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The Development of Internet Intelligent Platform in Art Education and Emotional Interaction Therapy for High School Students in Shanghai

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Abstract

Human sentiment represents a complex aspect of psychology and consistently attracts attention across various scientific disciplines. This type of communication, inherently embedded in human interaction, conveys not just explicit messages but also a wealth of underlying emotional elements. This multifaceted nature of emotional communication is leveraged extensively in the study of emotions. In modern society, the unprecedented development of social economy and the unprecedented fierce competition for human survival have destroyed the harmony of human itself, between human beings and between human beings and nature. In the final analysis, it breaks the harmony of people's emotions, which leads to the negative development of emotions, so emotional cultivation is put on the agenda. Especially the emotional problems of senior high school students are particularly prominent. Based on the Internet intelligence platform, this paper analyzes the development of art education and emotional interaction therapy of senior high school students in Shanghai, and analyzes it through BP (Back-Propagation) neural network and DNN (Deep Neural Networks) Model. The results of the experimental evaluation indicate that the mean accuracy for identifying emotions stands at 61.4%. Within the spectrum of error assessment, the algorithm introduced in this study successfully mitigates 75.4% of potential inaccuracies. Therefore, a 60.2% improvement in the unweighted recognition rate of discrete emotions is quite meaningful, and also handles the unweighted case well. On the other hand, the recognition rate of emotional features under different samples has an average analysis strength of 67.4%.

Keywords: Internet, Art Education, Emotional Interaction

1. Introduction

As society progresses and evolves, the significance of education has increasingly come to the forefront. Ongoing educational reforms have led to the realization that traditional exam-centric approaches are unsustainable and do not align with the holistic development needs of students. This shift in perspective has given rise to a focus on comprehensive development, marking the emergence of quality education [1]. Concurrently, the swift advancement of the Internet has significantly transformed the educational landscape. However, while the Internet Centered media brings convenience to education, it also produces some problems. The biggest problem is the lack of emotional education caused by the prevalence of instrumentalism and utilitarianism. Emotional education is not only the most important content of personal development, but also the inevitable requirement of building a harmonious society. Art is an educational activity as important as moral education, intellectual education and physical education [2]. Its main task is to improve students' aesthetic quality, cultivate students' aesthetic concept, aesthetic consciousness and aesthetic ability, and guide students to form positive aesthetic interest and noble sentiment through aesthetic activities of artistic beauty, natural beauty, social beauty and scientific beauty. Art therapy is a psychotherapy technology mediated by art activities. It is a method and means to use art to treat some patients' physiological and psychological diseases in order to promote their rehabilitation.

As a new psychotherapy method, art therapy was introduced into China in the 1990s and gradually applied to the fields of education, medical treatment, justice and so on [3]. The approach, techniques, subject matter, and connections within therapy are crucial, as they mirror the evolution of an individual's character, distinct personality attributes, and subconscious layers. As art therapy is increasingly integrated into the mental health curriculum for high school students, it has emerged as a significant tool and strategy for fostering mental well-being at this educational level. The school should make full use of the advantages of taking the Internet intelligent platform as the media integration center, build a two-way interactive mode of the Internet, find the entry point for high school students' art education and emotional education, develop the potential of students' emotional education, cultivate students' humanistic feelings, and improve students' innovation ability [4]. Drouin believes that the lack of understanding of educational information system will directly affect the importance of developing, designing and popularizing Internet communication technology, rich resources and fast information to contemporary teaching construction in art teaching practice [5]. Andrelchik points out that the existing information systems in art education tend to overly emphasize superficial aspects like updating hardware, online coursework, and multimedia presentations. This approach essentially dresses traditional teaching methodologies in digital garb, failing to harness the true potential of educational technology in terms of interaction, monitoring, evaluation, and feedback within the teaching process [6]. Dell'erba research shows that using network education information system teaching can organize various types of open or semi-open teaching modes in more flexible and diverse forms, and better integrate rich network resources into the teaching mode [7]. Art therapy focuses on one's inner experience, not the final product. Leandro's research shows that through the process of artistic creation, it can alleviate emotional conflicts, purify emotions, improve the parties' insight into things, and is conducive to self-cognition and self-growth [8].

Lack of extracurricular resources for art education, weak campus art atmosphere and monotonous students' art life are also common problems in high school art education[9-10]. In the art class of Shanghai Senior High School under the background of art, teachers often use a single form of activity for teaching [11]. These activities seem to enable students to acquire knowledge, but they also bring some disadvantages [12]. From the perspective of students, a single form of activity is difficult to stimulate students' interest [13]. At the same time, due to the limitations of activities, students' ability can not be brought into full play [14],[15]. Taking the art curriculum education of senior high school students in Shanghai as an example, this paper discusses the implementation idea and effect of emotional interaction therapy based on Internet intelligent platform art education, and puts forward some implementation suggestions on the application of art and emotional education interaction therapy in senior high school students' mental health education. Therefore, this paper proposes the following innovations:

1. In this paper, a DNN with bottleneck layer is designed to extract the bottleneck features of emotional signals. DNN can compress the emotional information in the bottleneck layer, so that the bottleneck features have rich emotional information.

2. In this paper, the bottleneck features of different layers are extracted by setting the position of the bottleneck layer, and the features of different bottleneck layers are fused, and the students' emotion recognition is realized by combining a support vector machine.

The structure of this document is organized as follows: Chapter One serves as the introduction, setting the scene by delineating the research's backdrop, its relevance, and the innovative aspects of this study. Chapter Two delves into a synthesis of both national and international scholarly work on Internet-based smart platforms, focusing on their implications for art education and emotional interaction therapy for high school students, while also presenting this study's novel contributions and theoretical underpinnings. In Chapter Three, the methodology is thoroughly examined, detailing the application and theoretical underpinnings of pertinent algorithms, and introducing a fresh paradigm for art education and emotional interaction therapy, building on prior studies and the novelties introduced in this work. Chapter Four interprets the application of the algorithm, drawing from empirical findings. Finally, Chapter Five concludes by encapsulating the research findings of this study.

2. Related Works

Art therapy operates as a professional field where art, visualization, and the creative process, coupled with the client's interaction with these elements, are utilized to reflect an individual's growth, capabilities, persona, interests, dilemmas, and psychological battles. Grounded in the principles of human development and psychology, art therapy integrates assessment and therapeutic interventions, including educational, motivational, cognitive, and relational techniques. Its aim is to navigate emotional turmoil, foster self-awareness, enhance social competencies, regulate behavior, resolve issues, alleviate stress, support accurate self-perception, and bolster self-worth. Art therapists combine art theory, psychoanalytic theory, visual perception theory and other disciplines to analyze and evaluate the client's individualized art presentation, and use this as a diagnostic basis to treat the client to resolve emotional conflicts, improve social skills, and manage behavior, problem-solving, and anxiety reduction purposes.

In traditional teaching, Solfeggio is a technical training course which focuses on classroom teaching. In this paradigm teaching reform, Solfeggio is upgraded from classroom teaching to stage performance, and the results of paradigm teaching reform are highlighted through an on-site display. Changing the traditional written examination form of theoretical courses can evolve the theoretical course into the examination method of performance course, from classroom teaching to students' stage self-expression, and change the single written examination to stage work display.

2.1 Theory Review

Covic A, N Vonsteinbüchel, Kiese-Himmel C believe that speech is a common way of human communication, very natural and quick. The transmission of information and the communication between people are more convenient. Therefore, emotional signals contain semantic information and the emotional state of the speaker [16]. Davidson A·K, Lansley C, Costen and others proposed that under the conditions of modern social transformation and commodity economy, intense work, utilitarian pursuit and busy life make people almost have no time to take into account the needs and development of emotions. Become an oasis and rarity in the desert. In the current era when scientism prevails and utilitarianism and cognitivism in education are difficult to suppress, family education, school education, and social education pay very little attention to emotional development [17]. The research of Oatley K and Djikic M shows that emotion needs to be sublimated to a high-level emotional comprehension after forming a certain perception of artworks. Let students figure out and feel the emotions contained in the works of art, and turn static things into dynamic and rich things. The calm mood of the students was stirred up by layers of ripples and communicated with the works of art. While feeling the works of art, they have an independent sense of innovation [18]. Cui Y, Wang S and Zhao R believe that the research on art emotion recognition started relatively late, with a history of only more than 20 years. During this period, it has received extensive attention from relevant researchers around the world and achieved some impressive results. However, through a survey of the applied research listed above, we found that almost all research results are still

achieved in a laboratory environment, and the performance of the system is still far from our expected goals. No art emotion recognition system can stand the test of a practical application environment [19]. Ozeke MB proposed that digital teaching is based on digital technology, environment, resources and other conditions to improve students' basic learning ability, information literacy, innovative thinking ability, practical ability, interpersonal communication and cooperation spirit. Carry out digital teaching in basic art education, provide students with personalized and diversified learning, improve students' learning ability and learning efficiency, realize the digitization, informatization and modernization of art teaching, and adapt to the basic art under the background of "Internet + education" The development direction of education [20]. Flykt A, Hrlin T, Linder F et al. suggested that education cannot simply be considered immutable. We can only say that the impact of Internet development on education in the past was not strong enough to fundamentally change the entire educational ecological environment and update teachers' teaching concepts. However, when information technology has entered all aspects of our lives, the Internet has become one of the basic conditions for human survival, and information technology represented by computers and the Internet will lead to a comprehensive change in the educational ecosystem [21]. Tangguk and Ozkara Abo suggest that the essence of aesthetic education lies in nurturing students with refined aesthetic sensibilities. This encompasses a broad spectrum of attributes, including aesthetic perception, discernment, sentiment, exposure, and capacity. The aim is to structure and refine these elements systematically and logically, empowering students to perceive life and approach their future professions through an aesthetic lens [22].

2.2 Art Education and Emotional Interaction

Contemporary emotional education is based on the recognition of the historical inevitability and rationality of modern scientific development, so it never shies away from scientific and rational education [23]. It believes that the essence of science is human activity. Modern science and education only split the naturalness and culture of science, making science in modern society more subject to instrumental rationality than value rationality [24],[25]. Education is emotional. Through the transfer of emotion and the blending of art, the subject knowledge can be enriched, and students can have a deeper understanding of design works. Courses for art design majors should combine this emotion with it, broaden students' design ideas, and let students feel the connection between different art forms and majors, so as to avoid sticking to a single learning method [26]. Emotion belongs to the category of aesthetic education. The objective is to develop an individual's capacity for recognizing, experiencing, sensing, valuing, and producing beauty, thereby fostering a person's aspiration, sensitivity, integrity, and proficiency in the realm of aesthetics [27]. Also, [28] has illustrated that application of modern technology in public art education, and comprehensively proposes the guiding role of public art in aesthetic education.

3. Methodology

"Internet plus" is a new form in the information age. The re-integration of various resources in Internet technology and Internet thinking can allocate resources more effectively, thus improving product quality and providing more convenient services. In the information age, the Internet is bringing about unprecedented profound changes all over the world with its irresistible force. Emerging industries such as finance, Internet+medical care in Internet plus are developing rapidly. Several important differences between modern emotional education and traditional emotional education are as follows: traditional emotional education is based on human nature, with idealized transcendental subjects and beautiful yearnings. It is different from animal sexual impulses, which started from Aristotle's "Man is a rational animal". The educational process based on this view is the realization of preset goals, introduced goals and expected goals, and the results are often naive, romantic, pale and unscientific. Emotion recognition technology is to combine the emotional characteristics of signals with the corresponding classification models to obtain the final recognition results. Referenced in Figure 1, a comprehensive system for recognizing artistic emotions primarily encompasses stages such as preprocessing of emotional signals, extraction of key features, training of the model, computation of pattern matching, and the generation of outcomes.

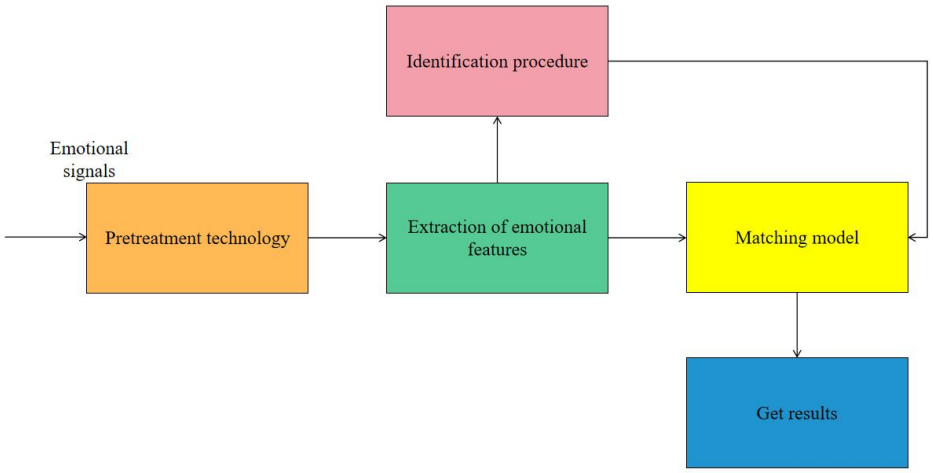

Figure 1. Emotion Recognition Model

Next, this paper compares Dis-EC emotion corpus with some representative emotion corpora at home and abroad. As shown in Table 1, we mainly compare some indicators including language, emotion category, database size and database type. The comparison shows that dis EC corpus can be positioned as a medium-sized, performance-oriented, Chinese emotional corpus containing four emotional states: happiness, anger, sadness and surprise.

Table 1. Auditory Recognition Results of Discrete Emotional Feature Database Dis-EC

Emotion type	Happy	Anger	Sadness	Other	Error Rate
Happy	268	0	9	4	4.75%
Anger	235	25	35	15	7.14%
Sadness	465	12	0	39	4.95%

In emotional signal processing, a short-term average zero-crossing rate is often used. It represents the number of times that the amplitude value of emotional signal is zero in each subframe. The short-term average zero-crossing rate of emotion signals can describe the frequency spectrum characteristics of signals to some extent, so the frequency spectrum characteristics can be roughly estimated. The short-term average zero-crossing rate is calculated as follows:

$$Z_m = \sum_{n=-\infty}^{\infty} \left|\operatorname{sgn}\left[x(n)\right] - \operatorname{sgn}\left[x(n-1)\right]\right| w(m-n) \tag{1}$$

Where Z_m represents the short-time average zero crossing rate of the emotional signal in frame m, $x(n)$ represents the emotional signal, $w(m)$ represents the window function, the length of the window function is N, and $\operatorname{sgn}[\ ]$ is the symbol function. At this time, the expression is:

$$\operatorname{sgn}\left[x(n)\right] = \begin{cases} 1, x(n) \geq 0 \\ -1, x(n) < 0 \end{cases} \tag{2}$$

It can be understood that when the signs of two adjacent samples are the same, and it is showed $\left|\operatorname{sgn}\left[x(n)\right] - \operatorname{sgn}\left[x(n-1)\right]\right| = 0$ does not generate zero-crossing; when the signs of two adjacent samples are opposite, $\left|\operatorname{sgn}\left[x(n)\right] - \operatorname{sgn}\left[x(n-1)\right]\right| = 2$ is twice the number of zero-crossings. Therefore, when calculating the short-term average zero-crossing rate of a frame, the sum must be divided by 2N. At this time, the window function is expressed as:

$$w(m) = \begin{cases} \dfrac{1}{2N}, 0 \leq m \leq N-1 \\ 0 \end{cases} \tag{3}$$

Fundamentally, a deep neural network is a unique form of multi-layer perceptron. It typically incorporates one or more hidden layers, structured as a sequence of stacked restricted Boltzmann machines. As depicted in Figure 2, the traditional DNN model consists of three primary sections: the input layer, hidden layer(s), and the output layer.

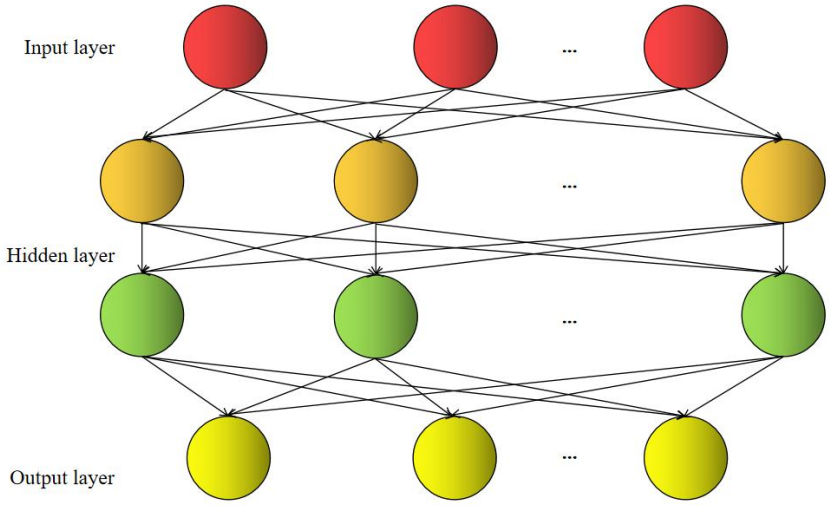

Figure 2. Traditional DNN Model

In a restricted Boltzmann machine, the value types of the neuron nodes in the visible layer and the hidden layer are also different. In every RBM (Restricted Boltzmann Machine), there is a visible layer vector V in the visible layer, and there is also a hidden layer vector h in the hidden layer. According to the energy theorem, a certain relationship can be obtained between them. This relationship has been given an energy value function by researchers, which is defined as:

$$E(v,h|\theta)=-\sum_{i=1}^{n}\sum_{j=1}^{m}W_{ij}v_ih_j-\sum_{i=1}^{n}b_iv_i-\sum_{j=1}^{m}a_jh_j \tag{4}$$

Where $v\in\{0,1\}^{N_v\times 1}, h\in\{0,1\}^{N_h\times 1}$ and θ represent the parameters in the whole RBM model, $\theta=\{W,a,b\}$ and W represent the weight matrix, a_i,b_j represents the threshold values of visual layer unit i and hidden layer unit j respectively, and W_{ij} represents the weight values of visual layer unit i and hidden layer unit j. At this time, this model can represent a vector free model, as shown in Figure 3.

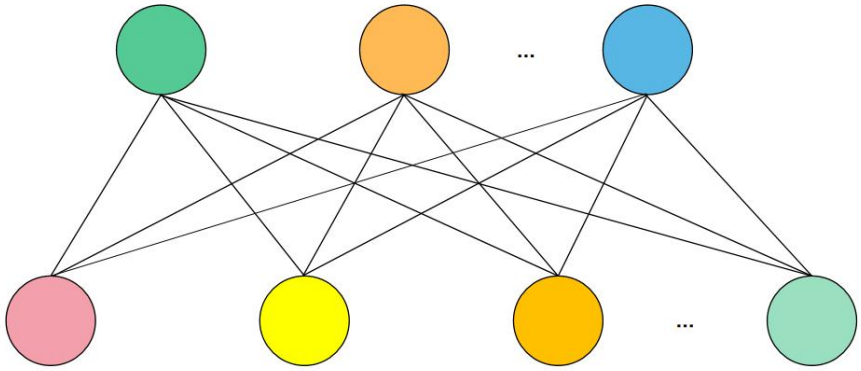

Figure 3. RBM Model

From the above, the probability function can be obtained as:

$$p(v,h|\theta)=\frac{e^{-E(v,h|\theta)}}{Z(\theta)} \tag{5}$$

Where $Z(\theta)=-\sum_{v,h}e^{-E(v,h|\theta)}$ represents a normalization factor. From the perspective of general

probability theory, the expression of probability distribution function v of visible layer $p(v|\theta)$ can be obtained as follows:

$$p(v|\theta)=\frac{1}{Z(\theta)}\sum_{h}e^{-E(v,h|\theta)} \tag{6}$$

At this time, we can start from the structural characteristics of RBM. When the neuron node state of the visible layer is determined, the neuron node state in the hidden layer is subject to conditional independence. At this time, the distribution function can be expressed as:

$$p(h|v,\theta)=\prod_{j}p(h_j|v,\theta) \tag{7}$$

The pre-training of RBM is essentially to learn the entire model parameters during the training process to make it fit the input data as closely as possible. Generally, a DNN is composed of several RBM through certain rules. In order to fully train the whole DNN, it is necessary to train the RBM of each layer and train each RBM layer by layer.

Each unit in the structure diagram of BP neural network has an activation function and is parameterized by the weight matrix W, where $W_{ij}^{(l)}$ represents the weight parameter of the l node in the j layer connected with the l+1 node in the i layer, $b_i^{(l)}$ represents the offset term of the l node in the i layer, $a_i^{(l)}$ represents the output value of the l node in the i layer, and the circle with "+ 1" mark represents the offset node, L_1 represents the input layer containing a single neuron node and a bias node, L_2 represents the hidden layer containing two hidden layer nodes, and L_3 represents the output layer containing one output node. Its general structure is shown in Figure 4.

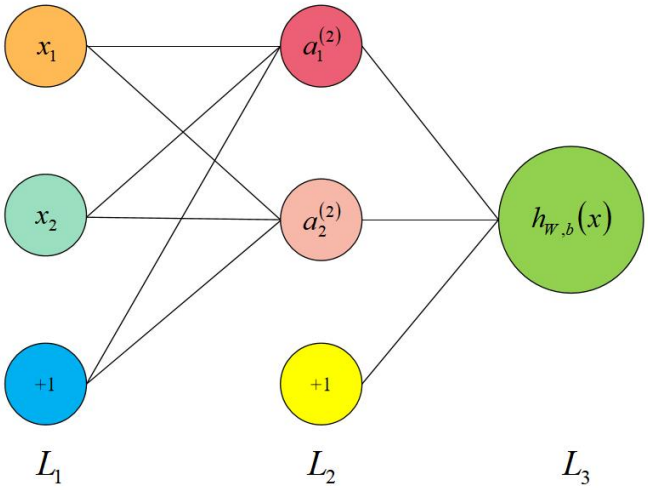

Figure 4. Basic Structure of BP Neural Network

At this time, the expression between each node is:

$$a_1^{(2)}=f\left(W_{11}^{(1)}x_1+W_{12}^{(1)}x_2+b_1^{(1)}\right) \tag{8}$$

$$a_2^{(2)}=f\left(W_{21}^{(1)}x_1+W_{22}^{(1)}x_2+b_2^{(1)}\right) \tag{9}$$

$$h_{W,b}(x)=a_1^{(3)}+f\left(W_{11}^{(2)}a_1^{(2)}+W_{12}^{(2)}a_2^{(2)}\right) \tag{10}$$

Where $h_{W,b}(x)$ is the result of the output layer. According to the above mathematical expression, n samples are used as the input layer of the neural network, and the neurons are propagated to the hidden layer after operation. At this time, the output generated from the hidden layer will be used as the input of the output layer, and then propagated to the output layer, and the final output will be obtained after the weights multiplication, bias and activation of the neurons themselves.

4. Results and Discussion

In order to verify that the algorithm proposed in this paper provides reasonable support for the development of art education and emotional interaction therapy for senior high school students in Shanghai. Therefore, this paper conducts experimental analysis on the basis of the above research,

hoping to get a strong conclusion on the development of art education and emotional interaction therapy under the Internet framework in the process of inputting the original data. People who appreciate the works and creators of artworks break the time and space restrictions through the works, and they have emotional resonance. The two sides really realize some form of communication through the works. When training DNN, batch size, learning rate and network structure are very important for the training of the model. According to the previous research on relevant parameters and experiments, the effect is the best when the batch value is 15. Too high batch value will lead to network overfitting and reduce the recognition efficiency. A learning rate of 0.015 is optimal, and a learning rate that is too high will cause the network to not be fully trained, resulting in a drop in the recognition rate. There are sample sets X1 and X2 as the experimental sets on the average emotion recognition rate and error occurrence rate, and the analysis results are shown in Figure 5 and 6.

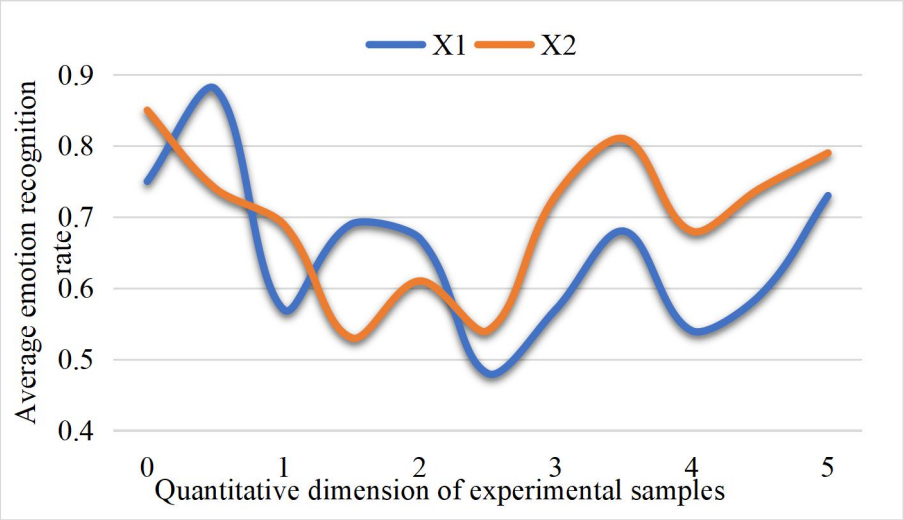

Figure 5. Analysis of the Average Emotion Recognition Rate

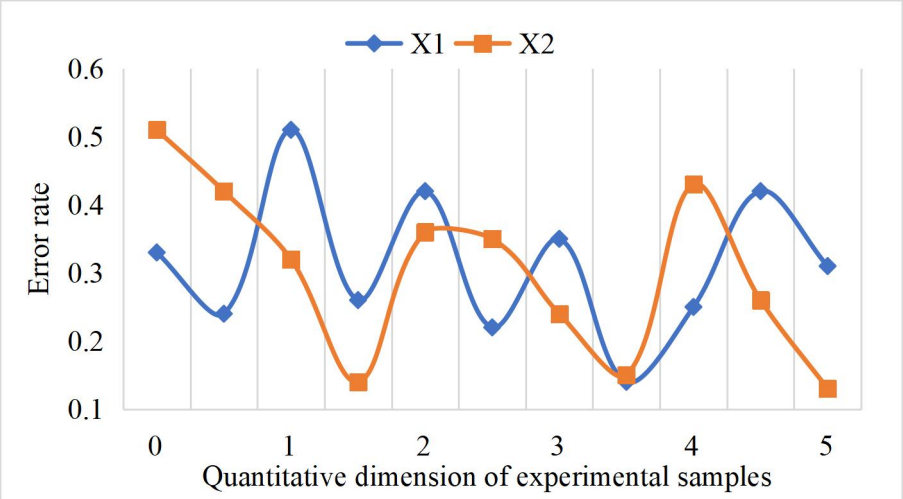

Figure 6. Analysis of the Incidence of Errors

As can be seen from the above figure, when the average emotion recognition rate is analyzed experimentally, the average emotion recognition rate will be above 40% in actual operation, which also ensures the connection between emotion and art education and the emotion recognition of each network node in DNN model. In the 1-3 interval, because there are too many neurons in the bottleneck layer, when the number increases, it will lead to feature-carrying noise, and a few neurons will also lead to insufficient features, resulting in the decline of recognition rate. Therefore, in general, the average emotion recognition rate can reach 61.4%. For the error occurrence rate, this is based on the general experimental data obtained after actual operation, which has practical significance. Comparing the two experimental sets, it can be found that the error is basically below

50% in the entire quantification axis, and it also shows a regular pattern. volatility. In the whole error analysis, the algorithm designed in this paper can avoid 75.4% error. On the basis of the above research, this paper designs and analyzes the unweighted recognition rate of discrete emotions and the recognition rate of emotional features under different size samples, and processes the data on the experimental sets Q and M, and there is a quantitative relationship of Q < M. The following are experimental analysis in Figure 7 and 8.

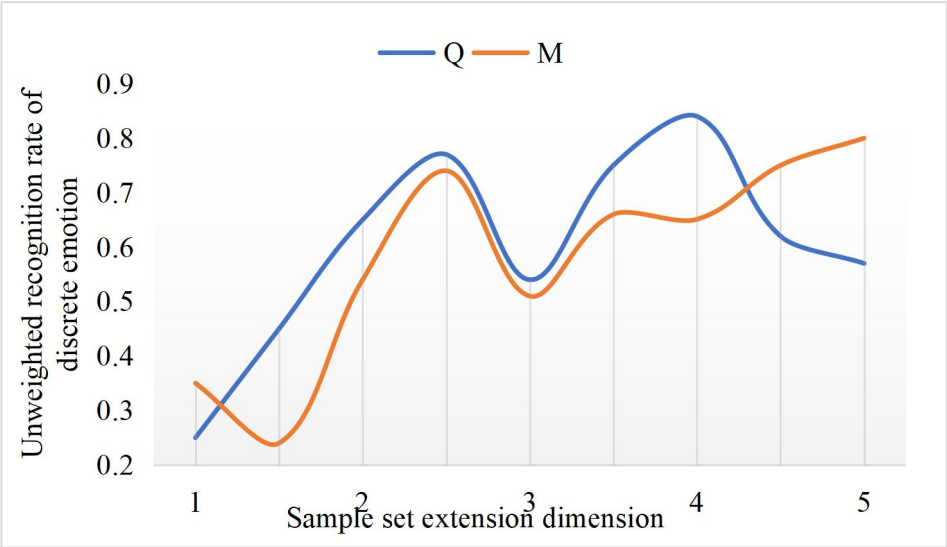

Figure 7. Unweighted Recognition Rate Analysis of Discrete Emotions

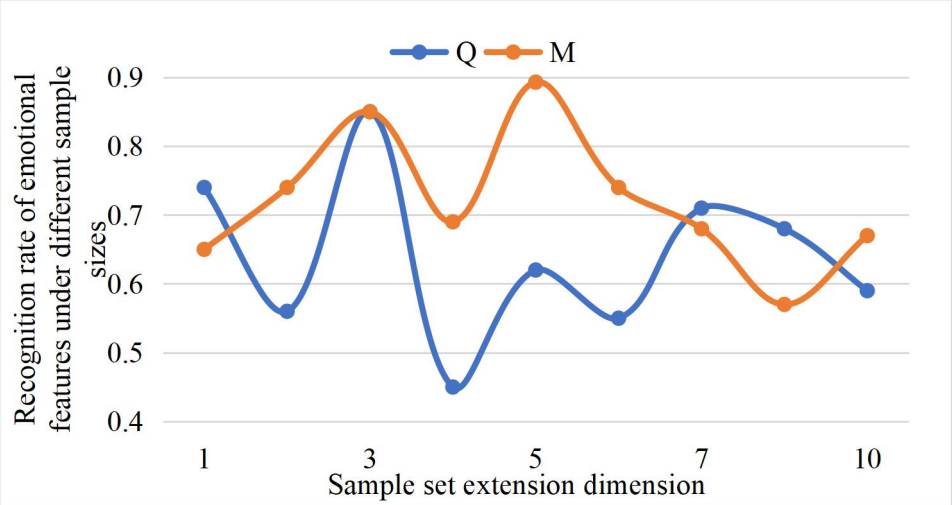

Figure 8. Analysis of Emotional Feature Recognition Rate under Samples of Different Sizes

It can be observed in the above figure that for any given number of codebooks, the classification performance of the system increases with the increase of codeword length; For any given codeword length, the classification performance increases with the increase of the number of codebooks. However, we should also be aware that both the larger number of codebooks and the length of codewords may impose a larger burden on the data transmission bandwidth. Therefore, for the unweighted recognition rate of discrete emotions and the recognition rate of emotional features under different sizes of samples, it is easier to extract the feature set with always large samples. In this case, the number of emotional signals is also a reflection of the feature quantity. Therefore, it is meaningful to improve the unweighted recognition rate of discrete emotion by 60.2%, and it can also deal with the unweighted situation well. The recognition rate of emotional features under different sizes of samples also has an average analysis intensity of 67.4%, which will greatly improve the fault-tolerant rate of the algorithm.

5. Conclusion

Appreciation of artworks can be understood as a mental process of the integration of our own feelings and our own cognition of society. For those who appreciate artworks, they must put in their true feelings, experience, observe and feel sincere. In this process, the appreciators need to cognize and understand the artworks themselves by combining their own life experience and knowledge, give full play to their various thoughts and emotions, and communicate with the creators of the works through their works. Based on the development of art education and emotional interactive therapy for senior high school students in Shanghai, under the framework of Internet, through the infiltration of emotional art education, many courses have become rich and interesting, and the classroom has become more active, especially the cultivation of students' thinking in images. In this paper, the research algorithm of artistic emotion recognition based on BP neural network firstly extracts different kinds of features, then combines them, and selects the appropriate combination of features as the input of BP neural network. DNN with bottleneck layer extracts bottleneck features of emotional signals. DNN can compress the related information of artistic emotion recognition at the bottleneck level, so that the bottleneck features have rich emotional information. Next, this paper extracts the bottleneck features of different layers by setting the position of bottleneck layer, and then combines the features of different bottleneck layers to realize artistic emotion recognition with support vector machine. Based on the experimental analysis, it can be seen that the average emotion recognition rate for general situations can reach 61.4%. In the overall error analysis, the algorithm designed in this paper can avoid 75.4% error. Therefore, it is meaningful to improve the unweighted recognition rate of discrete emotions by 60.2%, and it can also handle unweighted cases well. The recognition rate of emotional features under different sample sizes also has an average analysis intensity of 67.4%. There are many ways to promote students' emotional experience. As long as we fully mobilize the factors that stimulate emotions in art education, rationally use the ways of emotional regulation and constantly optimize the means of emotional regulation, we can greatly enhance students' interest in learning and strengthen their motivation for learning.

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