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Song Emotion Intelligence Analysis for Psychological Stress Relief

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ABSTRACT

In today's digital and networked era, multimedia content such as images, audio, and video have become an important part of the data transmitted on the Internet's information superhighway. How to manage the stress in the college student population is directly related to the future life and development of college students. In this article, based on domestic and international data mining technology, the authors designed an intelligent analysis system for college students' mental health, pre-processed the data, then analysed these data in detail by using the outlier analysis algorithm in clustering algorithm, and finally mined the intrinsic connection between the psychological problems and attributes by using the Apriori association rule algorithm, so as to provide the decision makers with a reliable basis. This study puts forward reasonable solutions and suggestions for the problems existing in the psychological level of contemporary college students.

KEYWORDS

DM, Intelligence Analysis, Multimedia Big Data, Psychological Stress, Song Therapy, Songal Emotion

INTRODUCTION

As the backbone of the country's and society's future development, college students will face severe consequences if psychological factors affect their development (Vandebroek et al., 2018). In terms of their interpersonal environment, entering high school from junior high school, students face new teachers and classmates and a new learning environment and school management atmosphere; boarding students also face new living environments and conditions, as well as new psychological weaning (Yan et al., 2022). University teachers and students increasingly recognize song therapy. This study uses group song therapy, drawing on relevant theories of group psychological counseling, to systematically intervene in the psychological stress of college students and explore the application effect of group song therapy on stress reduction in college students. However, existing song fragment melody retrieval methods continue to be based on the physical characteristics of the song, and the retrieval process cannot continue when users do not remember the song melody (Wang, 2014). In the advanced semantic features of songs, emotional semantics are higher-level features beyond melodic semantics. Therefore, users' emotional needs must be considered thoroughly in song retrieval. At the

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same time, the users of emotional songs are not experts but ordinary users, which results in songs—searched based on input emotional characteristics—not being what users need (Li & Yu, 2021).

On this basis, songs must be labeled with the emotions of ordinary users to make comprehensive recommendations in combination with expert categories. On professional forums, the classification of songs is accurate and detailed, providing users with a friendly interactive platform, and the emotional tendencies reflected by a large number of user comments determine the public emotions of a song. Therefore, this article proposes a song sentiment semantic analysis, processing, and retrieval scheme based on song comment content. The article uses a clustering algorithm-based outlier analysis algorithm to analyze these data in detail, attempting to determine the mental health status of each college student. Then, we use the Apriori association rule algorithm to explore the intrinsic connections between psychological problems and various attributes, thereby providing a reliable basis for decision-makers. The song's emotions are taken from the user and fed back to the user, thus achieving the effect that the song's emotions are closely related to the user and change with the user. Through this study, we hope to provide more effective psychological intervention methods for college students to promote healthy growth and development.

This paper mainly offers the following innovations:

1. If mental illness is regarded as "abnormal," it can be regarded as a "rare category" or "outlier" due to the small number of such categories, which can be classified as the problem of mining unbalanced data sets. For this kind of problem, it is difficult to achieve ideal results when using traditional clustering and classification techniques (categories must be known in advance).
2. Most research on college students' psychological problems collects data through mental health testing tools (such as the SCL-90 symptom self-rating scale or the Chinese College Students' Mental Health Assessment System). Then, it conducts analysis and statistics on these data. The content of the psychological test questionnaire is effective for the judgment and prediction of mental health. The conclusion is scientific and accurate, but this method is still lacking in determining the cause analysis of mental health problems. It does not consider the influence of many factors on mental health, such as the fluctuation of students' academic performance, family status, and students' love. Therefore, it is more reasonable and effective to comprehensively use various data and apply correlation analysis techniques to mine and analyze the data.

LITERATURE REVIEW

In ancient China, good Chinese medicine did not treat diseases with acupuncture but with song.\ The combination of Chinese traditional songs and medical treatment has a long history in China, having experienced the process of origin, development, maturity, and even gradual extension. Multimedia content, such as audio, images, and videos, currently accounts for 15% of the World Wide Web, a number that is growing rapidly (Karageorghis et al., 2021). The traditional way to search for a song is to query a music database by matching the song name, singer name, or lyric content to return relevant results. In essence, such databases use a text search based on keywords. Users must remember relevant information to search, such as in Google's song search function or Baidu mp3 search (Sinclair & Tinson, 2017). As a unique language, music can express the sounds of nature and convey people's emotions. Especially when people are experiencing pain, sadness, and loss, music also alleviates, relieves, and eliminates these pains. In China's historical records, written records of applying song in medicine and psychotherapy have existed for a long time (Croom, 2015). With China becoming increasingly internationalized, people's lives are becoming richer. The satisfaction of their material needs has broadened people's horizons, and they have begun to pursue their own spiritual needs. Many of them have begun to pay more attention to song, dance, painting, and other art forms, hoping to enrich themselves through artistic edification, to make up for a feeling of emptiness and a low level of spirituality, and to improve their quality and shape a noble personality (Sinclair & Tinson, 2017).

In 1950, the establishment of the National Association for Music Therapy (NAMT, which later merged with the American Association for Music Therapy to become the American Music Therapy Association or AMTA) marked the official establishment of the discipline of music therapy (Suleman et al., 2024). Compared with the past, today's college students are more precocious and are highly sensitive to many things in society. Their social environment is constantly changing, and their contact channels also vary. Network channels such as Weibo, QQ, and Facebook can promptly convey everything in society to them (Faulkner et al., 2010). Many things exist in the world, especially in a developing country like China, and inevitably, some things that are detrimental to the development of mental health will happen (Hernandez-Ruiz et al., 2022).

Like the origin of music therapy in the West, the status and influence of songs in people's lives are also recorded and reflected in Chinese traditional culture and religious fables. Modern people are paying more and more attention to physical and mental health. When people talk about physical and mental health, their concerns often involve psychological stress.

According to Khan et al. (2024) 's investigation and analysis, the psychological stress of college students includes three parts: one is the pressure of campus life, including pressure related to love, interpersonal matters, cohabitation, and sex, as well as consumption and adaptation pressure; exam pressure; and finally, self-growth pressure, including pressure to seek independence and a desire to communicate. Alderdice (2024) 's research results also indicate that cohabitation and sexual stress, adaptation stress, self-reliance, and communication stress reflect that contemporary college students' psychological stress is epochal and social. Tian et al. (2021) give a design scheme for a data mining (DM) system for college students' mental health problems. This paper presents a design scheme for a data mining system for college students' mental health problems. Its primary method uses the ID3 algorithm to construct a decision tree for classification mining and the Apriori algorithm to mine association rules. Good background knowledge exists from psychological research, but the data it uses is only obtained from mental health test questionnaires, and the research object includes only the students of a particular grade in the authors' schools (Freer & Evans, 2019). The tree mining algorithm called IMB3-Miner is applied to acquire knowledge and patterns from semi-structured records of patients with mental illness and to explore the influence of gene and environmental factors on mental health problems to provide helpful information for preventing and treating mental illness (Clarke & Clarke, 2011). Schry et al. (2012) defined the concept of "coping" in their research as the process of coping with those perceived as nervous or exceeding the internal or external requirements of individual data. Clarke et al. (2020) depend on the threshold of interest, and the threshold setting differs for different types of web pages. For example, for forums with relatively free content forms, this method cannot extract such topic information well if a post does not use punctuation or special symbol intervals (Clarke et al., 2020). Juncos et al. (2017) found that college students' main psychological stressors come from three aspects: learning disturbances, personal disturbances, and adverse life events, including learning, employment, interpersonal relationships, life, economy, society, examinations, family, love relationships, future, ability, health, competition, life and learning environment, and personal (growth and appearance) stress. Students' stressors show diverse development (Juncos et al., 2017). Hidayah et al. applied the tree mining algorithm known as IMB3-Miner to obtain knowledge and patterns from semi-structured mental illness patient record data to explore the influence of genetic and environmental factors on mental health problems to provide helpful information for the prevention and treatment of mental illnesses (Hidayah et al., 2021).

Combining the techniques of psychological problem analysis and DM can help find the hidden regularity in a small amount of data on mental health problems. This is an excellent way to improve the scientificity of school mental health education by using advanced intelligent means (Badalov et al., 2021). The research on mental health problems all uses international psychological test scales, such as SCL-90, MMPI, EPQ, etc. Among them, the SCL-90 scale is the most widely used. However, the vast majority of scale surveys often stay in the traditional analysis and statistics stage and do not

deeply mine the potential value of data, and the explanation of problems only stays in the presentation stage (Kitson et al., 2020).

RELATED MATERIALS AND METHODS

Music Therapy

Song therapy is a therapeutic method that uses singing and music to alleviate psychological stress and promote emotional regulation through emotional expression, emotional release, and emotional experience. This method originated in Japan and has been widely applied worldwide. The main characteristics of song therapy are as follows:

1. Music therapy: Song therapy focuses on music as its core, allowing participants to enjoy the beauty of music through singing and playing, thereby relaxing the body and mind and reducing stress.
2. Group therapy: Song therapy is usually performed within a group, where participants can support, share, and listen to each other, establish good interpersonal relationships, and gain emotional support and satisfaction.
3. Emotional expression: Song therapy encourages participants to express their emotions through singing and music, release emotions, and achieve the effect of emotional release and experience.
4. Self-control: Song therapy emphasizes cultivating an individual's ability to control and regulate their emotions. Participants learn self-regulation and self-control through singing and music, enhancing their emotional management abilities.

Song therapy is suitable for people of all ages, especially those facing psychological problems such as stress, anxiety, and depression. It can be used as an auxiliary treatment method, combined with other medical or psychological intervention methods, to help people relieve stress and improve their mental health. It can be done in groups, where participants sing specific songs together and achieve emotional expression and release through the power of music. Experimental research has found that song therapy has the following values:

1. Psychological intervention effect evaluation: Through experimental research, the impact of song therapy on psychological stress, anxiety symptoms, and emotional regulation ability can be evaluated. Researchers can use different psychological measurement tools and indicators to compare the psychological changes of participants before and after receiving song therapy to evaluate their intervention effects.
2. Individual difference analysis: Experimental research can explore the differential reactions of different individuals when receiving song therapy. By collecting participants' personal characteristics, psychological characteristics, and background information, the differences in response to song therapy among different groups or individuals can be analyzed to understand which people are more suitable for receiving this treatment and how to develop personalized intervention plans for different individuals.
3. Mechanism analysis: Experimental research can further explore the mechanism of action of song therapy. Through methods such as neuroscience, psychology, and physiology, the brain activity, psychological processes, and physiological changes of participants receiving song therapy can be studied, thereby revealing the specific impact mechanism of song therapy on emotional regulation.
4. Comparative efficacy study: Experimental studies can compare song therapy with other commonly used psychological intervention methods to evaluate its relative efficacy and advantages. For example, song therapy can be compared with traditional talk or medication therapy to explore the

differences in the effectiveness of different methods in relieving psychological stress, providing a reference for clinical practice.

Overall, the value of experimental research on song therapy lies in evaluating its intervention effect, analyzing individual differences, revealing the mechanism of action, and comparing it with other treatment methods, providing a basis for the further promotion and application of this treatment method.

Outlier Analysis Algorithm Based on Clustering Algorithm

In this research, we mainly use the outlier analysis algorithm based on the clustering algorithm to identify outliers in the dataset. The outlier analysis algorithm based on the clustering algorithm is a valuable tool that can help us discover and understand anomalies in data, thereby supporting decision-making and problem-solving. It has a wide range of applications, covering many fields, including finance, cybersecurity, manufacturing, and healthcare. The outlier analysis algorithm based on the clustering algorithm can be carried out using the following steps:

1. Data preprocessing: Clean and preprocess the original data, including removing missing values, handling outliers, and standardization.
2. Feature selection: Select appropriate features from the preprocessed data for clustering analysis. Feature selection can be performed using correlation analysis and principal component analysis methods.
3. Cluster analysis: Use clustering algorithms, such as k-means, DBSCAN, and hierarchical clustering, to divide data samples into clusters. The clustering algorithm categorizes samples into the same cluster based on similarity, each representing a group of similar samples.
4. Outlier detection: Determine the degree of anomaly for each sample by calculating the distance or other similarity measures between each sample and its corresponding cluster. The specific methods include calculating the distance from the sample to the cluster center and calculating the average distance between the sample and other samples within the cluster.
5. Outlier marking: Mark or exclude abnormal samples based on the threshold of outliers. Thresholds can be set based on experience; alternatively, statistical methods, such as adding or subtracting several times the standard deviation from the mean, can determine the threshold for outliers.
6. Result evaluation: To evaluate the effectiveness of outlier analysis, indicators such as accuracy, recall, and F1 value can be used to evaluate the performance of outlier detection algorithms.

It should be noted that outlier analysis algorithms based on clustering algorithms are not suitable for all situations, especially in cases of uneven data distribution or the presence of noise. Therefore, selecting the appropriate algorithm and parameter settings is crucial, and adjustments and verifications must be made based on specific problems. It has a wide range of applications, covering many fields, including finance, cybersecurity, manufacturing, and healthcare. In the data preprocessing stage, clustering algorithms can identify and handle outliers to improve data quality and accuracy. In the financial field, clustering algorithms can identify abnormal transactions and detect potential fraudulent behavior. In network security, clustering algorithms can detect abnormal network traffic and discover possible attacks or intrusion behaviors. In industrial manufacturing processes, clustering algorithms can help detect equipment failures or abnormal operations, improving production efficiency and quality. Compared to other anomaly detection methods, clustering-based anomaly value analysis algorithms have the following advantages:

1. Discovering unknown anomalies: Clustering algorithms can help identify anomalies outside the normal distribution by dividing data samples into clusters. This is useful for undefined abnormal patterns, as clustering can automatically identify potential abnormal patterns in the data.

2. Unsupervised learning: Clustering-based outlier analysis is an unsupervised learning method that does not require prior knowledge or labeled outlier samples. This means that it can be applied to many fields, especially when the definition of abnormal behavior is unclear.
3. Efficient processing of large-scale data: Clustering algorithms typically have good scalability and can handle large-scale datasets. This makes it suitable for processing large amounts of data, such as transaction data in the financial field or log data in the cybersecurity field.
4. Interpretability: Clustering algorithms can provide interpretability about abnormal features and patterns by comparing abnormal samples with other normal samples. This helps to further analyze the causes of anomalies and take corresponding measures.

It should be noted that outlier analysis methods based on clustering algorithms also involve some challenges and limitations. For example, for high-dimensional data or datasets containing noise, the performance of clustering algorithms may decrease. In addition, selecting appropriate clustering algorithms and parameter settings also requires some experience and domain knowledge.

THEORETICAL ANALYSIS OF PSYCHOLOGICAL SONG RELIEVING STRESS

Different countries and organizations have different definitions of song therapy (Medeshova et al., 2016). Mature emotion-based song search methods mainly analyze audio content according to the multi-feature combination of audio and give the emotional features of songs according to the similarity of users' auditory content. However, in reality, most users are not experts, and they have different views on the emotional understanding of a piece of music. At the same time, the users of emotional music are not experts but ordinary users; thus, the songs retrieved according to the input emotional characteristics are not what the users need (Louie, 2020). Music has a very significant influence on human emotions. Mood is a cognitive response. Emotions can determine and affect people's cognitive systems. Song therapy uses the influence of music on emotions to change people's moods and emotions and then change their "cognitive evaluation" to some extent.

The human nervous system is divided into the sympathetic nervous system and the parasympathetic nervous system (Parsons et al., 2019). The activation of the sympathetic nervous system raises the level of physiological activation, which leads to emotional experiences such as panic, anger, and tension. However, music stimulation causes changes in the parasympathetic nervous system. Contrary to the function of the sympathetic nervous system, activating the parasympathetic nervous system can make the body relieve tension, reduce physiological activation, and help people enter a relaxed state. Song therapy is different from general psychotherapy. The difference is mainly reflected in the differing treatment methods and effects on brain activity. In particular, music can directly affect the neural structure, especially the cerebral cortex. Specifically, when different musical instruments are playing, people react to them through their melodies and tones, which can effectively act on human organs, thus achieving specific therapeutic effects. It pays attention to the whole rather than the part and emphasizes the coordination and unity of the whole and its living environment. It is not equal to music education, but a kind of music function. Unlike music education, which attaches importance to the cultivation of aesthetic knowledge and skills, music therapy is mainly used to help correct negative behaviors or mental diseases. Its goal is to help people better adapt to society and to coordinate an individual's body and mind; it is not simple psychotherapy but a more professional scientific process. It changes the patient's cognition by changing their mood and then treating them after the mood eases. It is not ordinary music appreciation.

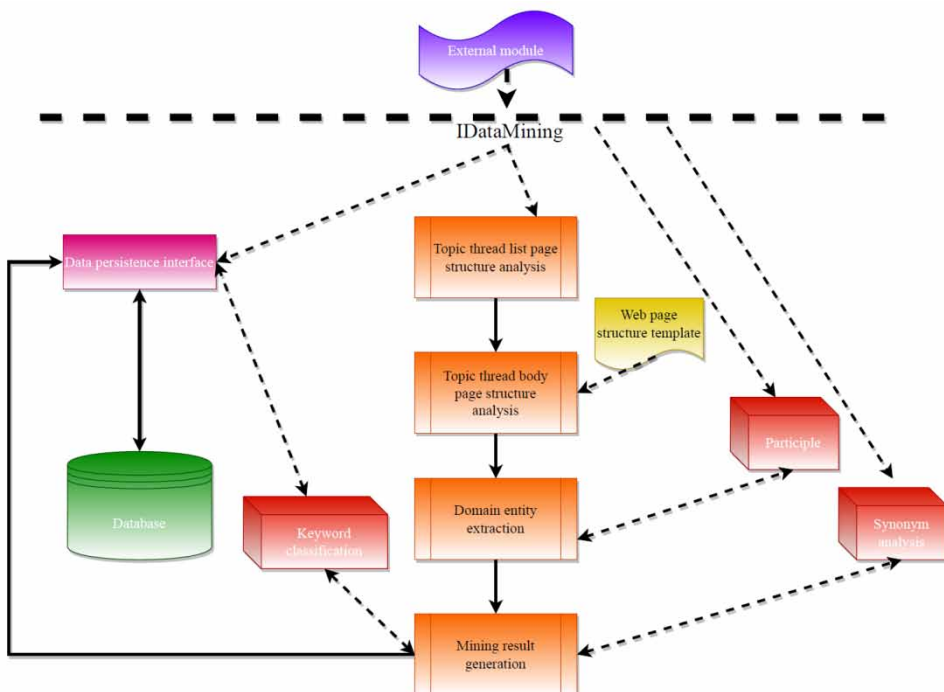### Data Mining System

The model-based clustering algorithm attempts to find a specific mathematical model to describe each cluster and then forms clusters on this basis. This method assumes that the given data set satisfies the mathematical distribution of a certain probability. This method mainly includes statistical methods and neural network methods. Two methods, subjective and objective, can be

used to detect the amount of mental ambiguity. The so-called objective approach uses various devices and sets up appropriate experimental indicators to detect the psychological quantities marked by fuzzy subsets. For some abstract characteristics of objects, such as satisfaction, severity, integrity, and other indicators of fuzzy subgroups, sets are often difficult to achieve by objective means because the object lacks a measurable corresponding complex. In order to overcome the limitations of these language computing models, this study puts forward a language computing model based on semantic similarity based on the Lawry compound language model. This language calculation model emphasizes the semantic similarity between language values and assumes that this similarity is a fundamental feature of human brain language cognition, which aligns with the behavior pattern of music emotion cognition.

On this basis, it is necessary to use the emotions of ordinary users to label songs and combine expert categories to comprehensively recommend songs. The definition includes three aspects, without any one of which cannot be song therapy: (1) Song therapy is a systematic intervention process, which includes the establishment of long-term goals and short-term goals, as well as pre-treatment evaluation and evaluation of efficacy; (2) Song therapy is not just about listening to music and relaxing. Listening-based song therapy is only one method in song therapy. In the treatment, the therapist can use all music-related activities as the treatment means according to the situation of the visitors; (3) In the process of song therapy, in addition to music and the treated patient, specially trained song therapists are also necessary. Professional forums provide users with a friendly interactive platform because the classification of music is accurate and detailed. The emotional tendency reflected by a large number of user comments determines the mass emotion of a piece of music. The DM process is shown in Figure 1.

Figure 1. Framework of song forum analysis module

The responsibilities of each part of data mining (DM) are shown in Table 1 and Table 2.

Song emotion constitutes a unique language value system. We have the following definition. Definition 3-1 (Language-valued model). Two-tuple <LA,R> is represented as a language-valued model:

$$LA = (L_1, L_2, \ldots, L_n) \tag{1}$$

$$R = (r_{ij})_{n \times n}, r_{ij} \in [0,1], i, j = 1, 2, \cdots, n \tag{2}$$

satisfying the following two characteristics: $r_{ij} = r_{ji}$ and $r_{ii} = 1$. In this way, in this model, we do not need to define the fuzzy set and its membership function for the language value L_i, but define the similarity relation of language values by the fuzzy relation matrix to explain the connotation of language values.

Definition 3 (song emotion). For a song with independent emotional semantics, the emotional connotation is represented by the eight-dimensional vector E defined on the Hevner emotion ring and the element value. R = r (Song, laoma) represents the semantic similarity between the song and each sub-emotional language value. The similarity is expressed by a value between 0 and 1. We call this vector song emotion e:

$$E = (r(Music, LAoM\}), \ldots, r(Music, LAoM), \ldots, r(Music, LAoMS)), i = 1, \ldots 8 \tag{3}$$

Among them, the sub-emotion with the largest value is defined as the dominant emotion of Song E_{don}:

Table 1. Data mining (DM) responsibilities list

DM name	Description
DM0001-Spider	Capture web pages from the Internet
DM0002-Digger	Mining user reviews of music and user preferences from web page text
DM-0003-Analyzer	In-depth processing of the excavated information to provide a variety of enterprise characteristics
DM0004-Searcher	Establish an inverted index for the information manually configured by the managers of the excavated information, and provide a search function
DM0005-Controller	Basic data configuration, system management
DM0006-Portal	Operator interface for prototyping demonstrations

Table 2. Subsystem responsibilities

Subsystem name	Describe
SUBSY0001-SongBBS	External component, music forum site in any web format
SUBYS0002-Portal	External parts, used to demonstrate the functionality of the system

$$E_{don} = \max(ei), i = 1,\dots,8 \tag{4}$$

The previous discussions are all about songs or segments with independent emotional semantics. In fact, according to the analysis of the movement of musical emotions, a complete piece of music often has emotional connotation transformation and transition. If a piece of music can be divided into N segments according to its emotional semantic features, the emotional chain can be defined as follows.

Definition 5 (Song Emotion Chain). The song emotion chain is the movement state of emotion on the time axis of the music sequence, which can be expressed as:

$$EmoChain = (E_1, E_2, \dots, E_i, \dots, E_n) \tag{5}$$

Through a network questionnaire survey for college music majors, the participants were asked to imagine a piece of music with the emotion expressed by the reference words and score the similarity of the music when expressing the emotion of other comparative words at the same time. The degree difference ranged from 0 for "dissimilarity" to 3 for "the same." The experiment obtained 154 valid samples. The sample data were calculated according to Equation 6:

$$\widetilde{r_{ij}} = \left(r_{ij} = \min_{i,j\in[1.8]}\left(r_{ij}\right)\right) \Big/ \max_{i,j\in[1.8]}\left(r_{ij}\right) \tag{6}$$

According to Hevner's emotional ring theory, the eight emotional sub-categories in the musical, emotional language value set form a ring structure in which any link has a progressive relationship with its adjacent links in emotional logic. According to our definition, (sacred, sad) > (sacred, yearning), in line with the psychological characteristics of Hevner's emotional circle.

The short zero-crossing rate refers to the number of times the time-domain signal waveform of a frame of audio crosses the zero level. The high-frequency zero-crossing rate is high, and the low-frequency zero-crossing rate is low, which can be used to distinguish unvoiced sound from voiced sound. The short-time zero-crossing rate of the nth frame is defined as:

$$Z_n = \frac{1}{2}\sum_{m=1}^{N}\left|\text{sgn}[s_n(m)] - \text{sgn}[s_n(m-1)]\right| \tag{7}$$

The short-time autocorrelation function is the result obtained by intercepting a section of signal near the m-th sample point of the signal with a short-time window and doing an autocorrelation calculation. The short-time autocorrelation function of frame n is defined as:

$$R_n(k) = \sum_{m=1}^{N-k+1} s_n(m)s_n(m+k-1) \tag{8}$$

The autocorrelation function provides a method to obtain the period of a periodic signal.

The relevant definitions of spectrum analysis are as follows: the Fourier transform (FFT) is:

$$X(k) = \sum_{j=1}^{N} x(j)\omega_N^{-(j-1)(k-1)} \tag{9}$$

where $\omega_N = e^{(-2\pi i)/N}$; $x(j)$ is a time domain signal. The amplitude spectrum is:

$$B_{1\omega,n} = \left| X(k) \right| \tag{10}$$

The construction method of the "spherical field" of the k-th sample X_i is as follows:
Take any point a_i that has not been covered, and use Equation 11:

$$\begin{cases} d_1(k) = \max_{x \notin x_k} \left\{ \langle a_i, x \rangle \right\} \\ d_2(k) = \min_{x \in x_k} \left\{ \langle a_i, x \rangle \big| \langle a_i, x \rangle > d_1(k) \right\} \\ d(k) = (d_1(k) + d_2(k)) / 2 \end{cases} \tag{11}$$

Calculate the coverage radius r = d(k), where < x, y > represents the inner product of X and y, $d_2(k)$ is the minimum distance between sample A_i and a dissimilar sample x, $d_1(k)$ is the maximum distance between a and similar sample x, where $d_1(k) > d_1(k)$. R is the coverage C_i of the radius. By adjusting the field center and radius, more similar samples can be covered to identify similar samples.

The analysis and extraction of song features play a vital role in realizing automatic song recognition. The scientificity of the extraction object, the feasibility of the extraction method, and the accuracy of the extraction result directly influence the effect of automatic recognition. Therefore, the feature extraction link is a necessary research and discussion content of the computer recognition system of the song mood, and it is also an indispensable part of realizing the system's function, as shown in Figure 2.

Figure 2. Flow chart of song emotion recognition
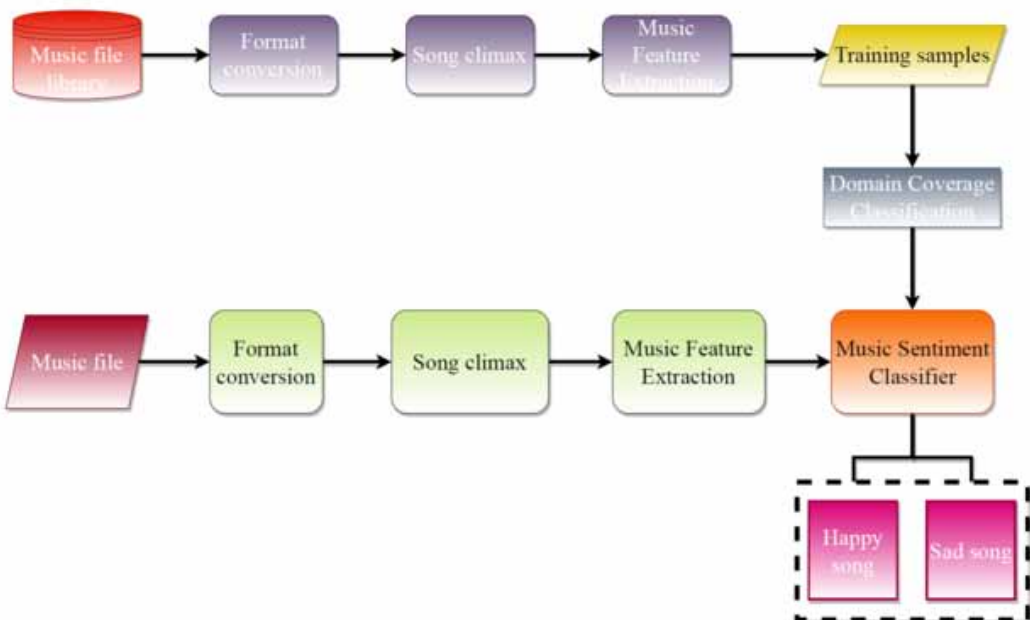
A person's emotional experience is divided into positive emotional experience and negative emotional experience. Positive emotional experience refers to a state in which an individual can accept his past, feel the present happily, and be full of hope for the future. If you have a positive emotional experience, you will feel happy. This also enhances people's recognition of the environment so they can adapt to the new environment well. A positive emotional experience can not only help people eliminate the psychological stress caused by stressful events such as exams and adapt to the new environment but also improve their physical and mental health. Optimistic students get along well with their classmates and have good interpersonal relationships. They get along well with their classmates, teachers, and parents and rarely stay alone. Whether the students know each other well or not, as long as they are in harmony with others, this increases the students' positive emotional experience.

Generally speaking, setbacks are related to difficulties and failures, which are harmful. However, if we deal with appropriate or moderate setbacks positively and optimistically instead of adopting a pessimistic explanation style, then setbacks can positively influence students. Therefore, in the educational process, teachers should guide students on how to face setbacks in a healthy way. Schools should pay sufficient attention to students' mental health, not just their academic performance. If we ignore students' mental health and the improvement of their psychological stress, it will inevitably affect their learning status and academic performance. Thus, if schools consider mental health, the gains will outweigh the losses in the long run. Schools must set up mental health education courses according to high school students' psychological development characteristics. According to the physical and mental development characteristics of first-year students in senior high school, the corresponding educational content and key points must be arranged pertinently with a focus on self-education. This study examined the results of carrying out education on the following topics: cultivating a positive, healthy, and good personality; helping students to enhance their self-confidence and self-improvement; cultivating their ability to resist stress and establish an optimistic attitude towards life; learning effective stress reduction skills, including measures to relieve anxiety before exams; and cultivating good and harmonious interpersonal strategies.

RESULTS AND ANALYSIS

Analysis of Experimental Results

In the experiment, firstly, we selected a piece of music to judge whether its emotional color is lyrical, sad, happy, relaxed, and so on. Then, we checked the system's judgment, getting the test result based on the keywords obtained manually. The scoring rules include the average recall and accuracy rates of each test sub-item (emotional and situational words), a simple average, and multiplication by (100+20). Among them, 20 is used to offset the error caused by manually obtaining keywords.

A big problem remains in terms of matching the song names, particularly regarding the identification of short song names. The long song name has less ambiguity after matching. For example, "the airport without tears—linjunjie" can be identified clearly as the song name, while the short song name cannot be identified as the literary song name because it includes much repetition with common words, such as "killer—linjunjie" or "Chinese—S.H.E." These short words exist in the daily language of the forum; thus, it is inappropriate to identify them as song names such words are used. However, if these are ignored, most short song titles will not be recognized. No relevant solutions have previously been found for this problem. In order to address this problem, this paper proposes a rule-based identification/extraction method for music information entities. Domain entity extraction is mainly used to obtain data in music review content analysis, mine forum content, and obtain keywords, including the following four parts: (1) Get the song information from the posts and classify the posts according to the music clues. (2) To obtain the keyword list for each post, use the word segmentation function. (3) The separation of emotion and situational words requires using the synonym function. (4) According to the keyword information, obtain the user's attitude towards

music clues, post quality, post value, related emotional words of resources, situational words, and other words (configurable).

Based on collecting primary psychological testing data, this paper counts changes in students' academic performance, family situation files, and student dynamic information. The DM algorithm is used to comprehensively analyze these data, determine the main factors that lead to college students' psychological problems, and establish an intelligent prediction method. This can make mental health work more targeted, improving the level and efficiency of mental education and providing a basis for the planning and decision-making of school mental health education. Abnormal points can be judged by projecting each cluster. The abnormal points are divided into four levels, A, B, C, and D, corresponding to the following health conditions: "relatively serious," "obvious," "require further inspection," and "healthy." Aiming at the possibility that mental health data sets may form arbitrary clusters, we adopted an anomaly mining algorithm based on arbitrary shape cluster clustering, as shown in Table 3.

The OBASC algorithm can obtain arbitrary shape clusters in the data set; its advantages are obvious, and the clustering accuracy can reach a relatively high level.

After data preprocessing, we obtained 1,583 pieces of data. First, the 1,583 pieces of data were detected using clustering-based anomaly mining, and five clusters were obtained. The distribution is shown in Figure 3, the corresponding cluster distribution analysis diagram. The attribute cluster describes the sequence number of clusters, and the attribute instance describes the number and proportion of instances.

Through abnormal DM, we can understand the scores of each college student according to various aspects, that is, the projection values of each data object for ten factors and the student's

Table 3. OBASC algorithm description

Input: dataset D, nearest neighbor threshold V
Output: cluster CS containing n elements
Begin
(1) Initialization cluster geometry CS is null;
Repeat;
(3) Select data objects that have not been added to any cluster from dataset D;
Find all the neighbors of the newly added object, and calculate the number of clusters n that contain the neighbors of the new object;

Figure 3. Analysis of cluster distribution

comprehensive mental health. Before applying mining association rules, two parameters must be determined: the minimum support threshold minsubscript and the minimum confidence threshold minconfidence. Notably, few college students have "serious" or "obvious" mental health conditions, which introduces difficulties in mining. No matter how we set the minimum support threshold or the minimum confidence threshold, the rules obtained are not ideal. Figure 4 shows the mining of association rules under different support thresholds when the minimum confidence threshold is 50%.

According to the different domains of the eigenvalues in the time, frequency, and cepstrum domains, we obtain the emotion recognition of the combination of six groups of features, as shown in Figure 5.

As shown in Figure 5, the time domain features have a good effect on the emotion recognition of songs, with a correct rate of 80.65% for happy songs, a correct rate of 79.79% for sad songs, and a total correct rate of 80.21%. The combination of time domain eigenvalues and cepstrum domain eigenvalues also has a good musical emotion recognition effect. The correct rate of happy songs is 81.72%, that of sad songs is 76.77%, and the total correct rate is 79.17%. However, the other four groups of eigenvalue combinations for the song emotion recognition effect are poor.

The analysis found that the text analyzed by label-based song retrieval is only the emotional label of the song, and the similarity usually deals with relatively long text information, which may not be very good for short text. The effect of the similarity algorithm is slightly worse than the one based on the semantic similarity calculation and the output algorithm, as shown in Figure 6.

The issues discussed in traditional documents, blogs, and professional forums have a certain degree of aggregation, which is suitable for obtaining characteristic information using statistical methods. For example, for the content in the "display discussion area" of the computer forum pconline, the display-related features (or rules) can be obtained after training. Then, the content discussed in each post can be divided by the classification method into "screen-problem," "screen-AC," and so on.

The following describes a group comparison experiment designed in this section. The former group is used to test the sum and change of the retrieval results after fusing the heat information. The latter group is used to compare the final results of three methods after fusing information from several heats, as shown in Figure 7.

Figure 4. Mining of association rules under different minimum support thresholds when the minimum confidence is 50%
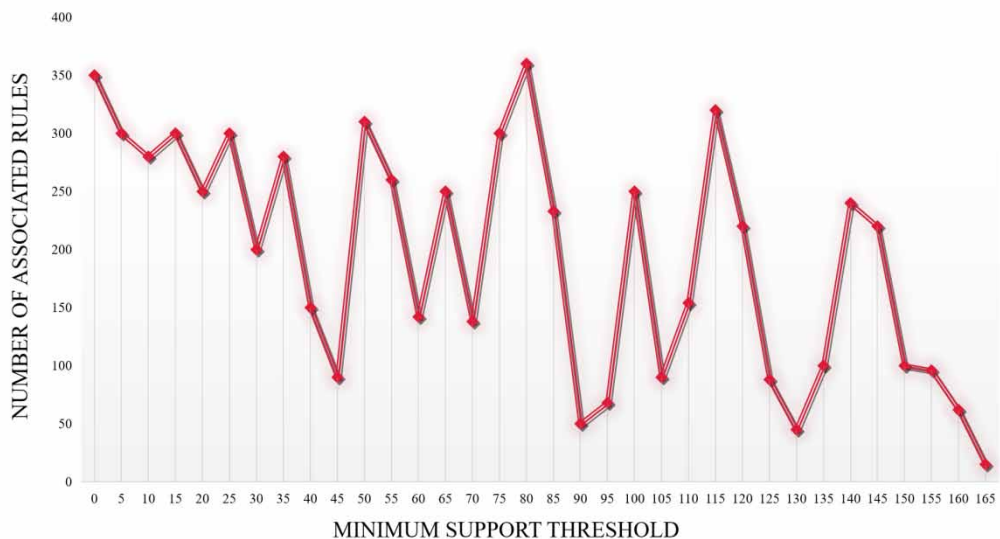
Figure 5. Test results of time domain, frequency domain, and cepstral domain feature combinations
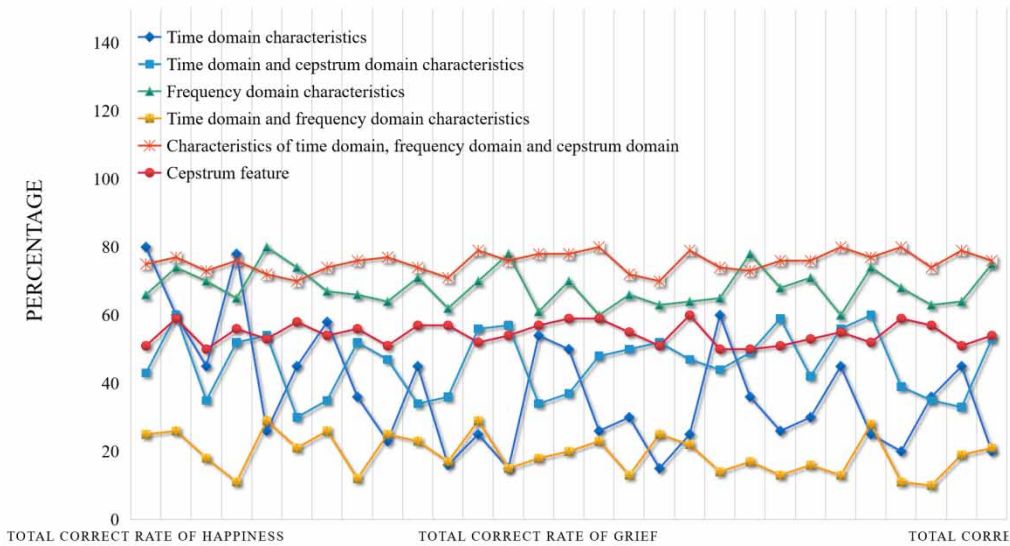
Figure 6. Single method P@N value
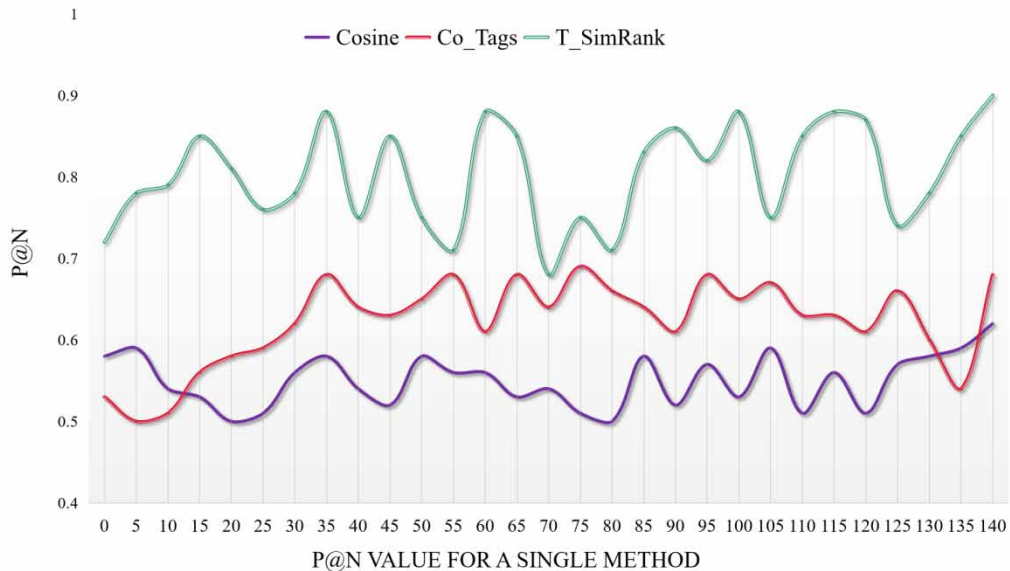
An analysis of Figure 6 and Figure 7 indicates that these three methods are fused in pairs, and all three are fused.

Hevner's emotional model divides the emotions of music into major categories, and each piece of music contains one major emotion and several minor emotions. Considering the differences between Chinese and Western cultures, thinking, habits, and historical backgrounds, through the actual questionnaire, the vocabulary in the emotional circle is converted from English to Chinese, and the number of vocabulary is reduced, making the selected emotional adjectives more in line with

Figure 7. Average NDCG value after T_PageRank is fused by a single method

Average NDCG value after fusion of T_PageRank with a single method
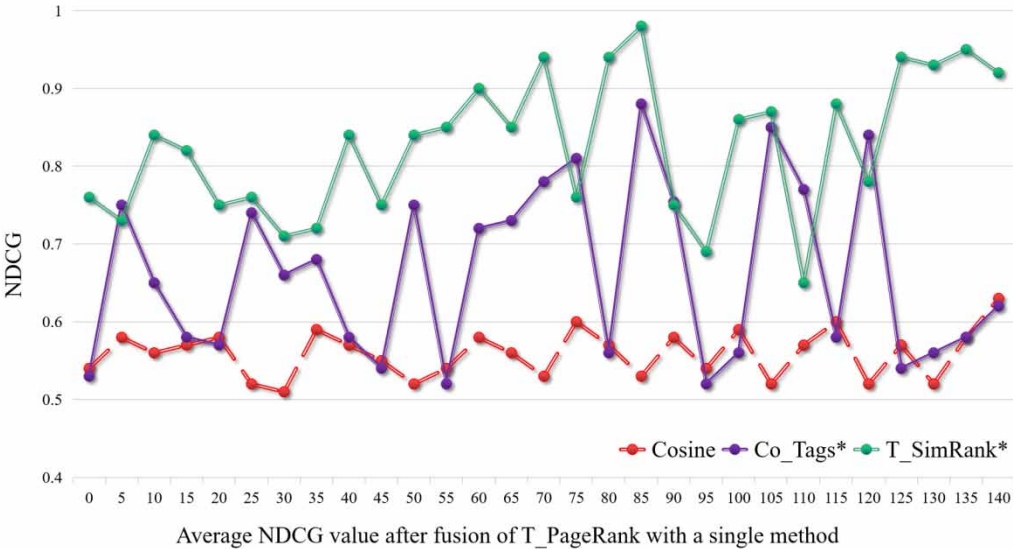
Chinese people's expression habits. Table 4 shows the mapping of emotional categories in Chinese and English.

This paper divides the emotional tags into three emotional categories from the table. If the emotional tags do not appear in the emotional dictionary, the most similar emotional category is selected.

Each song puts forward an emotion vector and has a primary emotion, but not every user agrees with this emotion. Therefore, it is necessary to judge whether the current user holds a supportive, neutral, or negative attitude toward the song's emotion and whether the current user's attitude corresponds to the song's emotion. The extended information mainly includes two parts: (1) User information mining: For each user, analyze the keyword information of all related posts in the topic thread to obtain the user's preference (Favorite). (2) Song information mining: For each song clue, analyze the keyword information of all related posts to obtain the attention and level of the music entity object described by the song clue. According to these keywords, the emotional expression and scene expression of the music entity object are obtained, and the emotional features and scene

Table 4. Mapping of emotional categories in Chinese and English

English Category	Chinese Category
Dignified	Divine
Sad	Sad
Dreamy	Look forward to
Soothing	Express/convey one's emotions
Graceful	Slim and graceful
Joyous	Happy
Exciting	Enthusiasm
Vigorous	Life

features are obtained using the classification sub-module. The following table is based on the test results of the given test sample set (provided by the acceptance company). These sample sets include music websites such as Qingfeng, Weimei, Baishigao, Baidu Head, and Xuanyin. Based on whether the sample set can be successfully excavated, 10 points are recorded for the successfully excavated sample set; otherwise, 0 points are recorded, as shown in Table 5.

According to the test results, the music review content analysis results are perfect regarding running speed and breadth of application. According to the test results in Table 5, it can be found that the music emotion recognition effect of time-domain features is better, so the combination of the second group of eigenvalues mainly takes the time-domain features as the main body and randomly extracts the eigenvalues of the frequency and cepstrum domains, combining them to find the feature combination with better music emotion recognition effect, as shown in Figure 8.

Table 5. Analysis results of song review content

ID	Site name	Test sample set size	Time (seconds)	Is the excavation finished?	Score
1	Cool breeze	3.58	254	Yes	10
2	Cool breeze	3.15	100	Yes	10
3	Baishigao	2.31	473	Yes	10
4	Baishigao	2.89	534	Yes	10
5	Head	6.84	546	Yes	10
6	Head	21.46	512	Yes	10
7	Xuanyin	3.55	491	Yes	10
8	Xuanyin	21.43	2645	Yes	10
9	Aestheticism	368	24651	Yes	10
10	Aestheticism	671	24392	Yes	10

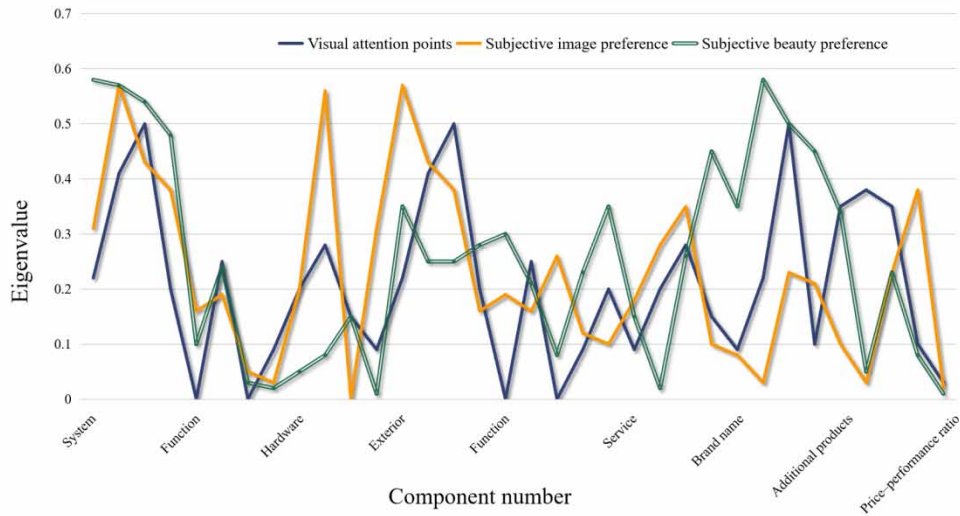**Figure 8. Standardization coefficient**

Figure 8 shows that the second, fourth, and fifth feature combinations have the best emotion recognition effect, and the correct rate is about 90%. The recognition accuracy of the three feature combinations is shown in Table 6.

As seen in the table, the best feature combination for the music emotion recognition experiment based on the domain coverage algorithm is the feature combination composed of four time-domain features, spectrum, amplitude spectrum, and phase spectrum, the feature combination composed of short-time energy, short-time average amplitude, short-time zero crossing rate, spectrum, amplitude spectrum and phase spectrum, and the feature combination composed of four time-domain features, spectrum, amplitude spectrum and phase spectrum. The experimental results show that the time-domain features positively impact music emotion recognition.

The study results show that after the group counseling intervention of song therapy, the overall stress score and the scores in 11 dimensions, including family stress, interpersonal stress, and adaptation stress, were significantly reduced. This result supports the purpose of this study. Group song therapy is effective in relieving the psychological stress of college students. Through the intervention of group song therapy, participants' interpersonal communication ability is improved, and they can start to know others correctly and comprehensively to care about and better understand others. For example, one participant mentioned: "I was in a low mood at that time when I decided to participate in the activity because I felt that my friend had hurt me, and I joined in with decompression and curiosity." The intelligent analysis system of college students' mental health aims to find those students who have problems through data analysis and try to find the causes of their problems through association rule mining so psychological tutors can find a suitable remedy for the case and solve the students' mental health problems. The system can quickly identify college students who have problems by analyzing abnormal data, and association rule mining can assist in finding the cause. This intelligent analysis system can significantly improve college students' mental health.

We can summarize the findings into two points: First, according to the characteristics of mental health data, the related data items for mental illness are equated to abnormal data, and then the problem is transformed into the problem of data mining of abnormal points. Secondly, from the perspective of data integrity, we combine static data with dynamic data and use the related technology of association rules to gather knowledge, thereby discovering some meaningful rules.

Analysis of Practical Applications

In modern society, college students face increasing psychological pressure and challenges. Academic pressure, interpersonal relationships, employment prospects, and other issues often make them feel anxious and confused. In order to help college students better cope with these psychological troubles, many schools and institutions provide various mental health services and support. However, how to effectively intervene in the psychological stress of college students remains a topic worth exploring and researching. This study aims to explore the application effect of group song therapy in psychological stress intervention for college students and develop an emotional analysis and recommendation scheme based on song comment content. Through these efforts, we hope to provide more effective support

Table 6. Recognition accuracy rate of three feature combinations with the best recognition effect

Coverage Test Results	Second Type	Fourth Type	Fifth Type
	Feature combination	Feature combination	Feature combination
The total correct rate of happiness %	88.1	83.45	88.12
Total sadness correct rate %	90.3	89.34	88.49
Total correct rate %	94.5	98.52	88.79

for college students' mental health, helping them alleviate stress and improve their mental health. The practical application of this article is mainly reflected in the following aspects:

1. Psychological health services for college students: This study used group song therapy to intervene in the psychological stress of college students, and the results showed that this method could significantly alleviate these students' psychological stress and anxiety symptoms. Therefore, school psychological counseling services can draw on this study's methods to provide more diversified and effective mental health services for college students.
2. Music therapy practice: This study explored the application of group song therapy to address college students' mental health, providing an effective approach to music therapy practice. Meanwhile, the research findings also provide some reference for music therapists to apply group song therapy to psychological interventions for different populations.
3. Psychological health education: The results of this study indicate that college students face high levels of psychological pressure and anxiety. Therefore, schools can enhance mental health education to improve students' mental health awareness and coping abilities, thereby minimizing the occurrence of psychological problems.
4. Scientific research: This study utilized group song therapy as a novel psychological intervention while exploring emotional semantic analysis and retrieval schemes based on song comment content. These research methods and techniques can provide a reference for future related research and promote interdisciplinary research in psychology and musicology, for example.

Although we have obtained some meaningful results, we also must recognize the limitations of our current research. Firstly, the sample selection scope of this study is limited as we only selected college students from specific regions and schools as the research subjects. This may limit the generalizability of the research results, as college students from different regions and schools may have different psychological pressures and needs. Future research can consider selecting college students from different regions and schools as samples to increase the representativeness and generalizability of the research results. Furthermore, researchers could consider including college students of different grades, majors, and backgrounds to better understand and meet the psychological needs of various groups.

Secondly, this study used group song therapy to intervene in individual psychological stress. However, the psychological state and needs of each individual differ, so group therapy may not be able to meet everyone's personalized needs. Future research can explore individualized psychological intervention methods, combining individual characteristics and needs to provide more targeted psychological support and assistance.

In addition, the emotional semantic analysis and retrieval scheme based on song comment content proposed in this research still needs further improvement and verification. The current methods mainly rely on user comments and expert classification. However, user comments may be subjective and inaccurate, and expert classification may also be influenced by personal preferences and subjective judgments. Therefore, more natural language processing and machine learning technologies must be introduced to improve the accuracy and reliability of sentiment analysis and song recommendation.

Finally, this study only focuses on the psychological stress and mental health issues of college students while ignoring other possible influencing factors. Future research can consider incorporating other social, cultural, and individual factors into the analysis to comprehensively understand the complexity and diversity of mental health issues among college students.

In summary, this study has achieved particular results through group song therapy and the emotional semantic analysis of songs. However, several limitations remain regarding sample selection, individualized intervention needs, method improvement, and comprehensive analysis. Future research can continue to explore and improve these aspects to provide more effective psychological support and promote college students' physical and mental health development.

CONCLUSION

Emotion is an essential feature of music, and using language to express or search for songs aligns with the habits of ordinary users, including song emotion representation models, song comment feature recognition, emotion song classification, and emotion song retrieval. Currently, relatively little research exists on this topic. With the development and progress of society, psychological quality has become increasingly important. As the main force of our future society and the country, college students must have a good psychological quality. This study adopts group song therapy, draws on relevant theories of group psychological counseling, and systematically intervenes in the psychological pressure of college students, exploring the application effect of group song therapy on stress relief for college students. The research results indicate that intervention through group song therapy can effectively help college students reduce psychological pressure, improve their mental health, and promote their physical and mental health development. In addition, this study proposes a song sentiment semantic analysis, processing, and retrieval scheme based on song comment content. Through this scheme, we successfully combined the emotional needs of users with the emotional characteristics of songs, achieving accurate retrieval and recommendation of emotional songs. This solution not only meets the emotional needs of users but also provides essential support and assistance for song promotion and the development of the music industry. This study has achieved particular results related to group song therapy and the emotional semantic analysis of songs, but it involves limitations related to sample selection, individualized intervention needs, method improvement, and comprehensive analysis. Future research can continue to explore and improve these aspects to provide more effective psychological support and promote college students' physical and mental health development. In summary, through group song therapy and emotional semantic analysis based on song comments, we can better promote the physical and mental health development of college students and provide new ideas and methods for promoting songs and developing the music industry. We believe that in future research, these methods and schemes will be more widely applied and promoted, making significant contributions to the development and progress of society.

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