Research Article

Analysis and Research of Psychological Education Based on Data Mining Technology

Haiyun Sang

Faculty of Transportation Engineering, Huaiyin Institute of Technology, Huaian, Jiangsu 223003, China

Correspondence should be addressed to Haiyun Sang; xscsang@hyit.edu.cn

Received 19 July 2021; Revised 22 July 2021; Accepted 6 August 2021; Published 19 August 2021

Academic Editor: Danfeng Hong

Copyright © 2021 Haiyun Sang. This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

With the era of the Internet, linking the prevention and treatment of mental health problems in colleges and universities with the Internet will become a general trend. In order to improve the effect of identifying the psychological crisis state of college students, a method of identifying the psychological crisis state of college students based on data mining technology is proposed. First, we analyze the current research progress of college students’ psychological crisis state recognition and point out the defects of the current college students’ psychological crisis state recognition methods; then, we collect college students’ psychological crisis state data and use the support vector machine in data mining technology to analyze the psychological crisis state data. We analyze and model and then establish the recognition model of college students’ psychological crisis state; finally, we carry out the simulation experiment of college students’ psychological crisis state recognition. The experimental results show that the accuracy rate of college students’ psychological crisis state recognition by this method is over 90%, and the rejection rate and misrecognition rate are extremely low. The recognition effect is significantly better than other methods, and it can provide valuable information for college student psychological management personnel.

1. Introduction

With the continuous increase in the number of college students, college education has entered ordinary families. However, due to the continuous increase in academic and employment pressures, many college students have certain psychological problems, which directly affect the mental health of college students, and college students’ psychological crisis state recognition research can help college student management workers understand the state of students’ psychological changes and make certain interventions in advance to ensure the mental health of college students. Therefore, the research on college students’ psychological crisis state recognition has become a current research hotspot [1–3]. Initially, the recognition of the psychological crisis state of college students was diagnosed by experts. This method is expensive and time consuming, with poor intelligence and unstable recognition results. The recognition results of the psychological crisis state of college students may be different for each expert. Therefore, the shortcomings are very obvious and cannot meet the requirements of the development of modern university students’ psychological crisis research [4–6]. With the development of neural network technology, artificial neural network methods for identifying the psychological crisis state of college students have emerged [7–9], such as BP neural network and RBF neural network, which have automatic learning abilities and can recognize the problems and organize the structure of the neural networks to effectively fit the characteristics of changes in the psychological crisis of college students. However, because the BP neural network is a traditional machine learning algorithm, the structure is difficult to determine, and the learning process is very complicated, and it is difficult to obtain a stable psychology of college students. As a result of the recognition of the crisis state, the research on the recognition of the psychological crisis state of college students faces huge challenges [10–12].

Support vector machine is a new type of data mining technology, which overcomes the defects of low learning efficiency of neural network and unstable modeling results and has been widely used in many fields [13, 14]. In order to
solve the deficiencies in the process of identifying the mental crisis state of college students and to improve the accuracy of the recognition of the mental crisis state of college students, this paper proposes a method of identifying the mental crisis state of college students based on data mining technology. Firstly, laser sensors are introduced to collect the signals of college students’ mental crisis state recognition; then, wavelet transform is introduced to denoise the college students’ mental crisis state signals, and the nuclear principal component analysis algorithm is used to extract the characteristics of college students’ mental crisis state recognition; finally, support vectors are used. The computer establishes the recognition model of the psychological crisis state of college students and compares the test with other methods of recognition of the psychological crisis state of college students. The results show that the accuracy rate of college students’ psychological crisis state recognition by this method is high, and the rejection rate and misrecognition rate of college students’ psychological crisis state are greatly reduced, which has obvious advantages. Universities should not only pay attention to the teaching of students’ knowledge but also pay attention to their psychological problems, so as to cultivate a healthy personality of college students. Although the psychological counseling center has basically covered all colleges and universities, it has played a certain role in solving the psychological problems of college students. However, mental health counseling is usually limited to two offline methods: opening psychological counseling rooms to help visiting students solve problems and holding activities related to mental health education. It is worth noting that only through the above channels, there will undoubtedly be problems such as incomplete coverage of health education objects and untimely discovery of psychological problems. Nowadays, with the emergence of the “Internet age,” people’s lives are inseparable from the existence of the Internet. Various types of application software continues to develop and update functions to affect people’s lives in a more convenient and concise way. Therefore, we have the idea of establishing a mental health problem prevention platform. Based on data mining and databases, this method can help students deal with psychological problems timelier and effectively and promote their healthy growth.

2. Related Works

At present, although the issue of students’ mental health [15–17] has attracted the attention of colleges and universities, there are still problems in the prevention and treatment of students’ psychological health issues in colleges and universities. The inability to timely prevent and cure the psychological problems of college students is mainly due to the subjective and objective aspects. Subjective refers to the college students’ own aspects. Most students think that it is a shame to have psychological problems, and they do not want to be known by others when they have done psychological counseling. The main objective aspects are as follows: (1) the school lacks professional psychological counseling teachers [18]; (2) the school’s ability to prevent and monitor psychological problems is not enough, and most of them are through subjective observation methods. This method is lack of objectivity and support with data. In order to solve these problems, it is necessary to establish an online prevention and treatment platform for college students’ psychological and health problems based on data mining and database [19] and carry out prevention and treatment work through a combination of online and offline methods. First of all, the platform can be used as an intermediary system to communicate between college students and the team of psychological counselors, realize the sharing of psychological counseling teachers in different regions, and effectively solve the phenomenon of lack of teachers; second, the school can use the platform to regularly issue mental health questionnaires to all students. The information and privacy of the students will be absolutely protected; at the same time, real-time monitoring and precise analysis can be realized by using data mining and databases, and the prevention and monitoring efforts can be enhanced.

Based on the mining of association rules in the data mining [20] of the psychological problem prevention platform design, the application of association rules in this design can draw the connection between different options in the psychological questionnaire of different college students in the database and find out the possible psychological existence of college students from these connections problem; through this kind of rule, we can automatically match psychological tutors that meet college students for targeted psychological counseling, effectively conduct college student psychological counseling tests, and automatically associate college student information and other services.

The current classic classification algorithms in the stage of big data analysis and data mining mainly include decision trees [21], Naive Bayes [22], support vector machines (SVMs) [23], neural network [24] classification algorithms, and so on. Decision tree classification algorithm is a kind of inductive learning algorithm, which mainly refers to the classification rules that infer a “tree” structure from a series of irregular and unordered sample data information to make predictions. The decision tree classification algorithm can intuitively display the decision-making problems and key points of different periods in the entire decision-making process. The decision tree is composed of root node, internal node, leaf node, and directed edges connecting nodes. The root node is unique and represents the sample set to be classified; the internal nodes represent the characteristic attributes; the leaf nodes represent the classification results. The algorithm decision process starts from the root node, selects branches from top to bottom to the corresponding node according to the corresponding attribute value in the set to be classified, repeats this step until the leaf node is reached, and the category stored in the leaf node is used as the classification result. Neural network refers to artificial neural network, based on network topology knowledge to simulate the structure and function of the human brain to form an effective computing model, which mainly includes the input layer, hidden layer, and output layer. Each layer node outputs the weighted sum of the input information and performs nonlinear transformation, and its output value is
used as the input value of the next layer and so on until the final classification node [25]. Common neural network [26] categories include single-layer neural networks, two-layer neural networks, multilayer neural networks, convolutional neural networks, and recurrent neural networks. In the neural network learning stage, the final output value is gradually close to the true value by adjusting the weight of each connection, and finally an accurate model is reached. After the neural network is trained, it dynamically responds to the input information and then obtains the classification result from the output. There are many neural network classification algorithms, such as BP neural network [27], RBF neural network [28], self-organizing feature map neural network [29], and learning vectorized neural network. The BP neural network is currently widely used. The main features of neural network classification algorithm are as follows. First, neural network has strong learning ability. Second, due to the effect of weights, neural networks have better robustness in noisy environments. Third, the artificial neural network classification algorithm also has good predictive classification capabilities for untrained data. Fourth, because the artificial neural network is a nonlinear model, it can adapt to various complex data relationships. At the same time, the defects of artificial neural network classification algorithm are also more prominent [30], mainly due to the establishment of neural network itself. To build a relatively complete neural network, the learning process is longer, and the selection and combination of activation function, optimization function, and loss function will also affect the accuracy of the final model, and the work is more difficult. Some scholars proposed to prune the network before extracting the neural rules to delete the nodes and chain branches that have a negligible impact on the classification accuracy, thereby simplifying the neural network. Secondly, compared with the decision tree classification algorithm, the neural network has poor interpretability, which may be more difficult for nontechnical users.

### 3. Method

In the process of identifying the psychological crisis state of college students, the first step is to collect the psychological crisis state signal of college students. This is a very critical step. At present, the sensor is mainly used to collect the psychological crisis state signal of college students. Compared with other sensors, laser sensors have anti-interference property. With strong ability, low requirements for the environment, and low price, this article uses laser sensors to collect the psychological crisis state signals of students, which can reduce the cost of psychological crisis state signal collection. Suppose that the psychological crisis state signal of the original college students is $y(n)$, which contains a certain amount of noise $n(n)$. So, we can get the psychological crisis state signal as shown in the following formula:

$$y(n) = s(n) + n(n),$$  \hspace{1cm} (1)

where $s(n)$ represents a useful signal of the psychological crisis state of college students.

Suppose $\Psi(t) \in L^2(R)$, its Fourier transform is $\psi(\omega)$, and the mother wavelet of wavelet transform is defined as follows:

$$C_\psi = \int_R |\psi'(\omega)|^2 |\omega| d\omega < \infty.$$  \hspace{1cm} (2)

Perform telescopic and translational operations on $\psi(t)$ to obtain

$$\psi_{a,b}(t) = \frac{1}{\sqrt{|a|}} \psi(t-b/a).$$  \hspace{1cm} (3)

The calculation formula of wavelet coefficient is

$$\omega_{j,k} = \int_{-\infty}^{\infty} y(n) \psi_{a,b}(n) dt = (f, \psi_{a,b}).$$  \hspace{1cm} (4)

Because of the different wavelet coefficients of useful college students’ psychological crisis state signals and noise and the value of the noise’s wavelet coefficients is relatively small, the hard threshold method is used to set the noise’s wavelet coefficient to 0, and then a noise-free psychology of college students can be obtained through reconstructing the crisis status signal. The hard threshold method can be described as

$$T_h(\omega_{j,k}, \delta) = \begin{cases} 
\omega_{j,k}, & |\omega_{j,k}| \geq \delta, \\
0, & |\omega_{j,k}| < \delta.
\end{cases}$$  \hspace{1cm} (5)

The kernel principal component analysis algorithm introduces the function $\Phi(x_k)$ to process the psychological crisis state signal data $x_k$ of college students to meet the following conditions:

$$\sum_{k=1}^{N} \Phi(x_k) = 0.$$  \hspace{1cm} (6)

The calculation formula of the covariance matrix $C_\Phi$ of the training dataset of the psychological crisis state of college students is

$$C_\Phi = \frac{1}{N} \sum_{k=1}^{N} \Phi(x_k) \Phi^T(x_k).$$  \hspace{1cm} (7)

Calculate the solution of the characteristic equation of college students’ psychological crisis state and get the value.

$$\lambda_i = C_\Phi \nu.$$  \hspace{1cm} (8)

According to the working principle of the kernel principal component analysis algorithm, $\nu$ in formula (8) can be expressed as a linear combination of $\Phi(x_1), \Phi(x_2), \ldots, \Phi(x_N)$.

$$\nu = \alpha_i \sum_{k=1}^{N} \Phi(x_k),$$  \hspace{1cm} (9)

where $\alpha_i (i = 1, 2, \ldots, N)$ is a constant.

When $K_{i,j} = \Phi^T(x_i) \Phi(x_j) = k(x_i, x_j)$, the equations are as follows:
Support vector machine is used here as a tool for data mining. The calculation formula of the support vector machine is shown below.

\[ f(x) = \omega \cdot \phi(x) + b, \]  

where \( \omega \) is the autoregressive coefficient and \( b \) is the error value.

Based on the structural risk minimization, we can obtain the following optimization equations.

\[
\begin{align*}
\min & \quad \frac{1}{2} |w|^2 + C \frac{1}{k} \sum_{i=1}^{N} \epsilon (f(x_i) - y_i), \\
\text{s.t.} & \quad \epsilon (f(x_i) - y_i) = \begin{cases} 
|f(x_i) - y_i| - \epsilon, & \quad |\omega \cdot \phi(x) + b - y_i| \geq \epsilon, \\
0, & \quad |\omega \cdot \phi(x) + b - y_i| < \epsilon.
\end{cases}
\end{align*}
\]

By slack variables \( \epsilon \) and \( \epsilon^* \), the learning process of the support vector machine is transformed into another form.

\[
\begin{align*}
\min & \quad \frac{1}{2} |w|^2 + C \sum_{i=1}^{j} (\xi_i + \xi_i^*), \\
\text{s.t.} & \quad \epsilon (f(x_i) - y_i) = \begin{cases} 
y_i - \omega \cdot \phi(x) - b \leq \epsilon + \xi_i, \xi_i \geq 0 \\
\omega \cdot \phi(x) + b - y_i \leq \epsilon + \xi_i^*, \xi_i^* \geq 0
\end{cases}, \quad i = 1, 2, \ldots, n.
\end{align*}
\]

Use the Lagrangian multipliers \( a_i \) and \( a_i^* \) to establish the dual form, and the specific equations are shown below.

\[
\begin{align*}
\min_{a_i, \alpha_i \in \mathbb{R}} & \quad \frac{1}{2} k \sum_{i=1}^{N} (a_i^* - a_i)(a_i^* - a_i) + \epsilon \sum_{i=1}^{n} (a_i^* + a_i) - \sum_{i=1}^{n} y_i (a_i^* + a_i).
\end{align*}
\]

The decision function of the support vector machine is

\[ f(x) = \sum_{i=1}^{n} (a_i - a_i^*) (\phi(X_i), \phi(X)) + b. \]  

4. Experiment and Results

To analyze the superiority of the method of identifying the mental crisis state of college students based on data mining, simulation tests are carried out. The platform for identifying the mental crisis state of college students is shown in Table 1.

On the same test platform, two comparison methods are selected for comparative test experiments. The specific design is as follows. (1) A single support vector machine method for identifying the psychological crisis state of college students directly extracts features from the psychological crisis state of college students, instead of denoising the signals of the psychological crisis state of college students. (2) The RBF neural network’s method of identifying the mental crisis state of college students uses wavelet analysis to denoise the college students’ mental crisis state signal and at the same time extracts the characteristics of college students’ mental crisis state from the denoised signal, but the modeling method uses RBF neural network. In order to reflect the fairness of the results of the college students’ psychological crisis state recognition experiment and increase the persuasiveness of the results, each method is subjected to 10 simulation experiments, and each experiment selects a different number of samples for simulation testing. Table 2 shows the distribution of sample data of the simulation experiment of college students’ psychological crisis state recognition.

To show the superiority of our method, here SVM and RBF neural network will be compared with our proposed algorithm. The number of training times is 50. From the
training loss and accuracy shown in Figure 1, our algorithm converges faster and is more stable. Judging from the test results of the test set in Figure 2, the prediction accuracy of our proposed algorithm is significantly higher than that of the other two algorithms.

We analyze the experimental results by using the recognition accuracy, false recognition rate, and rejection rate of college students’ psychological crisis state and count the results of each college student’s psychological crisis state recognition experiment. The recognition accuracy, false recognition rate, and rejection rate are shown in Figures 3–5, respectively.

From Figures 3–5, the recognition accuracy, false recognition rate, and rejection rate of college students’ psychological crisis state recognition can be seen. (1) The recognition accuracy, rejection rate, and absolute recognition rate of college students’ psychological crisis states are 84.13%, 8.38%, and 7.4%, respectively. It can be concluded that this method is not ideal for identifying the psychological crisis state of college students. This is because there is a lot of noise in the psychological crisis state signal of college students, and this method does not process the noise, which causes a certain interference to the feature extraction, which makes the recognition error rate of the psychological crisis state of college students relatively high. (2) The correct rate, false recognition rate, and rejection rate of RBF neural network for the recognition of the psychological crisis state of college students are 84.97%, 8.17%, and 6.86%, respectively. The recognition effect of the psychological crisis state of college students is not the best. This is because although this method performs noise processing on the psychological crisis signal of college students and eliminates the interference of noise, because the RBF neural network is a learning algorithm based on the principle of minimum experience risk, it is prone to “overfitting” or “under learning.” The correct rate of identifying the psychological crisis state of college students needs to be further improved. (3) The correct rate, false recognition rate, and rejection rate of college students’ psychological crisis state recognition by this method are 94.42%, 3.25%, and 2.33%, respectively. Compared with support vector machine and RBF neural network, the college students’ psychological crisis state recognition by this method shows that the correct rate increased by 10.29% and 9.45%, respectively. This is because the method in this paper first preprocesses the psychological crisis state signals of college students, extracts better identification features, and introduces the best support vector machine in the current data mining technology to simulate the change characteristics of the psychological crisis state of college students. Together, a better recognition model of college students’ psychological crisis state is established, which verifies the superiority of the method in this paper.

5. Discussion

Due to the continuous expansion of colleges and universities, there are more and more college students, which leads to higher requirements for the modeling speed of college students’ psychological crisis state identification methods. The modeling speed is mainly reflected by the modeling time. The modeling time mainly includes the training time and test time for the recognition of the psychological crisis state of college students. The statistical methods and the modeling time of each simulation experiment of the recognition of the psychological crisis state of college students are shown in Table 3.

Comparing the modeling time of college students’ mental crisis state recognition in Table 3, we can find that the average modeling time of college students’ mental crisis state recognition in this paper is 17.03 s, while the average modeling time of support vector machine and RBF neural
Figure 1: The results of training set about three methods. (a) Training loss of three methods. (b) Training accuracy of three methods.

Figure 2: The results of testing set about three methods. (a) Validation loss of three methods. (b) Validation accuracy of three methods.

Figure 3: Recognition accuracy.
network is 85.6 s and 28.37 s. It can be seen that the method in this paper shortens the time for identifying and modeling the mental crisis state of college students and increases the speed of identifying the mental crisis state of college students, which has higher practical application value.

6. Conclusion

The psychological crisis of students directly affects the mental health of students, and the research on it has very important value. In order to obtain the ideal results of identifying the mental crisis state of college students, this paper proposes a method of identifying the mental crisis state of college students based on data mining technology. The simulation experiment results of the recognition of the psychological crisis state of college students show that the method in this paper is a method of high accuracy which needs short modeling time for the recognition of the psychological crisis state of college students. The recognition results can provide important information for the psychological management personnel of college students. The psychological problem prevention platform can effectively evaluate the psychological characteristics of different college students and analyze the data of different college students to obtain different categories. The categories include college students meeting the standard of healthy psychology, college students having psychological problems, and college students needing psychological counseling. We match the psychological tutors that are most suitable for college students, use association rules to summarize several reasons for college students’ psychological problems and better guide the psychological state of college students, and finally store them in the database and analyze the differences between individual college students. Based on the analysis of college students’ tutors and psychological tests, it is very important to explore the laws of college students’ psychological trends and make positive guidance. The purpose of this platform is to provide college students with a real-time assessment of the psychological health of college students, a prevention and treatment platform. Currently, college students are in the golden stage of life and in the transitional period of life. Timely and appropriate psychological guidance is necessary, and good psychological quality is an important guarantee for them to enter society. It is hoped that the establishment of this platform will promote the prevention and treatment of psychological problems of university students and will actively guide the health and psychology of high-end talents in the society in the future.

Data Availability

The datasets used during the current study are available from the corresponding author upon reasonable request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

Acknowledgments

This study was supported by General Topic of Mental Health Education and Research Project in Colleges and Universities in Northern Jiangsu (SBXLKTYJ33013), Jiangsu Province Educational Science “13th Five-Year Plan” Project: The construction of innovation and entrepreneurship education
References

[1] V. Thakur and A. Jain, “COVID 2019-suicides: a global psychological pandemic,” Brain, Behavior, and Immunity, vol. 88, pp. 952-953, 2020.

[2] D. Gould, K. Dieffenbach, and A. Moffett, “Psychological characteristics and their development in Olympic champions,” Journal of Applied Sport Psychology, vol. 14, no. 3, pp. 172–204, 2002.

[3] L. Dalton, E. Rapa, and A. Stein, “Protecting the psychological health of children through effective communication about COVID-19,” The Lancet Child & Adolescent Health, vol. 4, no. 5, pp. 346-347, 2020.

[4] X. Jiang, L. Seng, Y. Zhu et al., “Psychological crisis intervention during the outbreak period of new coronavirus pneumonia from experience in Shanghai,” Psychiatry Research, vol. 286, Article ID 112903, 2020.

[5] Y. Zgueb, S. Bourgou, A. Neffeti et al., “Psychological crisis intervention response to the COVID 19 pandemic: a Tunisian centralised protocol,” Psychiatry Research, vol. 289, Article ID 113042, 2020.

[6] K. Zhong, P. Wang, J. Pei et al., “Multiobjective optimization regarding vehicles and power grids,” Wireless Communications and Mobile Computing, vol. 2021, Article ID 5552626, 6 pages, 2021.

[7] X. Liu, J. Zhang, S. Jiang et al., “Accurate localization of tagged objects using mobile RFID-augmented robots,” IEEE Transactions on Mobile Computing, vol. 20, no. 4, pp. 1273–1284, 2021.

[8] J. Su, Z. Sheng, A. Liu, Z. Fu, and Y. Chen, “A time and energy saving based frame adjustment strategy (TES-FAS) tag identification algorithm for UHF RFID systems,” IEEE Transactions on Wireless Communications, vol. 19, no. 5, pp. 2974–2986, 2020.

[9] J. Pei, “Big data mining in the control of epidemic,” Basic and Clinical Pharmacology and Toxicology, pp. 429-430, 2020.

[10] L. Dong and J. Bourey, “Public mental health crisis during COVID-19 pandemic, China,” Emerging Infectious Diseases, vol. 26, no. 7, p. 1616, 2020.

[11] D. Hong, L. Gao, J. Yao et al., “Graph convolutional networks for hyperspectral image classification,” IEEE Transactions on Geoscience and Remote Sensing, vol. 59, no. 7, 2020.

[12] D. Hong, N. Yokoya, J. Chanussot et al., “An augmented linear mixing model to address spectral variability for hyperspectral unmixing,” IEEE Transactions on Image Processing, vol. 28, no. 4, pp. 1923–1938, 2018.

[13] J. Pei, “Solving the problem of charging and discharging of electric vehicles based on particle swarm algorithm,” in Proceedings of the 2019 2nd International Conference on Information Systems and Computer Aided Education (ICISCAE), pp. 534–538, IEEE, Dalian, China, September 2019.

[14] J. Pei, J. Li, B. Zhou et al., “A recommendation algorithm about choosing travel means for urban residents in intelligent traffic system,” in Proceedings of the 2021 IEEE 5th Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), pp. 2553–2556, IEEE, Chongqing, China, March 2021.

[15] D. Hong, L. Gao, N. Yokoya et al., “More diverse means better: multimodal deep learning meets remote-sensing imagery classification,” IEEE Transactions on Geoscience and Remote Sensing, vol. 59, no. 5, pp. 4340–4354, 2021.