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# ORIGINAL

# PSYCHOLOGICAL ADJUSTMENT OF COLLEGE COMMUNITY SPORTS STUDENTS THROUGH BIG DATA MODELING

**Jing Wang[1], Ying Xu[2*]**

[1] Northeast Normal University School of Physical Education, Changchun City, Jilin Province, 130024, China
[2] Physical Education Teaching and Research Department of Jilin University of Finance and Economics, Changchun City, Jilin Province, 130117, China
**E-mail:** x19390017521@126.com

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## ABSTRACT

College sports students often face unique challenges, including high-pressure competition, academic demands, and social dynamics. Effective psychological adjustment is essential for coping with these stresses and achieving personal and athletic goals. This paper analyzes the possible psychological situation of college students and puts forward how physical education teachers can help students adjust their psychology. According to the intelligent needs of college sports students' psychological state assessment, the convolution results are de-linearized by activation function, and then pooled to improve the nonlinear fitting ability of the network. Use CNN_RNN (Convective Neural Network-Recurrent Neural Network) of DL (Deep learning) to extract text information, and make the model pay attention to the content related to the use of metaphor in the text through the mechanism of metaphorical attention. The results show that the prediction effect of single factor is far lower than that of core factor set, and the prediction accuracy of core factor set can reach over 90%. The experimental results show that the algorithm has certain advantages in predicting the user tasks of MH problem. It can provide theoretical guidance for physical education teachers to help students adjust their psychology.

**KEYWORDS:** Sports Students, Psychological Adjustment, Mental Health, Big Data

## 1. INTRODUCTION

As the new generation of college sports students in the future of our country, in the face of sudden crisis events, because college sports students are still in a mature period of psychological development, facing the pressures of study, college sports students are more likely to breed negative psychological emotions, such as depression, anxiety and stress, which will even affect their health in severe cases. Existing research shows that individuals are prone to negative emotions when faced with threats, especially college sports students who are in early adulthood and rarely experience major life events (Yusoff, 2012), and it is easier to have resonance phenomenon between bad psychology and behavior (Garriott et al., 2010). Due to the high density of school crowds, the tense situation will be more severe, so college sports students can't go to school normally, keep normal communication with the outside world, and carry out outdoor activities normally. They can only learn at home by online classes, which brings great pressure and burden to sports students' body and mind. State of mind plays a dominant role in people's behavior, and it can affect learners' learning will and efficiency in learning activities. A healthy mental state is the premise and guarantee for learners to form rigorous logical thinking and carry out creative activities (Chen & Tse, 2010; Rohner et al., 2010). Bergin et al. confirmed psychological entitlement's state and variability influenced by the situation through experiments (Bergin & Pakenham, 2016), which broke the previous research that psychological entitlement was regarded as a stable personality trait. Rohner et al. show that there is a high negative correlation between implicit narcissism and college sports students' pro-social behaviors such as helping or comforting (Rohner et al., 2008). Hirai et al. think that the development of an individual is influenced by many ecological subsystems such as family, school and peers (Hirai et al., 2015). Therefore, the stressors of college sports students mainly come from study pressure, autonomy and independence pressure, family and economic pressure, future pressure (employment pressure), social and interpersonal pressure, heterosexual pressure, major and sudden pressure, etc. Haj-Yahia et al. found that college sports students' coping style can significantly and positively predict MH(mental health) level (Haj-Yahia & Bargal, 2015). A cross-sectional study by Mollaei et al. on the coping styles of domestic college sports students in the past 15 years found that college sports students are increasingly inclined to adopt positive coping styles (Mollaei et al., 2012). In the teaching process, physical education teachers' good personality and psychological characteristics are conducive to creating a lively classroom atmosphere, which provides necessary conditions for sports students to master knowledge, technology and skills, and also provides an opportunity for teachers and sports students to interact with each other. The process of psychological adjustment is to coordinate emotions with cognition and behavior, so that emotions can reach a well-adapted, flexible, effective and manageable state in terms of physiological activation, subjective experience and expressive behavior.

Moreover, psychological adjustment helps to promote task-oriented behavior and cognitive activities, improve homework performance, and make human function reach the best shape. According to many current surveys, most college sports students' psychology is healthy, but this does not mean that the MH problem can be ignored. In practical work, it is of great significance to judge the psychological crisis of college sports students for effective intervention. Constructing the prediction model of college sports students' MH prevention and control period is conducive to the psychological counseling of college sports students' prevention and control period.

## 2. Related Work

### 2.1 Research on Students' Psychological Adjustment

Iturbide et al. think that physical education teaching mode is a strategy and way of physical education teaching activities in which a certain teaching idea of physical education becomes regular, which includes relatively stable teaching groups and teaching materials, relatively unique teaching process and corresponding teaching method system (Iturbide et al., 2009). Li et al. believe that psychological adjustment is the ability to flexibly respond to a series of emotional (both positive and negative) development requirements in a socially tolerable way, and the ability to delay the response when needed (Li & Yu, 2021). Pugsley pointed out that psychological adjustment is an activity that serves personal purposes and is beneficial to one's own survival and development (Pugsley, 2016).

Bernhardsdottir et al. set up multiple modules, integrated the theory of regulation mechanism, highlighted the social aspects of exercise prescription, and studied the biological factors, cognitive factors and socialization factors related to physical exercise and psychological regulation as independent variables, which is the key problem to be solved in the future research in this field (Bernhardsdottir et al., 2013). Huepe et al. found that emotion and cognitive system are two subsystems in the process of information processing. All information processing processes contain emotional components, and information processing without emotion does not exist. Positive or negative emotions are closely related to the efficiency of information processing (Huepe et al., 2011). Psychological adjustment is closely related to people's physical and mental health. In fact, the defect degree of psychological adjustment ability has become an important index for the diagnosis of many physical and mental diseases. Gallea et al. believe that psychological adjustment is a psychological process to regulate which emotions an individual has, when he has emotions, how he experiences or expresses emotions, etc. It can be either explicit or implicit (Gallea et al., 2021). It is found that adjusting the relationship between external and objective things and internal needs and expectations, or adjusting the cognitive evaluation of their relationship, will affect the individual's emotional

experience and reaction.

### 2.2 MH Education for College Students

The significance of mental health (MH) education for college students in China is growing increasingly recognized. In response, educational authorities at various levels have implemented numerous initiatives to enhance MH education among college students. Through a variety of assessment strategies, the importance of MH education in student management and quality education has been underscored. Chen and colleagues employed fuzzy clustering analysis to delve into the mental health of college students, examining the patterns and characteristics of their mental health and the behavioral traits of students with psychological disorders. By fuzzy clustering, they unearthed various potential correlations within psychological test data, providing a scientific foundation for the establishment and refinement of early prevention and intervention measures for student psychological disorders in higher education institutions (Chen et al., 2013). Ilhan and team utilized random forest models and logistic regression to explore the psychological status of college students and its influencing factors, offering suggestions based on their analysis (Ilhan et al., 2014).

Bech introduced an ecological method for real-time sampling and measurement of subjects' behaviors and experiences in their natural environment, which is highly authentic and dynamic, and can more accurately reflect the psychological characteristics of the subjects (Bech, 2010). Monahan and colleagues proposed an automatic evaluation method for college students' mental health based on the fusion of multimodal data calculations (Monahan et al., 2011). López and team applied the hidden Markov model to predict psychological crises among college students. After analyzing the factors affecting college students' mental health, they established a core factor set using vague set theory, determined the observable sequence set, constructed the hidden Markov model, trained the model parameters, and applied the trained model to predict psychological crises (López et al., 2013). These approaches demonstrate a commitment to advancing the understanding and management of mental health issues among college students, leveraging diverse methodologies to provide comprehensive insights and support.

## 3. Research Method

### 3.1 Automatic Evaluation Model of MH for College Sports Students

The psychological positive factors and negative factors of contemporary college sports students in China coexist, and they are in the process of rapidly maturing. However, many aspects, such as mental development, are still immature, and some aspects are relatively fragile and have strong plasticity.

For everything in the world, different people have different mental changes, different attitudes, motivations and beliefs, and different mental activities of memory and perception for different people. The task of psychology is to study the different psychology of different people, master the rules of psychological behavior, and guide practical activities efficiently, so as to achieve the goal of physical and mental health. Tailoring to the distinct personality traits of individual students, it is essential to conduct a precise analysis and understanding of the psychological fluctuations of college athletes at various developmental stages. Providing mental health (MH) counseling for college athletes should reflect an interactive process, respecting their agency and fostering their personal potential and growth. Through MH education, the goal is to facilitate holistic development, achieving a harmonious and optimal MH educational model. MH is characterized by a balanced operation of an individual's psychological functions. Anxiety and depression are among the most prevalent abnormalities in MH (Garriott et al., 2010). College athletes, who are at a transitional phase between campus life and society, often face multifaceted pressures, making them susceptible to a range of psychological issues, with depression being notably common (Monahan et al., 2011). To effectively utilizes assessment data and enhance the detection rate of psychological issues among college athletes, it is imperative to develop a more scientific model for recognizing MH states.

Uncovering the psychological state and emotional attitudes of individuals when they engage in content creation is crucial for accurately determining MH status (López et al., 2013). This study introduces artificial intelligence algorithms to deeply investigate the evaluation and early warning models for psychological states, utilizing text resources from internal university forums. The Fuzzy C-Means (FCM) algorithm incorporates the theory of information diffusion and the concept of class merging. It introduces attribute weighting parameters to identify the varying influence of each attribute, reflecting their impact on clustering outcomes. This approach allows the initial cluster positions to continually adjust, moving closer to the actual centroid, thereby enhancing the precision of the final clustering results. By applying such algorithms, the accuracy in identifying and addressing the MH needs of college athletes can be significantly improved, contributing to a more effective MH education framework.

If $\omega_j$ is used to represent the weight of the $j$th attribute, and $\sum_{j=1}^{s} \omega_j = 1$ is satisfied. Then the objective function of the improved FCM algorithm can be defined as:

$$J(u, v, \omega) = \sum_{i=1}^{c} \sum_{k=1}^{n} \sum_{j}^{s} u_{ik}^{m} \omega_j^{\beta} \left(x_{kj} - v_{ij}\right)^2 \quad (1)$$

Where, $c$ is the number of clusters, $s$ indicates that the data object has

$s$ -dimensional attributes, and $\beta$ indicates the weight index. CNN (Convolutional Neural Network) can accurately calculate sports students' psychological feelings when publishing images only by learning a large number of parameters and effective features.

When training CNN, this study releases the weight of the fifth convolution block of VGG to learn the expression of image emotion, which can not only make the network structure more suitable for calculating image emotion, but also avoid the risk of over-fitting. The emotional tendency value of the image can be obtained through dense connection layer integration and softmax classification, and the specific calculation is as follows:

$$S(V_i) = \frac{exp(V_i)}{\sum_{j=1}^{n} exp(V_j)} \tag{2}$$

Where, $\boldsymbol{V_i}$ refers to the $\boldsymbol{i}$th category element of the output vector of the dense connection layer, $\boldsymbol{S(V_i)}$ is the $\boldsymbol{i}$th category emotional probability value of the image, and $\boldsymbol{n}$ represents positive and negative emotional categories. With a certain distribution information, the grey number described by the whitening weight function can be used to describe the "preference" degree of different values within its value range. Let the weight of $j$ index $k$ subclass be $z_j$, and the formula

(3) is the grey weighted clustering coefficient of object $\boldsymbol{i}$ belonging to grey class $k$.

$$\sigma_i^k = \sum_{j=1}^{m} f_j^k \left(x_{ij}\right) z_j \tag{3}$$

The whole connection layer is used to connect the eigenvalues obtained after all convolution and pooling operations, and take them as the final eigenvectors representing the text information. The calculation in the full connection layer is as follows:

$$\vec{F} = \sum_{i=1}^{n-h+1} \left(w \cdot \vec{G}_i + \vec{b}_i\right) \tag{4}$$

$$\text{softmax}\,(x) = \frac{e^x}{\sum_{k=1}^{K} e^x} \tag{5}$$

Where $\boldsymbol{F}$ is the original feature information obtained after full connection, and $\boldsymbol{y}$ is the final classification result. Multi-modal data are fused by the maximum rule, and sports students' psychological changes in a specific time period are considered by CNN algorithm, so as to accurately evaluate the individual MH grade. The process of MH evaluation model is shown in Figure 1.

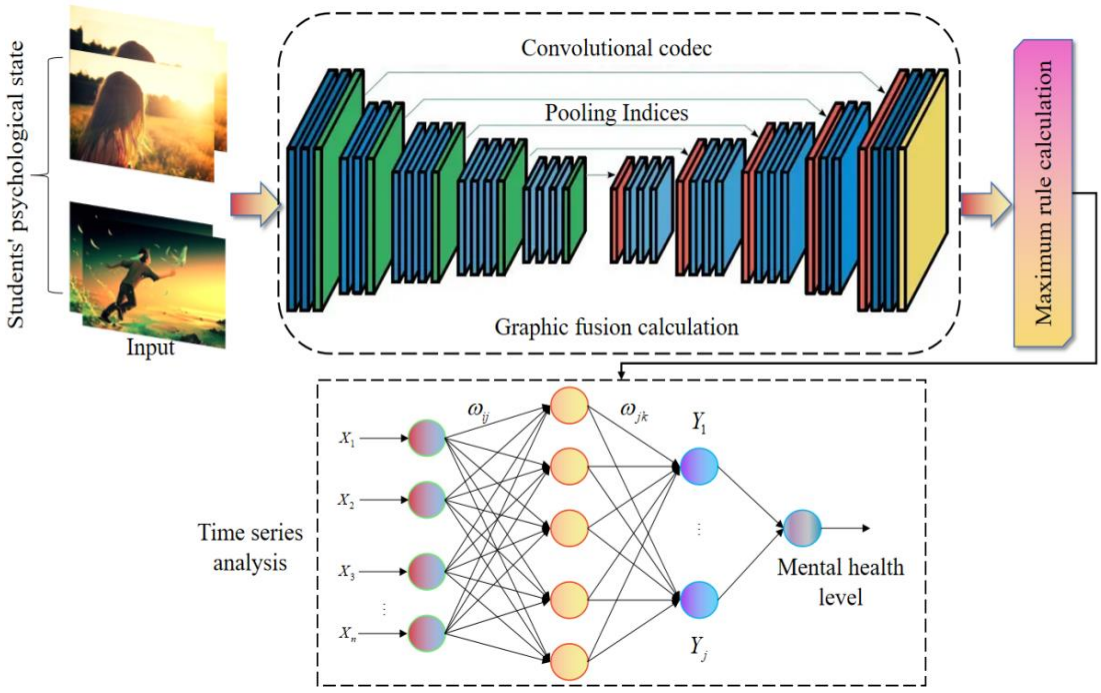


**Figure 1:** MH evaluation model process

Teachers teach sports students in accordance with their aptitude according to their specific situations, practice sports students in groups, and draw up reasonable teaching plans and tutorials. Do not cling to the achievement standards, keep the competition and pressure within the acceptable range, pay attention to sports students' psychological feelings, so that sports students will not have no motivation due to repeated frustration in class, and let sports students learn in a relaxed and pleasant atmosphere and make continuous progress (Hirai et al., 2015).

### 3.2 Prediction of College Sports Students' Psychological Crisis

MH text data set is the basis of all prediction algorithms, and it needs a lot of text data related to the author's psychological state as scientific research support. These texts are difficult and costly to obtain, and the lack of resources has always been one of the bottlenecks restricting the development of related research. From the research point of view, the task of psychological problem prediction belongs to the downstream task of text classification research and application. The effective machine learning and DL (Deep learning) algorithms, features and models in text classification are also applied to MH text classification. In this paper, CNN _ RNN (Convective Neural Network-Recurrent Neural Network) structure is used to optimize the processing of long texts, and the attention mechanism is used to capture the text information related to metaphors in the texts, paying attention to the differences in metaphor use of patients, so as to realize the text classification of MH problems. The task flow of MH prediction is shown in Figure 2 below.

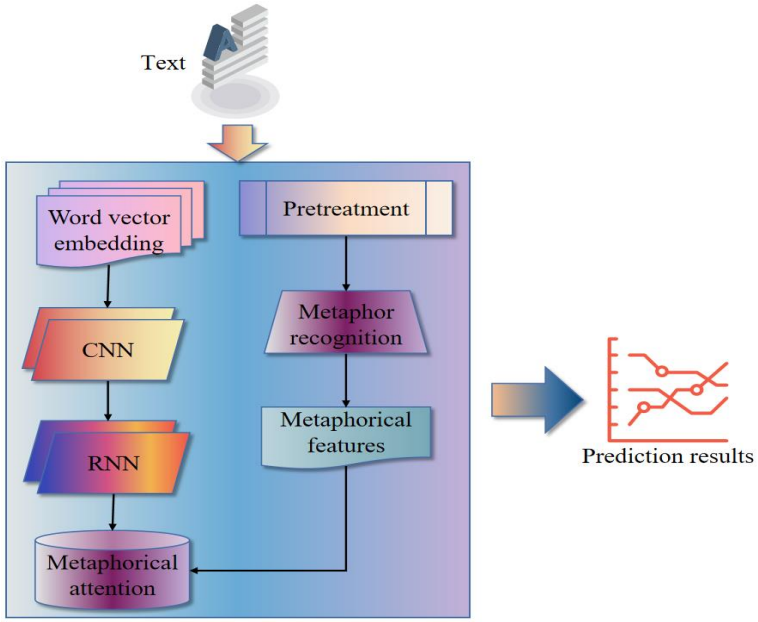


**Figure 2:** MH forecast process

The input of the task is the large-scale social text data provided by social media users, and after preprocessing, it is introduced into the text classification algorithm based on metaphorical attention mechanism to predict users' MH status. Attention module, capturing and utilizing textual metaphorical information. Make the model pay attention to the text content related to the use of metaphor and use metaphor information to improve the effect of text classification. In the process of sample clustering, with the increasing number of classes, the transition value of sample information bribe will change correspondingly. The main idea of class merging is: first, combine adjacent classes pairwise to form small class pairs, then judge whether small class pairs can be merged by evaluation function, and then observe whether small class pairs are evenly distributed. Set the small class pair to have $n$sample points, divide it into $c$ segments, and each segment has $d$ points, so that each segment has $d = n/c$ points on average:

$$f = \sum_{x=1}^{c}(d_x - d) \tag{6}$$

The median value of a set of sample points is $c * d/2$, if $f \leq (c * d/2)$, the two small classes can be merged, otherwise, they cannot be merged. The input of each sentence is a matrix of m*400, and $m$ represents the number of words in the sentence. Convolution kernel $k$ scans the contents of $x_{i:i+h-1}$ in the matrix with $h$ -sized window and generates corresponding eigenvalues. Convolution operation is shown in the following formula:

$$c_{ki} = f(w_k \cdot x_{i:i+h-1} + b_k) \tag{7}$$

$$c_k = ave\_pool([c_{k1}, c_{k2}, \cdots, c_{k(m-h+1)}]) \tag{8}$$

$$c_j = (c_1, c_2, \cdots, c_k) \tag{9}$$

Here, $x_{i:i+h-1}$ represents the window with the size of h*400 from row $i$ to row $i+h-1$ in the input matrix. $w_k$ represents the weight matrix, $b$ represents the deviation of convolution operation, and $f$ represents the activation function. Metaphor features include sentence-level metaphorical feature vectors and document-level metaphorical feature vectors, which together complete attention calculation based on metaphorical features. Attention makes the model pay more attention to the text sentences that have certain characteristics in the use of metaphor, or use or discard them. In the attention mechanism, document metaphor vector and sentence metaphor vector are the calculation benchmarks. The final text vector $r$ is connected with the output layer to output the classification label:

$$p(lab|r,t) = \sigma(W_r \cdot [r,t] + b_r) \tag{10}$$

$lab$ represents sample label, 0 represents healthy control, and 1 represents positive sample. $W_r, b_r$ is the weight and offset of the output layer.

## 4. Result Analysis

This experiment disregards temporal segmentation. To augment the dataset's scale, the subsequent ten grouped data entries for each user are segmented into ten distinct samples sharing the same label. This process, while increasing the sample count, reduces the text size of an individual sample, consequently enhancing the complexity of sample prediction. To substantiate the efficacy of the proposed multi-modal data fusion computation model, a comparative experiment was conducted. The data distributions for the text sentiment computation model and the image sentiment computation model were fairly evenly spread, and the general evaluation index was selected to evaluate the model effect to analyze the precision rate, recall rate and F value. See Table 1 for the results.

**Table 1:** Emotional calculation results

| MODEL | PRECISION (%) | RECALL (%) | F VALUE (%) |
|---|---|---|---|
| **(GALLEA ET AL., 2021)** | 88.3 | 87.5 | 89.3 |
| **(CHEN ET AL., 2013)** | 70.1 | 71.3 | 71.2 |
| **(ILHAN ET AL., 2014)** | 89.6 | 86.9 | 87.4 |
| **MODEL OF THIS PAPER** | 91.5 | 88.7 | 90.3 |

The results indicate that the emotional computation outcomes from the multi-modal fusion of graphics and text outperform those derived from a single modality. Specifically, the accuracy of the fusion computation methods, which use mean and maximum rules, is approximately 2.3% higher than that of the single text mode. This demonstrates that incorporating the image modality in

addition to the text modality can effectively address the deficiency of emotional information present in single-modal data. Multi-modal data has the capability to resolve the ambiguity in expressions and successfully capture the genuine emotional tendencies of student-athletes when they post self-reported content. The fusion of multi-modal emotion computation models is beneficial for accurately identifying the emotions of student-athletes. In determining the optimal number of iterations for the model, it's important to consider that the dataset used in this study includes a limited number of manually labeled samples. Excessive iterations may lead to overfitting in the Convolutional Neural Network (CNN); conversely, too few iterations could result in a model that does not meet accuracy requirements. Figure 3 illustrates the model accuracy for various iteration counts in both the training and validation datasets. This visualization aids in striking a balance between underfitting and overfitting, ensuring that the model generalizes well to new, unseen data while maintaining high accuracy.

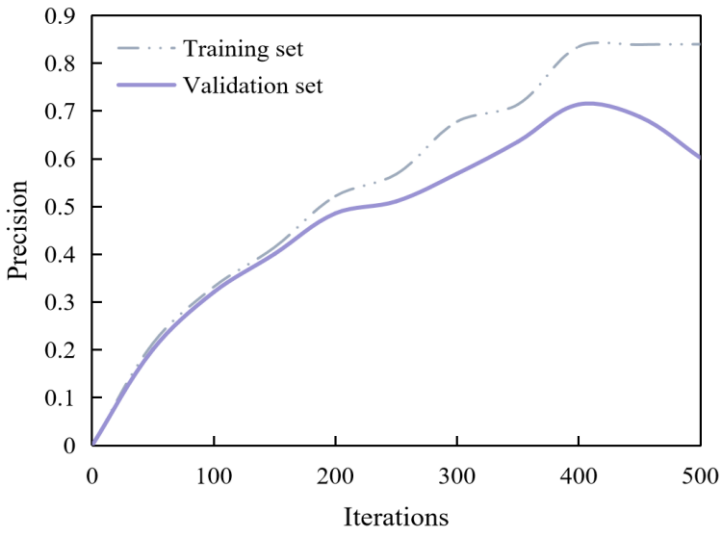


**Figure 3:** Relationship between iteration times and accuracy

It is observed that when the training set undergoes a low number of iterations, there is a high consistency in accuracy between the verification set and the training set, but the overall model accuracy is low. Conversely, increasing the number of iterations improves the accuracy of the training set model. However, this leads to a significant disparity in accuracy between the verification set and the training set, indicating a potential over-fitting of the model. To strike a balance between achieving high model accuracy and avoiding over-fitting, the paper has chosen an iteration count of 300 for the model. To further assess the model's effectiveness in identifying the psychological states of college sports students, a comparative experiment utilizing the Fast Text model was conducted in this study. Two common metrics used in machine learning classification tasks—F1 score and classification accuracy—were employed as the benchmarks to evaluate the model's

performance. The comparative test results for both models are presented in Table 2, providing a clear evaluation of their respective capabilities in predicting the mental states of student-athletes.

**Table 2:** Model calculation results

| MODEL | PARAMETER NAME | F1 | CLASSIFICATION ACCURACY |
|---|---|---|---|
| FASTTEXT | Cognitive ability | 0.33 | 0.16 |
| | Social support | 0.81 | 0.73 |
| | Positive emotion | 0.77 | 0.82 |
| | Full sample | 0.41 | 0.66 |
| MODEL OF THIS PAPER | Cognitive ability | 0.36 | 0.41 |
| | Social support | 0.89 | 0.88 |
| | Positive emotion | 0.93 | 0.86 |
| | Full sample | 0.55 | 0.75 |

From the recognition accuracy of each category of the model, the model in this paper is superior to the Fast Text model; In terms of the accuracy of the whole sample, the accuracy of the model in this paper reaches 0.75, which is higher than that of the Fast Text model by 0.66, which is improved by 0.09. To sum up, this model has better performance in the evaluation and early warning of mental state. The analysis results show that with the increase of training sample size, the prediction accuracy of the model gradually improves, and tends to be stable after reaching a certain number, and the model is convergent, as shown in Figure 4.

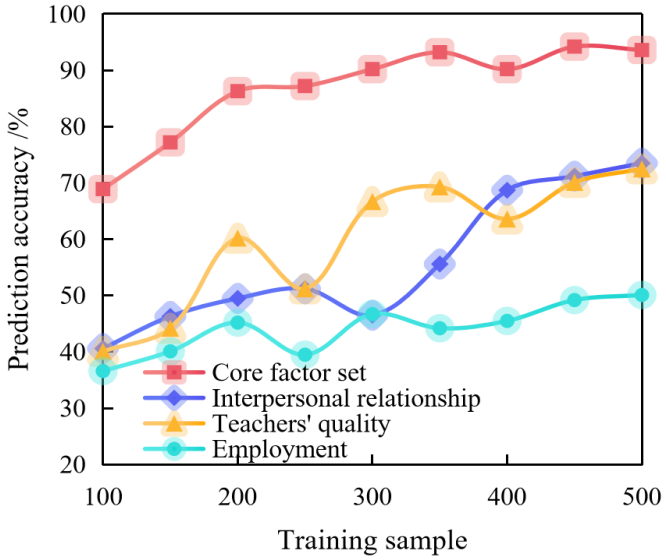


**Figure 4:** Prediction results based on each factor and core factor set

The prediction effect of single factor is far lower than that of core factor set, and the prediction accuracy of core factor set can reach over 90%. On the other hand, various factors have different influences on the forecast results,

among which "difficult employment" has a greater influence on the forecast. The FCM algorithm based on information entropy attribute weighting is applied to college sports students' physical health data analysis, and the clustering results are compared with the traditional FCM algorithm, and its effectiveness is verified by experiments. According to the determination of the final clustering center and the influence of ten factors on the clustering results, the samples are divided into four categories. The comparison of clustering results between the two algorithms is shown in Figure 5 and Figure 6.

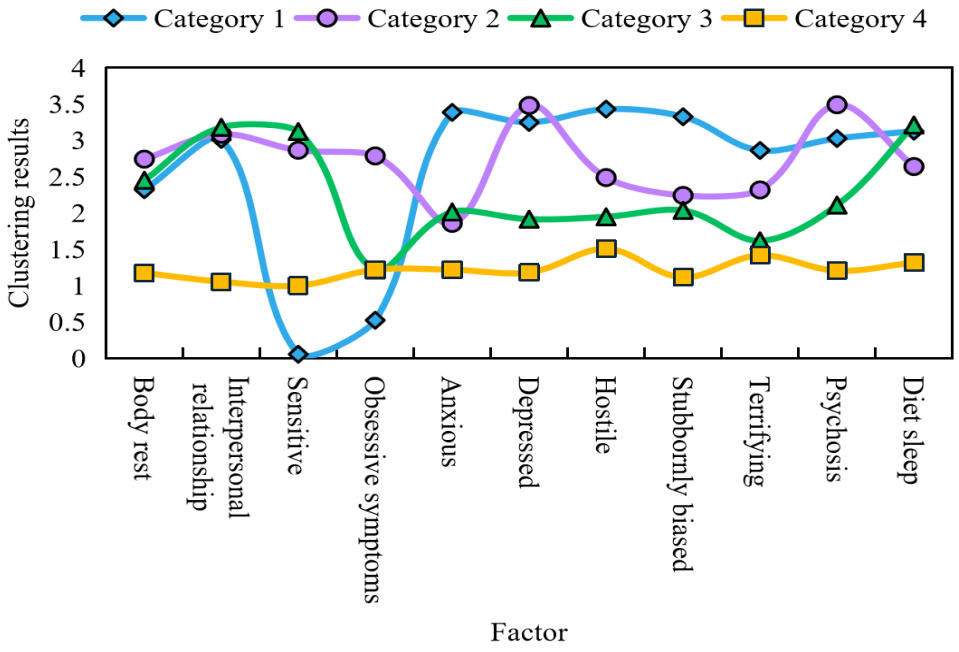


**Figure 5:** FCM algorithm clustering

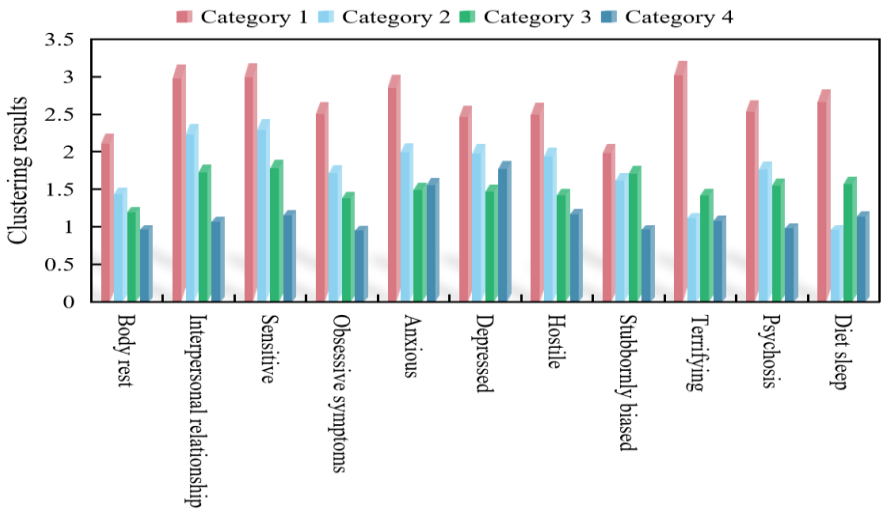


**Figure 6:** Centralization of weighted FCM algorithm based on information entropy attribute

It can be seen that the cluster center of FCM algorithm on the left has significant differences between the first category and the fourth category, which respectively represent the category of moderate and severe psychological

distress and the category of very healthy psychological condition, but the difference between the middle two categories is not obvious. After the improvement of the algorithm, the clustering center of FCM algorithm weighted by information entropy attribute shows that the difference between the first class and the fourth class is clear and decreases in turn. In the first category, the cluster center value of each factor ranges from 2.11 to 3.160, and the average value of all factors is greater than 2, and the cluster center value of four factors is greater than 3, which indicates that this kind of sports students have outstanding psychological problems and belong to the category of moderate and severe psychological distress. Verb metaphor is the most commonly used metaphor, and positive samples are higher than negative samples in all indicators of metaphor. These data reflect the statistical information of metaphor in the text, but they can't reflect the information of words, sentence patterns, context and so on related to metaphor in the text. Figure 7 Test the performance of this algorithm and RNN algorithm in metaphor recognition training.

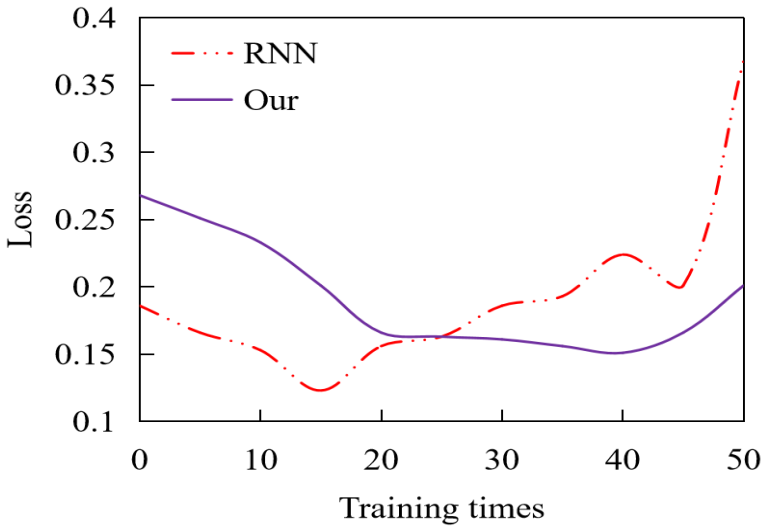


**Figure 7:** Loss change in algorithm training

The RN algorithm can quickly obtain a lower loss value, but with the increase of training rounds, there is an obvious phenomenon of over-fitting. In the verification of metaphor recognition effect, RNN's recognition effect is unstable, and it can't be directly used as the feature input of text classification. Although the lowest loss value in the training process of this algorithm is not as good as RNN, the verification effect is excellent, the loss value is relatively stable, and it is not easy to appear over-fitting. Physical education teachers are organizers who guide sports students to achieve physical education teaching goals, and sports students' psychological activities will directly affect the realization of school physical education teaching goals. Therefore, whether physical education teachers can effectively regulate sports students' psychology is an important aspect to measure physical education teaching effect and identify physical education teachers' level. The author thinks that the

above research results can help sports students to adjust their psychology from the following aspects: Improve the effectiveness of psychological crisis intervention. When a crisis happens, timely psychological crisis intervention for college sports students can not only reduce the negative impact of stress, but also help them recover and grow in the late crisis. Paying attention to the quality training of college sports students in coping with crises can not only enhance their ability to cope with crises, but also further enhance the effectiveness of psychological crisis intervention. Therefore, schools should strengthen the quality education of college sports students, such as regular lectures on psychological crisis intervention, drills of crisis events. Self-regulation, increase confidence. Good personality advantages are conducive to alleviating and strengthening themselves, and college sports students consciously and purposefully cultivate such personality advantages as bravery, interpersonal skills, rationality, insight, optimism, honesty, tenacity, gratitude, hope and purpose. Let yourself have a good self-protection ability as the central body, which is the best debugging measure. The degree of physical health in life is often closely related to the psychological state, which can improve the resistance to the environment, adapt to sudden environmental changes faster and better, reduce some negative emotions, and reduce some anxiety, thus achieving a relatively healthy spirit. Therefore, sports have a very important material basis for psychological adjustment. , all kinds of ball games that college sports students like can't be satisfied by reducing gathering and outdoor activities. Although there is no outdoor exercise, indoor exercise can achieve a balance between body and mind, and the psychological adjustment effect is better.

## 5. Conclusion

Big data provides powerful tools for analyzing patterns and trends in mental health and psychological well-being. By collecting and analyzing data from various sources—such as surveys, social media, and performance metrics—we can identify factors that influence psychological adjustment. Mobilizing sports students' enthusiasm, initiative and creativity is the foundation for contemporary physical education teachers to do well in physical education and sports training, and whether sports students' psychology can be effectively regulated or not is the key. The results of this study show that a single factor can't predict accurately, but the core factor set can significantly improve the prediction accuracy, and each factor has different effects on the prediction. The semantic representation of long text is realized by CNN_RNN structure, and the attention mechanism is adopted to make the model pay attention to the text content related to metaphor. The experimental performance on social media data sets shows that text classification has certain advantages in MH forecasting task. The construction of MH is not carried out by one person. In fact, it is the integration of many factors, which requires a good atmosphere and implementation according to the central body. Physical exercise is a good way

to relieve psychological stress. period, which requires physical and psychological recovery at the same time, it is necessary for physical education teachers to pay attention to and constantly think about the correct guidance and realization.

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