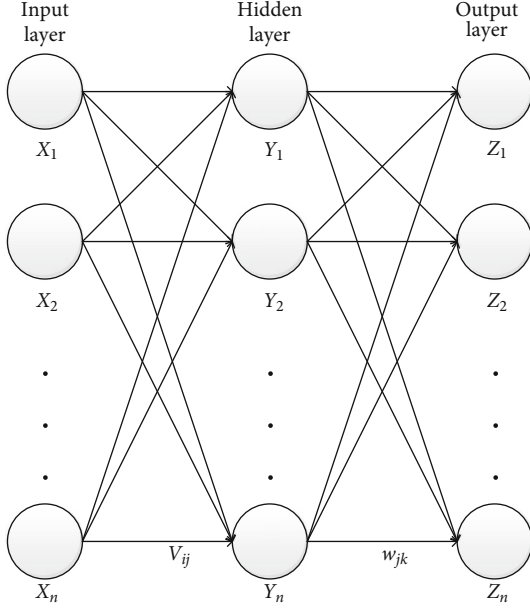


FIGURE 1: BP neural network structure diagram.

Among them, b_k represents the threshold of the connection between the hidden layer and the output layer.

For a training sample (x_k, z_k) , the final output value is $\bar{z}_k = (\bar{z}_1^k, \bar{z}_2^k, \dots, \bar{z}_l^k)$ [18]. Then, the error between the actual value z_k and the expected output value \bar{z}_k can be expressed as

$$E_k = \frac{1}{2} \sum_{k=1}^l (z_k - \bar{z}_k)^2. \quad (8)$$

With backpropagation to the hidden layer and the input layer, you can get

$$\begin{aligned} E_k &= \frac{1}{2} \left(z_k - g \left(\sum_{j=1}^m w_{jk} y_j - b_k \right) \right)^2 \\ &= \frac{1}{2} \sum_{k=1}^l \left(z_k - g \left(\sum_{j=1}^m \left(w_{jk} g \left(\sum_{i=1}^n v_{ij} x_i - b_j \right) \right) - b_i \right) \right)^2. \end{aligned} \quad (9)$$

Among them, g represents the inverse function of function f .

2.4. BP Algorithm. In the BP algorithm, the iterative methods of parameters are

$$\xi_i \leftarrow \xi_i + \Delta \xi_i. \quad (10)$$

The BP algorithm is composed of two parts: the forward propagation of information and the backward propagation of errors [19]. Assume that the input vector in the BP neural network is

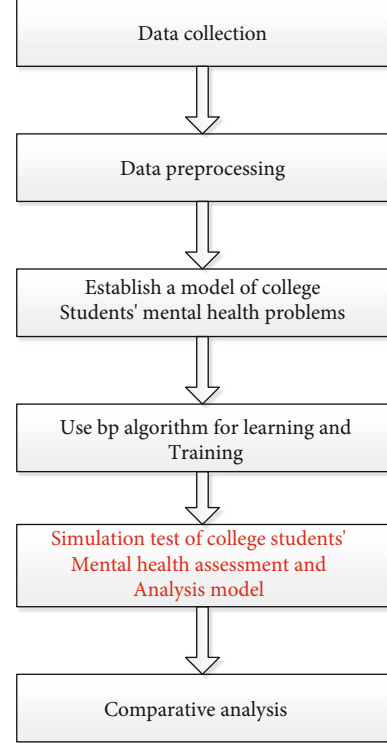


FIGURE 2: Research route.

$$x = (x_1, x_2, \dots, x_n)^T. \quad (11)$$

The hidden layer vector is

$$y = (y_1, y_2, \dots, y_n)^T. \quad (12)$$

The output layer vector is

$$\bar{z}_h = (\bar{z}_1^h, \bar{z}_2^h, \dots, \bar{z}_n^h)^T. \quad (13)$$

The weight from the input layer to the hidden layer is

$$V = (V_1, V_2, \dots, V_i, \dots, V_m). \quad (14)$$

Where

$$V_i = (v_1^i, v_2^i, \dots, v_n^i)^T, \quad 1 \leq i \leq m. \quad (15)$$

The weight from the hidden layer to the output layer is

$$W = (W_1, W_2, \dots, W_j, \dots, W_l). \quad (16)$$

Where

$$W_j = (w_1^j, w_2^j, \dots, w_m^j)^T, \quad 1 \leq j \leq l. \quad (17)$$

Through the gradient descent method [20], the weight adjustment formula of the hidden layer is

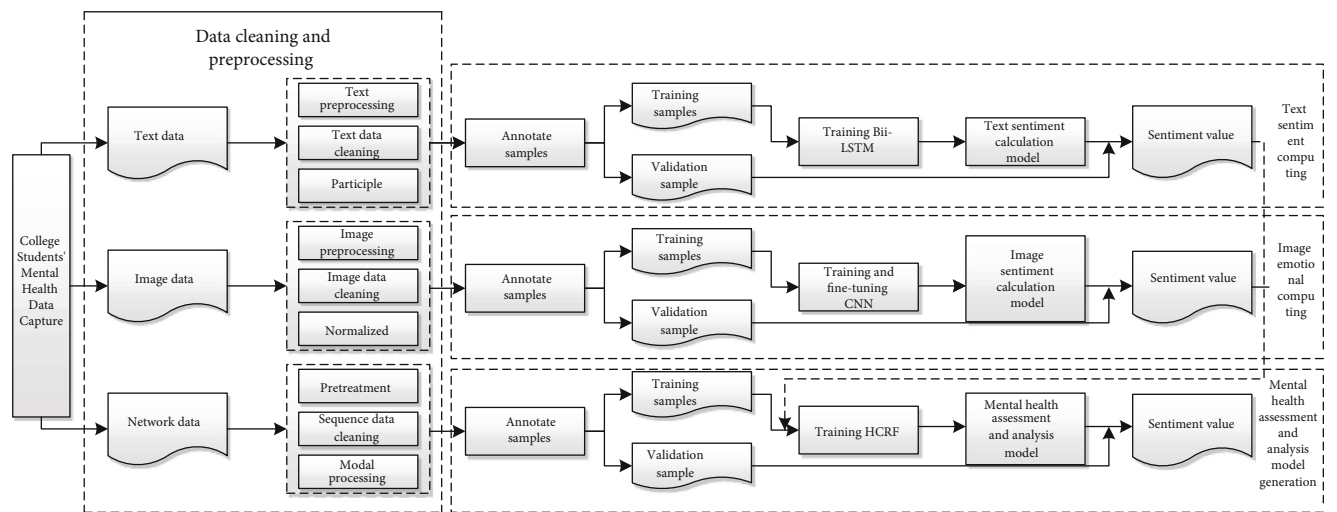


FIGURE 3: Mental health assessment and analysis model.

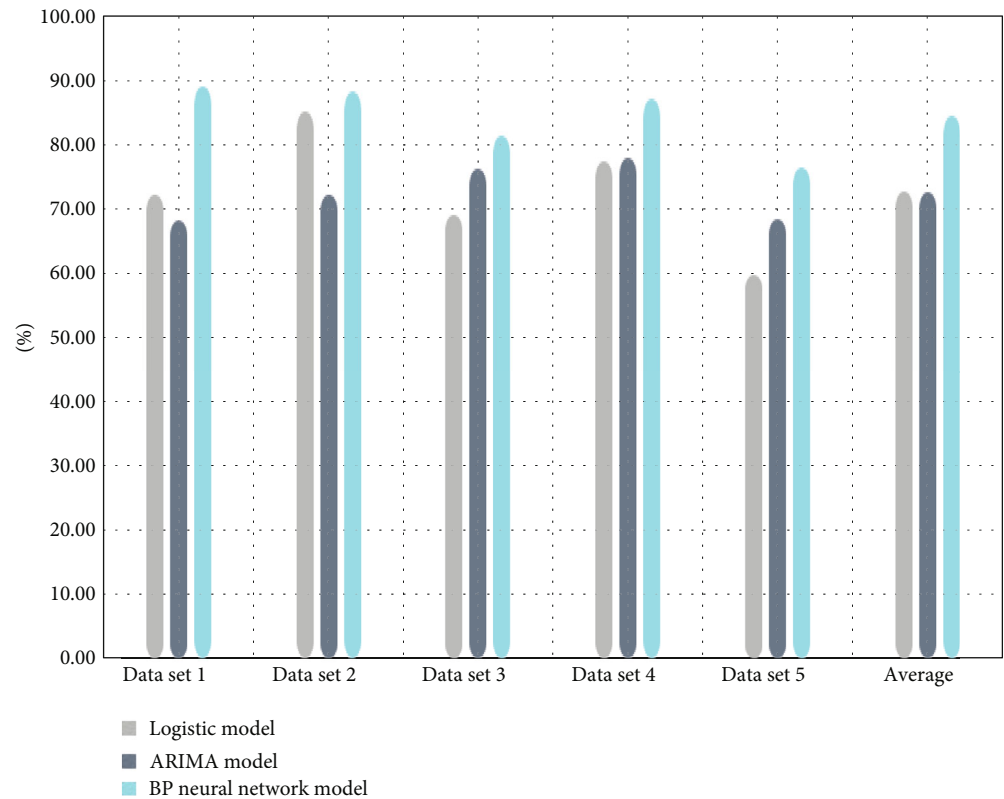


FIGURE 4: Model comparison.

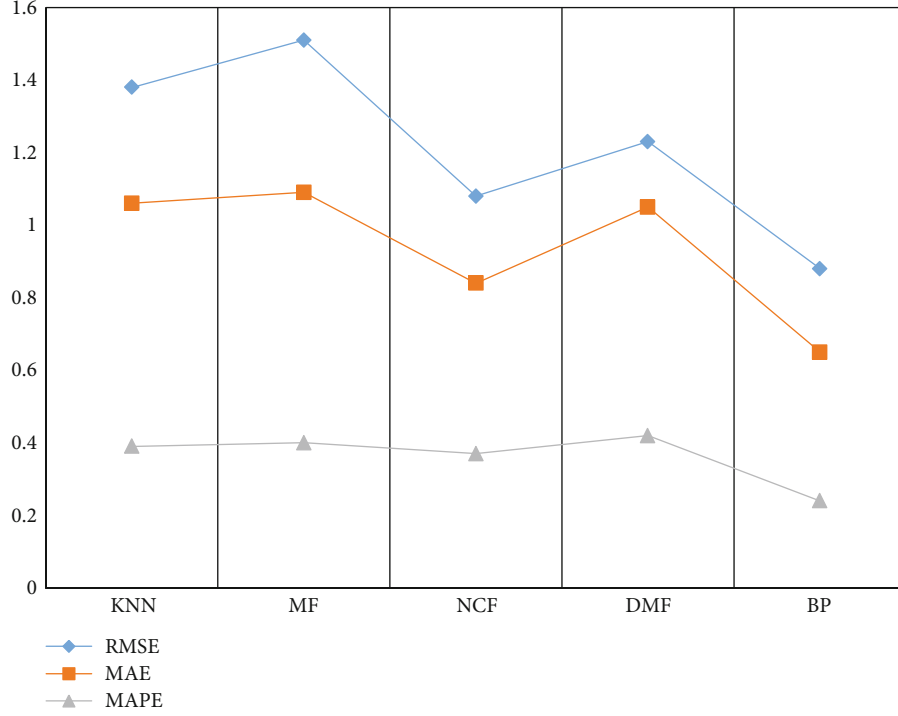


FIGURE 5: Model comparison.

TABLE 3: Comparative experiment.

	Accuracy	Precision	Recall	F1	AUC
LR	0.7990	0.8400	0.8728	0.8561	0.7557
SVM	0.8324	0.8464	0.9229	0.8830	0.7793
FM	0.8431	0.8552	0.9281	0.8902	0.7933
DNN	0.8440	0.8554	0.9294	0.8908	0.7939
DeepFM	0.8485	0.8603	0.9297	0.8937	0.8008
PNN	0.8576	0.8646	0.9392	0.9004	0.8098
BP	0.8668	0.8680	0.9499	0.9071	0.8179

$$\Delta v_{ij} = -\eta \frac{\partial E}{\partial v_{ij}}, \quad 1 \leq i \leq n, 1 \leq j \leq m. \quad (18)$$

The weight adjustment formula of the output layer is

$$\Delta w_{jk} = -\eta \frac{\partial E}{\partial w_{jk}}, \quad 1 \leq j \leq m, 1 \leq k \leq l, \quad (19)$$

where η is the learning rate of error E .

The gradient of the output layer threshold σ is

$$g_k = \frac{\partial E_c}{\partial \sigma_k} = \frac{\partial E}{\partial \bar{z}_k^c} \cdot \frac{\partial \bar{z}_k^c}{\partial \sigma_k} = \bar{z}_k^c (1 - \bar{z}_k^c) (z_k^c - \bar{z}_k^c). \quad (20)$$

The gradient of the hidden layer threshold θ is

$$h_j = \frac{\partial E_c}{\partial \theta_j} = \frac{\partial E_c}{\partial y_j} \cdot \frac{\partial y_j}{\partial \theta_j} = y_j (1 - y_j) \sum_{k=1}^l g_k w_{jk}. \quad (21)$$

3. Model Design

3.1. Research Route. Through the various indicators of psychological problems, the input test samples are evaluated and analyzed, and the data is continuously evaluated and analyzed through comparison, in order to fully understand the mental health of college students. First collect data pre-processing; then, establish college students' mental health problem model [21]. Use the BP algorithm for learning training, and then, simulate the simulation test of college students' psychological problems and final comparison results. This paper uses the main problem of students as a sample input. Add personal basic information in the data, and use the BP neural network to establish mental health assessment models. Through the mapping relationship between the influencing factors and psychological issues, the input test samples are studied; only constantly enter and complete training to achieve the purpose of the model established. The research route is shown in Figure 2.

3.2. Mental Health Assessment and Analysis Model. Firstly, the data of college students' mental health is obtained from three aspects of text, image and network evaluation. Among them, text data requires text pretreatment, text data cleaning, and word [22]. Image data requires image pretreatment, image

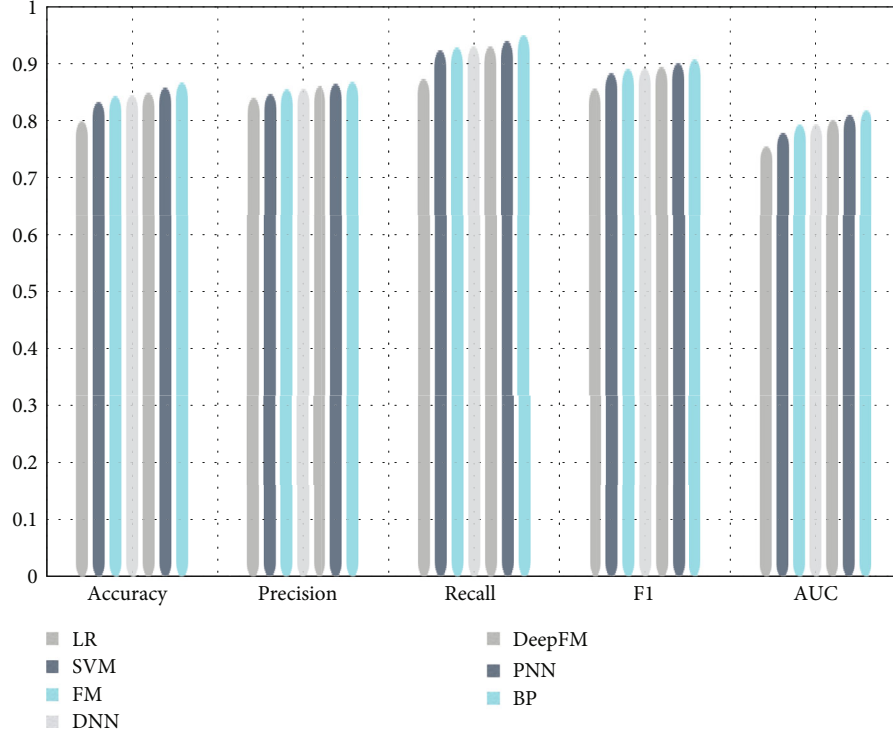


FIGURE 6: Comparative experiment.

TABLE 4: Test results of five indicators.

	Psychological adaptability	Frustration tolerance	Emotional stability	Temperament	Character
Student 1	89	91	95	98	83
Student 2	93	88	97	95	80
Student 3	78	97	83	96	89
Student 4	75	95	90	89	77

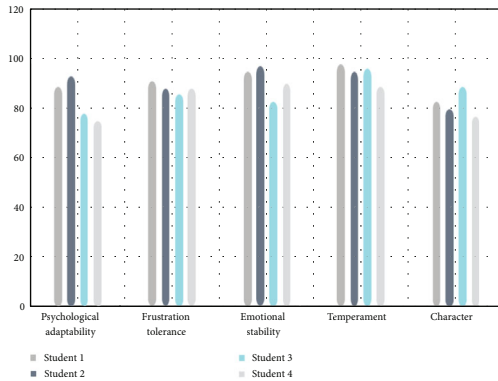


FIGURE 7: Test results of five indicators for students.

data cleaning, and normalization. Network data requires pre-processing, sequence data cleaning, and modal processing. The sample is then marked, and the samples are divided into training samples and test samples. After, training samples

need to be trained to calculate the emotional tendency value in the model and finally combined with the three emotional calculations for the evaluation and analysis of mental health. Training samples in text data use training BII-LSTM methods, training samples in image data use training fine-tuning CNN methods, and network data training samples adopt training HCRF methods, as shown in Figure 3.

3.2.1. Text Sentiment Calculation. Text information is the basic information of human conveying emotions, expressing ideas [23]. It is also the form of expression of an individual's psychological state. The formulas are

$$o_t = h_t \oplus h'_t, \quad (22)$$

$$h_t = f(W \times x_t + U \times h_{t-1} + b), \quad (23)$$

$$h'_t = f(W' \times x_t + U' \times h_{t-1} + b'). \quad (24)$$

Among them, the f function is a LSTM nonlinear

TABLE 5: Emotional stability test results.

	Excellent (number/rate)	Good (number/rate)	General (number/rate)	Poor (number/rate)	Different (number/rate)	Total (number of people)
Male	130/7.8	210/12.6	1200/71.9	120/7.2	10/0.6	1670
Female	40/5.3	81/1.1	560/74.1	70/9.2	5/0.7	756
Total	170/7.0	291/12.0	1760/72.5	190/7.2	15/0.6	2426

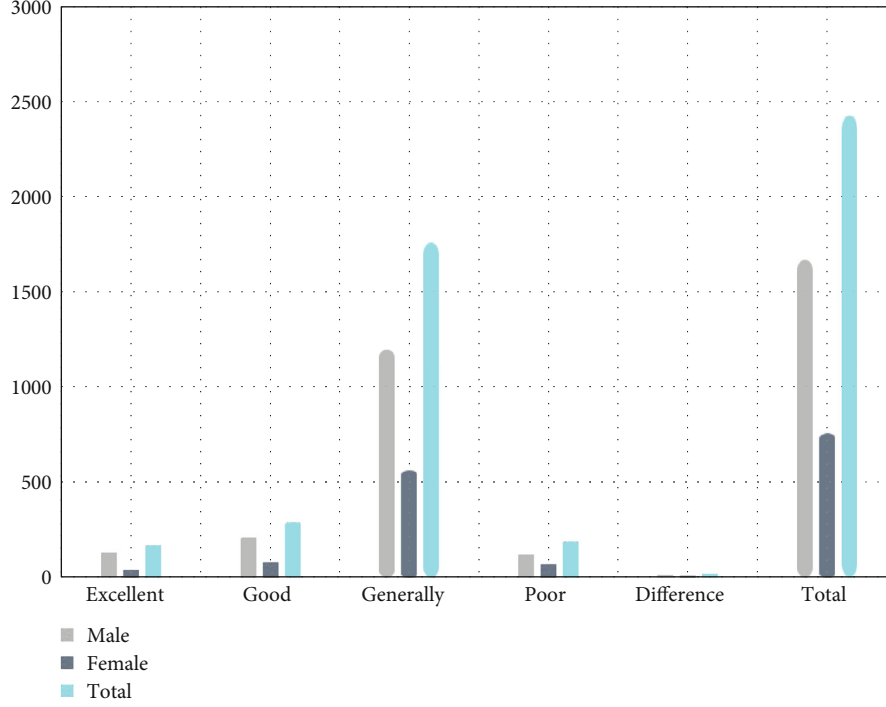


FIGURE 8: Emotional stability test results.

TABLE 6: Test results of frustration tolerance.

	Excellent (number/rate)	Good (number/rate)	General (number/rate)	Poor (number/rate)	Different (number/rate)	Total (number of people)
Male	1500/79.4	270/14.3	90/4.7	22/1.2	8/0.4	1890
Female	560/76.4	120/16.4	34/5.4	13/1.8	6/0.8	733
Total	2060/78.5	390/14.8	124/5.0	35/1.3	14/0.5	2623

function [24]. W , U , W' , and U' represent the weight of the function, and b , b' represent the bias of the function.

3.2.2. *Image Sentiment Calculation.* Image information is supplemented to text information [25]. The formula is

$$S(V_i) = \frac{\exp(V_i)}{\sum_{j=1}^n \exp(V_j)}. \quad (25)$$

Among them, V_i refers to the i category element of the output vector of the dense connection layer, $S(V_i)$ is the i

category emotion probability value of the image, and n represents the positive and negative emotion categories.

4. Experimental Part

4.1. *Model Test.* First, test the model.

4.1.1. *Model Comparison.* We compare the BP neural network model with the logistic model and the ARIMA model, respectively, use the three models in the evaluation and analysis of the mental health of college students, and compare

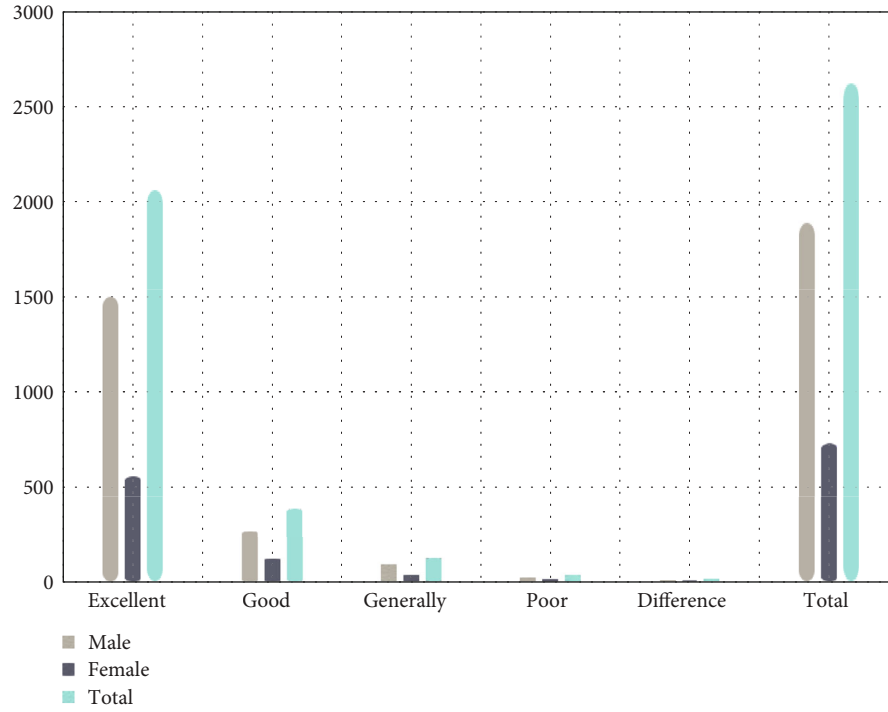


FIGURE 9: Test results of frustration tolerance.

the accuracy of the results of the three models. The result is shown in Figure 4.

Through the comparison of the three models, the accuracy of the BP neural network model is higher than that of the logistic model and the ARIMA model, and the accuracy rate is above 70%, indicating that the model is more suitable for the evaluation and analysis of the mental health of college students.

4.1.2. Model Comparison. In this experiment, the BP deep learning model proposed in this article is compared with several traditional methods (KNN, MF, NCF, and DMF) that are evaluating the mental health of college students. The final experimental results are shown in Figure 5.

It can be seen from the experimental results that the BP method of deep learning has achieved better evaluation results than the KNN, MF, NCF, and DMF methods. The BP method has a stronger ability to recognize input data and learn data hiding, with flexibility and accuracy.

4.1.3. Comparative Experiment. This article compares the BP depth learning model with other models, and the results are shown in Table 3.

According to the data in the table, a chart is drawn as shown in Figure 6.

It can be seen from the experimental results in Figure 6 that the BP model has improved the accuracy and AUC by 2% compared to the best traditional method DNN and has also significantly improved in the three indicators of precision, recall, and F1. The experimental results show that the values of accuracy, precision, recall, F1, and AUCs of the

BP depth learning model are 0.8 or more, ranking highest in all models.

4.2. Application Effect of College Students' Mental Health Model. According to this article, the mental health assessment and analysis model of college students is designed and psychologically assesses and analyzes a university student.

4.2.1. Test Results of Five Indicators. Students conduct specific assessments of five indicators: psychological adaptability, frustration tolerance, emotional stability, temperament, and personality, to obtain an individual student's evaluation results and summarize the overall psychological status trend of students based on various indicators. The conclusion is shown in Table 4.

The test results of the five indicators of students showed that the four students had better test results on psychological adaptability, frustration tolerance, emotional stability, temperament, and personality, indicating that the four students had no major problems in mental health, as shown in Figure 7.

4.2.2. Results of the Emotional Stability Test. In a survey of emotional stability in boys and girls, the results are divided into excellent, good, general, poor, and different, as shown in Table 5.

From the data in Figure 8, we can know that 72.5% of the students in the emotional stability test are average, indicating that college students still need to strengthen their emotional stability, and we should help students more in their emotional self-management.

4.2.3. Test Results of Frustration Tolerance. The frustration tolerance test was conducted on boys and girls, and the results were divided into excellent, good, average, poor, and different for statistics. The results are shown in Table 6.

From the data in Figure 9, we can know that 78.5% of the students in the test of frustration tolerance are excellent, especially boys. This shows that college students have better frustration tolerance, and they are not afraid of difficulties when facing setbacks.

5. Conclusion

College students are in an important stage of entering the society, and the mental health of college students is also an important issue facing our education. How to accurately evaluate and analyze the mental health of college students is the theme of this paper. In this paper, in-depth restudy of the perspective of college students' mental health evaluation and analysis model improves the accuracy and rate of evaluation and analysis and improves work efficiency.

The conclusions of the study are as follows:

- (1) Through the comparison of the BP neural network model, ARIMA model, and logistic model, the accuracy of the BP neural network model is more than 70% higher than that of the logistic model and ARIMA model
- (2) Comparing the BP depth of several traditional methods and learning methods (KNN, MF, NCF, and DMF) in the model stage, in the BP method, the RMSE is 0.88, the MAE is 0.65, and the MAPE is 0.24, which are lower than those in the other four traditional methods
- (3) In the comparative experiment, the accuracy of the BP model is higher than that of other models, and the other three indicators are also significantly improved
- (4) In this model, through the evaluation of psychological adaptability, frustration tolerance, emotional stability, temperament, and personality of the four college students, it shows that the mental health of the four college students is good, and the scores of each index are all above 70
- (5) In order to specifically test the emotional stability and antifrustration ability of college students, we divided college students into two groups, male and female, and tested them, respectively. The results showed that 72.5% of the students performed moderately in the emotional stability test and 78.5% of the students performed well in the frustration tolerance test

Data Availability

The experimental data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The authors declared that they have no conflicts of interest regarding this work.

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