Research on the Improvement of Learning Effect of Mental Health Education Curriculum Based on Big Data

Yan Zhang(✉)

Xi'an Vocational and Technical College, Xi'an 710071, Shaanxi, China

Abstract. This paper studies the concept, process, method and technology of big data technology, introduces in detail the research on the improvement of the learning effect of big data technology in the students' mental health education course, uses big data technology to establish the students' psychological problem model in the algorithm, and gives the classification rules, so as to provide some useful reference for the psychological consultation work in Colleges and universities. The experimental results show that this method has a certain practical value for the construction of preventive mental health education mode for college students.

Keywords: Data · Mental health · Education curriculum

1 Introduction

Many schools have set up special institutions for mental health education, counseling or consultation to survey the mental health of freshmen, conduct relevant psychological tests on students one by one, and establish students' personal mental health files on this basis. However, since its establishment, many psychological counseling centers in Colleges and universities have been in the plight of shortage of psychological counseling staff and funds. In addition, although they have conducted a survey on the mental health of freshmen and accumulated a large amount of data, the processing of these data is still in the stage of traditional analysis and statistics. How to establish a scientific and efficient early warning mechanism for students' mental health is a severe challenge for the current mental health education in Colleges and universities [1]. One of the effective ways to solve the above problems is to use data mining technology to find out the hidden information from the existing college students' personal mental health archives database and provide support for the planning and decision-making of mental health education in Colleges and universities.

2 Introduction and Application of Data Mining Algorithm

Data mining (DM) is to extract knowledge that people are interested in from a large number of data. These knowledge are implicit, unknown and potentially useful information, and the extracted knowledge is expressed as concepts, rules, rules and other forms.

M. A. Jan and F. Khan (Eds.): BigIoT-EDU 2021, LNICST 392, pp. 301–310, 2021.
https://doi.org/10.1007/978-3-030-87903-7_38

The process of data mining is a human-computer interaction process which is composed of multiple steps connected and repeated. A complete data mining process generally includes data preparation, data mining, expression and interpretation of results. There are many methods and technologies of data mining, including decision tree method, neural network method, association rule method, genetic algorithm, statistical analysis method, visualization method, rough set theory method and fuzzy mathematics method. Among them, decision tree method is the most popular data mining technology [2–4]. Compared with other data mining methods, decision tree method has less computation, can process continuous and discrete data, and can generate understandable rules. The research content of this topic is to build decision tree with C4.5 algorithm. This paper forecasts the mental health status of college freshmen, finds out the most likely attributes to affect their mental health, so that the school can scientifically and effectively warn, intervene as soon as possible, and focus on prevention of students' mental health problems, so as to make the school's psychological counseling work more targeted and purposeful, and improve the level and efficiency of psychological counseling work.

3 Principle of C4.5 Algorithm

3.1 Principle of C4.5 Algorithm

There are ID3 algorithm and C4.5 algorithm in common use. The core idea of ID3 decision tree algorithm is to use the information principle to select the attribute with the largest information gain as the classification attribute, recursively expand the branches of the decision tree, and complete the construction of the decision tree. However, in practical application, the following problems exist in the information gain function of ID3. The more branches of the test attribute, the greater the information gain value [5]. However, the more branches of the output does not mean that the test attribute has a better prediction effect on the unknown objects [6]. Therefore, in C4.5 algorithm, people propose to use the information gain rate as the basis for the selection of test attributes. C4.5 algorithm is an improved ID3 algorithm, which is based on the following principles.

Definition 1: let S be a set of S data samples. Assuming that the class label attribute has m different values, m different classes are defined $C_i : (i = 1, 2 \ldots, m)$. Let s be the sample number of class C. Where p is the probability that any sample belongs to C and is estimated by s, s. For a given sample classification, the expected information is as follows:

$$I(S_i, S_2, \ldots, S_m) = -\sum_{i=1}^{m} \frac{S_i}{S} \log_2 \frac{S_i}{S} \tag{1}$$

Definition 2: the information gain of a is the expected entropy compression caused by knowing the value of attribute a, and the formula is:

$$Gain(A) = I(S_1, S_2, \ldots, S_m) \tag{2}$$

The main idea of C4.5 algorithm is: assuming t is the training set, when constructing the decision tree for T, the attribute with the largest gainratio (x) value is selected as the

splitting node, and t is divided into n subsets according to this standard. If the classes of tuples in the i-th subset T are consistent, the node becomes the leaf node of the decision tree and stops splitting [7, 8]. For other subsets of t that do not satisfy this condition, the spanning tree is recursively constructed according to the above method until the tuples of all subsets belong to one category.

3.2 Application of C4.5 Algorithm

When freshmen enter school every academic year, many colleges and universities will make a thorough investigation on the mental health status of students. Schools with a high degree of information have stored these data in the database of student management system. To find out the hidden information from the massive data of the existing college students' personal mental health archives database, so as to provide decision support for college mental health education [9]. For example, through the analysis of the students' mental health archives database system, we can find the main factors that affect students' psychological problems, provide the basis for the school to carry out the planning and decision-making of mental health education, and further explore the new methods of early prevention and intervention of students' psychological barriers. In this paper, C4.5 algorithm will be used to create a decision tree, the specific implementation plan is as follows.

4 Data Preprocessing

In general, the collected data is incomplete, harmless and noisy, so it is necessary to preprocess the data to improve the quality of data mining objects, which helps to improve the accuracy and performance of the mining process. Data preprocessing usually includes the following three steps.

4.1 Data Cleaning

In the data of students' psychological problems, some interesting attributes lack values, which can be filled by data cleaning. For a large number of vacant items, the method of ignoring tuples is used to delete them. For individual vacancies, the method of manual filling is used. The filling method uses most of the attribute values on the attribute to fill in the vacant attribute. After data cleaning, the total number of records is 960.

4.2 Data Extraction

Data extraction is sometimes referred to as data sampling or data simplification. It is based on the understanding of the discovery task and the content of the data itself, to find the characteristics of the expression data that depend on the discovery target, so as to reduce the size of the data, so as to minimize the amount of data on the premise of keeping the original data as much as possible (see Fig. 1).

In this paper, we extract the attributes that have a key impact on students' mental health from the database of College Students' psychological problems, and determine the four attributes of introversion, family harmony, family income and mental genetic disease to be mined respectively.

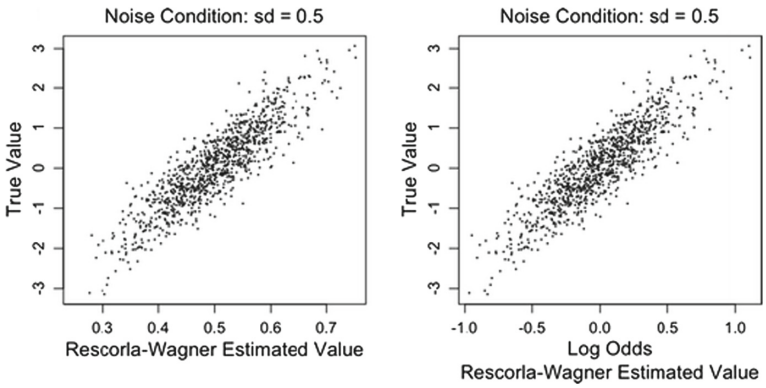

Fig. 1. Simulation with data extraction

4.3 Data Conversion

The purpose of data transformation is to transform the data information after data cleaning into a form suitable for mining, and establish a real analysis model suitable for mining algorithm. For example [10–15]. The "family income" field in mental health database was originally a continuous value. When data mining, this attribute must be transformed into a discrete value (the attribute name is changed to "economic difficulty", and the value is yes or no) to be suitable for classification mining task.

After data preprocessing, there are 960 student records. In order to evaluate and predict the decision tree model, 1/3 of the records are reserved as test data, and 2/3 of the record data are reserved as the training set of decision tree model, with a total of 640 records.

4.4 Building Decision Tree

The training set is taken as an example to illustrate the generation of decision tree model of students' mental illness. The steps of C4.5 algorithm to establish decision tree model are as follows: (1) calculate the information gain rate of each test attribute in Table 2; (2) select the attribute with the largest information gain rate as the root node, and divide the data set according to its value, if the attribute has only one value, stop dividing; (3) recursively execute (1)–(2) for each sub data set. According to the above formula, calculate the information gain rate of each test attribute, select the attribute with the largest information gain rate from the calculation results as the root node, divide the sample, lead to multiple branches, then calculate the division of each branch node, repeat the above steps, complete the division of each branch (see Fig. 2).

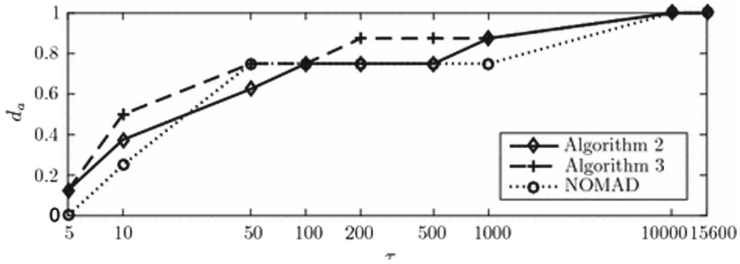

Fig. 2. Simulation of decision tree

5 Enhance the Understanding of College Students on the Course of Mental Health Education

Changing the traditional ideas is the key to let students accept new things independently. For college students' mental health education, it is a new teaching task with the development of society and economy, and it is a new teaching field. In order to promote the further development of this teaching interaction, the premise is to actively change the traditional teaching ideas of teachers and students. In this regard, we should do the following: first, we should fully understand the significance of College Students' mental health education [16]. For the teaching of College Students' mental health education, it is not only the transmission of students' knowledge, but also a new teaching concept. It is a teaching belief integrated with a variety of teaching tasks. It is a teaching content constructed by different types of teaching activities. Therefore, this kind of teaching activity is a new discipline different from the traditional teaching methods. The realization of College Students' mental health education course is not only aimed at the students with psychological problems or the students with psychological obstacles, but also in the face of the majority of teachers and students in the school. At the same time of obstacle prevention, it is to optimize students' psychology and use advanced teaching mode, so as to steadily improve students' overall psychological quality and make them face the challenges of life with a more positive attitude.

6 Building a Strong Team of Mental Health Education Teachers

For the study of this subject, its main purpose is not only to let students master a lot of theoretical knowledge, but also to cultivate students' comprehensive psychological quality. Mental health education course is a special course which is different from other professional disciplines. It is different from other courses. Specifically, its curriculum planning and activity organization are relatively special. For example, in the arrangement of psychological courses, the school generally chooses the compulsory course mode for the students to study the theory of psychology and discuss the psychological problems in the classroom. For a small number of students with special circumstances, it can adopt the mode of elective courses or organize psychological lectures to popularize psychological knowledge [17–19]. As far as the teaching content of psychological course is concerned, its main body is to focus on students' psychological needs and learning

interest, integrate the psychological template with the characteristics of the times, further approach students' life practice, use the teaching method with scientific interest, set up interesting psychological education courses, and attract students to actively participate in psychological learning. For the mode of psychological classroom, it should establish diversified classroom teaching, effectively combine psychological theory with psychological cases, reappear psychological accident cases in the course teaching, and arouse students' thinking, so as to better mobilize students' independent participation. At the same time, the formation of a large team of psychological teaching teachers to help the orderly development of psychological teaching tasks, on the current situation of psychological teaching, the completion of the teaching task of psychological teachers put forward strict requirements, so do a good job in Teachers' psychological course guidance, the establishment of University Teachers' psychological qualification certification system, can better promote the development of their work.

7 Establishing an Integrated Curriculum System of College Students' Mental Health

7.1 Effective Coordination of the Relationship Between Mental Health Education Curriculum and Psychological Counseling

Science and health education course is the popularization of psychological knowledge for all teachers and students in Colleges and universities, while psychological consultation is the psychological adjustment for different students. Through the effective combination of the two, we can integrate their psychological theory into the specific practice and build a unified whole. In short, teachers should strengthen the psychological education of students in the course task, guide students to establish a new understanding of psychological counseling, change the old ideas, and understand that psychological counseling is not only aimed at people with psychological diseases [20]. Let students redefine psychological counseling and get out of their own misunderstanding of psychological counseling.

7.2 Optimizing the Relationship Between Mental Health Education and Moral Education Curriculum

Most of the objects of psychological education courses in Colleges and universities are school students, whose main goal is to educate talents, while the development of school moral education courses is to cultivate students' all-round development ability as the theme, and their goals are the same. On this basis, the Education Department of our country has made a distinction between mental health and moral education curriculum. As far as moral education is concerned, it is mainly to effectively distinguish right from wrong in the ideological field, so as to improve the ideological understanding to a certain extent. As far as mental health education is concerned, it is mainly to strengthen students' psychological construction, while excavating students' psychological potential, To help students develop in a positive and healthy way.

7.3 Perfect the Relationship Between Mental Health and Ideological and Political Education

College Students' mental health curriculum is not equal to ideological and political education. They have essential differences and cannot be replaced by each other. However, they can integrate with each other through their own common points. First, promote the complementary advantages of the two. Through daily study, strengthen the ideological and political education of students, promote students to establish a correct outlook on life, world outlook, realize their life value. On this basis, through a series of Ideological and political teaching, it will be integrated into the students' psychological education, and guide the students to go out of the psychological misunderstanding independently. Second, optimize the psychological feedback system. We should build a bridge between the psychological education department and other colleges and universities, and exchange the psychological problems of modern college students in their mutual communication. Third, increase the mutual complement of education team [21]. We should give full play to the key role of the student management team in mental health education, increase the dialogue between students and teachers, popularize psychological knowledge to them, and increase the accumulation of their mental health awareness, so as to help them shape good psychological quality.

8 Carrying Out Teaching Reform and Innovating Teaching Mode

8.1 Case Study Method

The development of mental health education curriculum can not only teach students a lot of psychological knowledge, but also help students adjust their mental state and optimize their psychological quality in life. Therefore, if teachers only teach psychological theory knowledge in mental health education, they should further enhance their psychological adjustment ability on this basis. In this regard, teachers should focus on grasping the students' psychological situation, collect the common psychological problems in students' daily life, and put them into a book for students' reference. The third line is shown in the Fig. 3. While attracting students' heated discussion, teachers should teach students' psychological adjustment function. It should be noted that when teachers choose teaching cases, they should pay attention to the actual control of the cases, arouse students' resonance, and use the most representative psychological cases to actively participate in the mental health education curriculum.

8.2 Action Training Method

With the development of mental health education curriculum, the behavior training method can promote the change of students' cognition to a certain extent, use specific behavior patterns, constantly optimize students' behavior mechanism, and effectively correct students' bad behavior in psychological teaching. For example, in real life, some students do not dare to express their opinions, can not control their emotional problems, and finally make it unable to adjust the interpersonal relationship around them. In this regard, teachers can enhance students' confidence in the psychological teaching course,

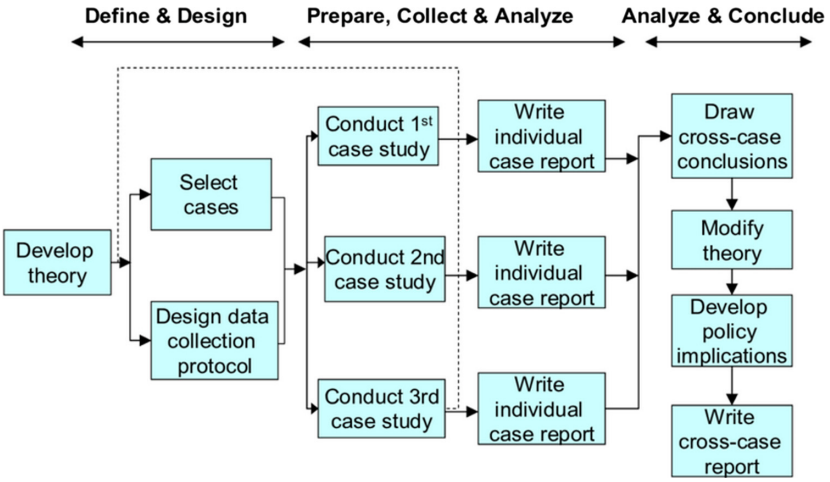

Fig. 3. Action training method

and optimize their behavior awareness through behavior training method. Specifically, organize the students to be divided into two groups, one is the opposite party, the other is the opposite party [22–24]. The teacher can encourage the other group of students who are not confident to learn to refuse, to express their own ideas, and to establish their own unique personality while letting others understand themselves.

9 Concluding Remarks

This paper mainly introduces the decision tree technology in data mining, and introduces the whole process of C4.5 algorithm mining in college students' psychological education. The data comes from the psychological test of 2010 freshmen in my college. Before data mining, data cleaning, extraction, conversion and other data preprocessing are carried out to lay a good foundation for further mining work. In the process of building the decision tree model, C4.5 algorithm is used. The algorithm recursively selects the attribute with the maximum information gain rate as the test attribute, and finally generates the decision tree model of whether the students have psychological diseases, and thus generates easy to understand classification rules, which provides some useful reference for the school's psychological counseling work. The follow-up work of this topic is to find out more attributes that are highly related to students' mental health. Using other mining algorithms (such as neural network, genetic algorithm) to further improve the prediction accuracy.

References

1. Wang, Y.: Practice of "teaching learning doing" mode in college students' mental health education. J. Beijing Print. Univ. **28**(12), 149–152 (2020)

2. Chang, E.: Research on teaching design of mental health education in secondary vocational schools. Mod. Vocat. Educ. **02**, 86–87 (2021)
3. Zhu, S.: The status quo and thinking of mental health education in primary and secondary schools – based on the investigation and analysis report of the status quo of mental health education in primary and secondary schools. Mental Health Educ. Prim. Second. Schools **36**, 4–10+14 (2020)
4. Ma, S.: Research on classroom teaching mode of college students' mental health education. J. Anhui Vocat. Coll. Electron. Inform. Technol. **19**(06), 73–75 (2020)
5. Ding, G.: Research on the Implementation Difficulties and Countermeasures of Mental Health Education Curriculum in Urban High Schools. Henan Normal University (2016)
6. Wang, J., Wang, X., Chen, D., Zhang, D.: Application of experiential teaching in college students' mental health education. China Med. Educ. Technol. **30**(02), 129–131 (2016)
7. Xu, R., Song, C.: Application of teaching mode under constructivism learning theory in college students' mental health education. West. Leather **38**(06), 284–285 (2016)
8. Qian, J.: Enlightenment of MOOC teaching on teaching reform of college students' mental health education. J Qiqihar Teachers Coll. **02**, 130–132 (2016)
9. Guo, Y.: Some ideas on the rational use of experiential learning method in university mental health curriculum. J. Jiamusi Vocat. Coll. **01**, 189–190 (2016)
10. Wan, R., Lan, W.: Classroom teaching experiment based on the learning needs of College Students – taking the course "mental health education for college students" as an example. J. Guizhou Normal Univ. (Nat. Sci. Ed.) **33**(06), 47–50 (2015)
11. Liang, P.: Exploration and practice of mental health education curriculum reform in secondary vocational schools. Curriculum Educ. Res. **35**, 237–238 (2015)
12. Qi, X.: Research on the development of mental health education curriculum in kindergartens in Shijiazhuang. Hebei Normal University (2015)
13. Pu, X., Zou, T.: Enlightenment of American social emotional learning on the construction of mental health education curriculum for college students in China. J. High. Educ. **20**, 21–23 (2015)
14. Wu, M.: Teaching research on mental health course in higher vocational colleges from the perspective of students' subjectivity. China Adult Educ. **16**, 147–149 (2015)
15. Hu, Y., Zhao, B.: Analysis of mental health status of higher vocational students and countermeasures. Acad. Theory **24**, 66–68 (2015)
16. Zhang, J.: Research and practice of social emotional learning curriculum in the United States. Development Psychology Committee of Chinese Psychological Society. Abstracts of the 13th Annual Conference of Development Psychology Committee of Chinese Psychological Society. Development Psychology Committee of Chinese Psychological Society: School of psychology, Department of education, Northeast Normal University 1 (2015)
17. Liao, X.: Development and practice of mental health education curriculum in junior middle school. Central China Normal University (2015)
18. Liu, K.: The current situation and reflection of mental health curriculum in Colleges and universities from the perspective of subjectivity education. Sci. Educ. Wenhui (Next Issue) **06**, 136–137 (2015)
19. Peng, Z.: Research on network curriculum design under the concept of blended learning. Shanghai Normal University (2015)
20. Chen, Y.: Exploration and practice of college students' mental health education curriculum reform. Xueyuan **17**, 65–66 (2015)
21. Lei, J.: Exploration of practicing "experiential learning" in "mental health education" course of secondary vocational school. Sci. Educ. Literat. Collect. (Next Issue) **05**, 101–102 (2015)

22. Zhang, X.: A road worth exploring: research learning practice of mental health education and color curriculum in secondary vocational schools. Jilin Educ. **10**, 149 (2015)
23. Liu, S.: Beauty education lays the foundation for a beautiful life. Future Educ. **z1**, 124 (2015)
24. Meng, R.: Exploring a new way to implement mental health education curriculum in Colleges and universities MOOC. Asia Pac. Educ. **07**, 126+124 (2015)