Artistic Appeal and Emotional Experience in Dulcimer Performing Arts in the Age of Intelligent Media

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Abstract: With the development of mobile Internet, big data, cloud computing, artificial intelligence and other technologies, the era of intelligent media has come, and intelligent technology is widely used in all aspects of media application. As a popular musical instrument for thousands of years, the dulcimer has rich artistic appeal and emotional experience. This paper aims to study whether the artistic appeal and emotional experience of dulcimer performance art have been affected in the era of intelligent media. This paper proposes the age of intelligent media and the importance of artistic appeal and emotional experience. From the data in the experiment, we can know that the development of dulcimer has become more and more rapid. The development trend of dulcimer has risen from a growth rate of 4.2% in 2005 to a growth rate of 13.6% in 2020, an increase of 9.4% in 2020 compared to 2005. It can be seen that the performing art of dulcimer performance is very important to people. It is also very meaningful to study the artistic appeal and emotional experience of dulcimer performance art in the era of intelligent media.

1. Introduction

Chinese folk music is the label and symbol of traditional Chinese national culture. In the long history of development, Chinese national musical instruments are one of the main material carriers for the dissemination and development of national music. Now, with the advent of the new media era, how to better promote and promote Chinese music culture, absorb the world's advanced music culture through new media, and improve people's musical cultural literacy is the pursuit of people's common goals and ideals.

The arrival of the new media era is a new opportunity and a new challenge for the development of various cultures and arts in society, and the development of dulcimer performance art is no exception. At this stage, the dulcimer performance art not only did not abandon the previous method, but also combined with the new media communication medium, and at the same time of the rapid development of the society, it also opened up a unique new type of performance art.

The innovations of this paper are: (1) This paper introduces the theoretical knowledge of the era of intelligent media and dulcimer performance art, and uses neural networks to analyze the importance of big data in emotion analysis in dulcimer performance art. (2) This paper expounds artificial neural network and convolutional neural network. Through experiments, it is found that the age of intelligent media can enhance the artistic appeal of piano performance art.

2. Related Work

The appreciation of music is inseparable from a strong artistic appeal and a good emotional experience. A J P found that the 'affective' and 'cognitive' neuroscience approaches to understanding emotion represent a potential synergy, but this theoretical point has not been tested. Here, he presents an exchange that concludes with a summary of the agreement and divergence of views, and a description of future experiments that may help resolve the remaining disputes. He also went further to investigate whether subcortical activation alone could produce emotional experiences. But he did not elaborate further on this future experiment [1]. Balzarotti S proposes a dimensional semantic model of emotion, positioning it in a four-axis space, in an attempt to quantify, rather than label, emotion that is thought to be changing over time. Although he proposed the model, he did not articulate the model clearly, making the usability of the model unproven [2]. The purpose of the Umasuthan H study was to assess the impact of two empathy dimensions (cognitive and affective attributes) on guests' emotional service experience and behavioral intentions, and to empirically compare the subjects' perceptions of empathy attributes. The survey is designed to examine how well hotel staffs are emotionally handling hotel guest incidents or inquiries related to any discomfort through personalized attention. Although he was very clear about his purpose, he did not explain the experimental subjects, nor did he have corresponding experimental data [3]. The purpose of the Miloevi M study was to examine the relationship between dimensions of emotional experience, emotional quality, and assessments of content familiarity. There are 92 participants rated their familiarity with the content of 40 photos. The photos are picked from a database and systematically varied according to the dimension and quality of the emotional experience. Although he had specific experimental subjects, he did not summarize his own experiments, nor did he mention what the conclusions were [4]. Romanov K M found that the characteristics of affective culture reflect the socially accumulated affective experience, which is regarded as an integral part of the overall culture. Its content includes psychological knowledge, emotional management and practical skills, and attitudes toward people, and the purpose of the study is to identify the emotional content of culture. Although he mentioned that the purpose of his experiment was to determine the emotional content of culture, he did not give a detailed introduction to the data and results after his experiment [5]. According to the network social mobilization theory and resource mobilization theory, Yang Y takes environmental documentaries as the research object, analyzes the network resource mobilization mechanism from three dimensions of resources, framework and members, and studies how to use resource mobilization to achieve the expected communication effect in the new media environment. In addition, he explores the problems in online mobilization of environmental issues and proposes alternative research methods for the future. Although he has a clear research object, he does not describe how to use resource mobilization to achieve the desired communication effect [6]. Willis B found that for the music industry, media ended up being the primary method of music delivery. While physical media remains popular in industrialized countries, more than 50% of the world's music lovers can now enjoy their music entirely without physical media, a trend that has seen double-digit growth for several years. Although he mentioned that all music lovers now use new media to create music, he did not compare traditional media with new media, which does not reflect the advantages of new media [7]. Wang C found that in the

context of the comprehensive development of Internet big data, the use of digital art technology to help transform technological innovation capabilities into real productivity is a new opportunity for digital cultural innovation and a rare opportunity for digital media disciplines in colleges and universities. How to seize opportunities and meet challenges is a problem that the cultural and creative industry must face. He analyzed the opportunities and risks brought by the era of big data to the cultural and creative industries of colleges and universities, but he did not explain the opportunities and risks in detail, nor how to solve these risks [8].

3. Artificial Intelligence-based Neural Network

3.1. The Development of Dulcimer Performing Arts

Dulcimer is worldwide, due to the differences between Chinese and Western cultures, dulcimer developed quickly after it was introduced into China, and was integrated into China's own national musical instrument by Chinese culture, economy and humanities. Dulcimer is a kind of plucked musical instrument that strikes the strings. According to the size of the body, the thickness of the strings, and the level of the sound range, the dulcimer is divided into high-pitched dulcimer, alto dulcimer, and bass dulcimer [9].

The dulcimer's playing form is also very rich. When dulcimer was first settled in China, it was displayed in the form of solo. It is common for dulcimer to accompany opera in the process of being sinicized. Later, in the academy, it accompanies the erhu, flute and other instruments. With the continuous improvement of techniques and the level of works, the dulcimer also has duet, unison and other performance forms [10]. The art of dulcimer playing is shown in Figure 1.

Figure 1. The art of dulcimer performance

As shown in Figure 1, the playing style of dulcimer is quite rich, and the playing emotion it contains is also very huge. It can not only play a light and cheerful style, but also express melancholy and sad emotions. It can show the different geographical landscapes of various ethnic groups in China, the personalities of different people and the different musical artistic conceptions through the unique playing techniques of dulcimer [11].

Intelligent media can not only be used as a means of information exchange and dissemination to meet the various needs of social life, but also enable the diversified development of art forms and promote the innovation of art forms [12]. As a new art form in the information age, new media art

has replaced the innovation in artistic concept and production method with the pioneering attitude of cutting-edge art, and has become a new trend of humanistic art in this era. Smart media is shown in Figure 2.
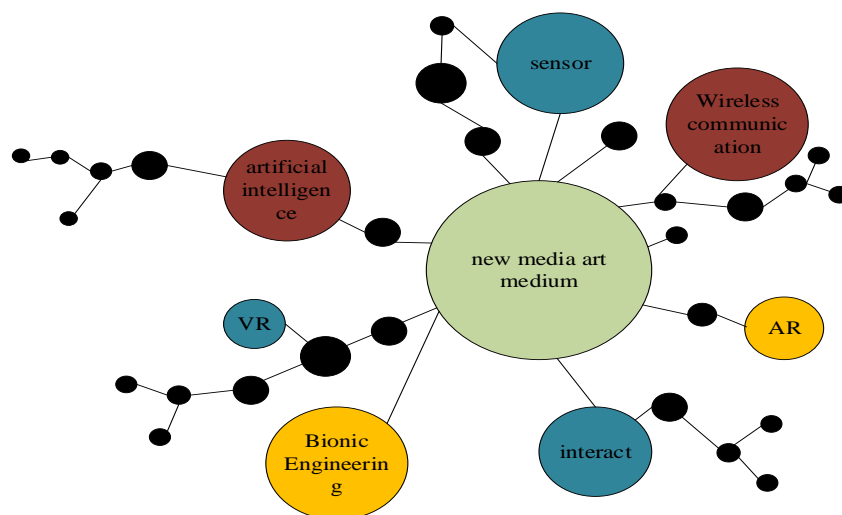

Figure 2. Smart Media

As shown in Figure 2, traditional art forms exist relatively in a solid and relatively static form. However, new media art has begun to no longer be limited to the traditional limited two-dimensional space and fixed state, and more emphasis is placed on the artist's ideological expression, public participation and public experience. People are in the sharing space created by the artist to express their subjective consciousness, sharing and communicating with the artist [13].

The appeal of art is also the charm of art. Excellent works of art in history have infected countless art lovers in different eras. The existence of artistic charm is due to the reliability and depth of social life reflected by art works. These artistic images or artistic concepts adapt to specific human attributes under specific practical conditions [14]. The appeal of art is shown in Figure 3.

Figure 3. The appeal of art

As shown in Figure 3, the emergence of new media breaks through the conceptual limitations of traditional dulcimer performing arts, using the latest science and technology as a means of dulcimer

performing arts, providing technical support for dulcimer performing artists' artistic practice and a new medium for expressing their views [15]. The new media used in new media art are all advanced scientific and technological achievements, and the progress of science and technology has made the practice of dulcimer performance art feasible today [16].

3.2. Neural Network Classification Algorithm

Artificial neural network is a new computing system, its main idea is to simulate human brain neural organization, artificial neural network simulates the operation characteristics of human brain neural network, and to some extent simulates some functions of human brain [17]. The perceptron is the simplest neural network model, and the basic structure of the perceptron is shown in Figure 4.
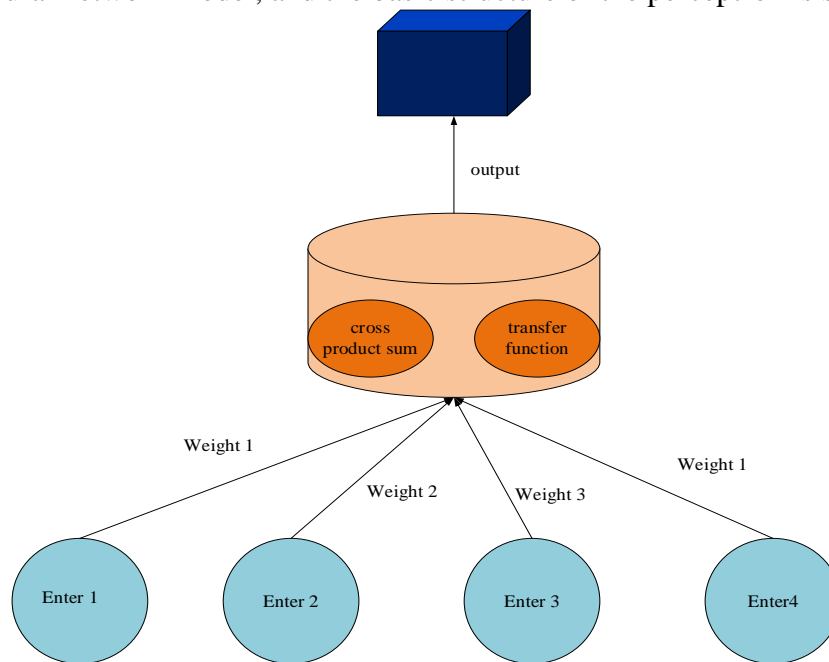

Figure 4. Perceptron model

As shown in Figure 4, let p, q, r represent the number of neurons in the input layer, hidden layer and output layer, respectively. $a_1, a_2, ..., a_p$ is the input layer, and $l_1, L_2, ..., L_q$ is the hidden layer. If the transfer functions of the hidden layer and the output layer are $f^{(1)}(a)$ and $f^{(2)}(a)$, respectively, the calculation method of the output layer is formula 1:

$$b_j = f^{(2)}\left(\sum\nolimits_{i=1}^{q}\left(l_i \cdot w_{ji}^{\{2\}} + b_j^{\{2\}}\right)\right)$$

(1)

Among them, l_i is calculated by formula 1, which is formula 2:

$$l_i = f^{(1)}\left(\sum\nolimits_{i=1}^{p}\left(l_i \cdot w_{ji}^{\{1\}} + b_j^{\{1\}}\right)\right)$$

(2)

Generally, the perceptron can solve the classification problem, but the perceptron cannot solve some characteristic problems, so the neural network in the general sense is a two-layer neural network [18]. The neural network structure is shown in Figure 5.
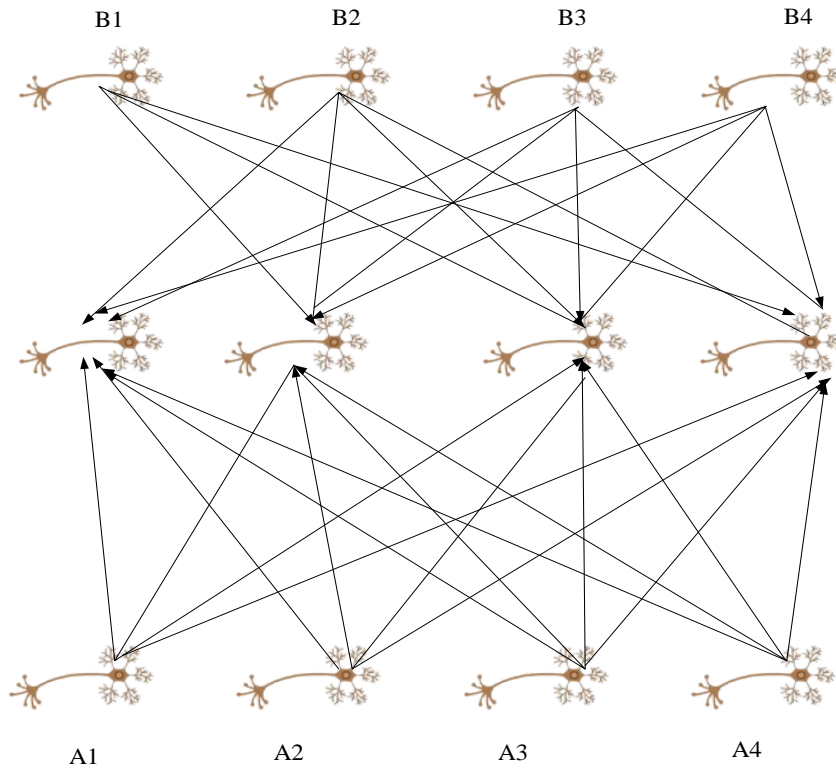
Figure 5. Neural network structure

As shown in Figure 5, in general, the more nodes in the hidden layer, the higher the accuracy of the neural network model and the longer the training time. The calculation formula of the number of neurons q is as formula 3:

$$q \pi \sqrt{p} + r + a, a \in [0,1]$$

(3)

The adjustment method of the weights in the network is formula 4:

$$\Delta W_{ij} = \eta s \lfloor w_{ij}, A, d_j \rfloor A$$

(4)

Among them, ΔW_{ij} is the weight from neuron i to neuron j, and η is the learning rate.

Emotional computing refers to the process of using scientific and technological methods to enable computers and humans to express self-emotion and achieve a more harmonious interaction between humans and computers [19].

3.3. Convolutional Neural Network (CNN)

The structure of convolutional neural network is similar to multilayer perceptron. The learning ability of this structure is very strong, and it can learn the relationship of high-dimensional, nonlinear and complex mapping, and it has been widely used in image recognition tasks, speech recognition tasks and other fields [20]. The convolutional neural network structure is shown in Figure 6.
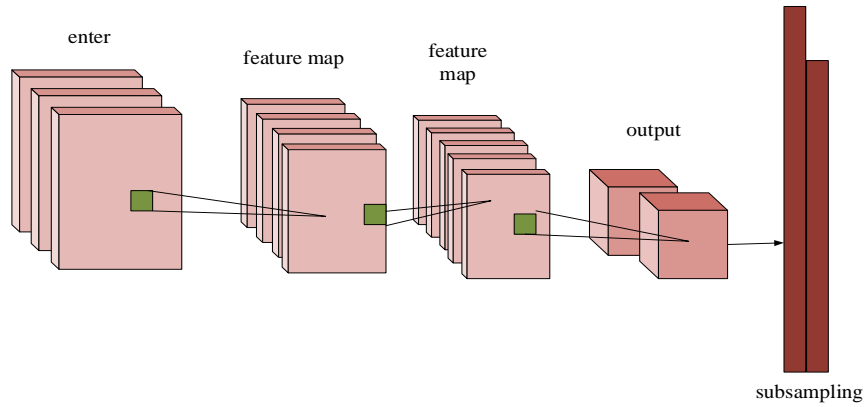
Figure 6. Convolutional neural network

As shown in Figure 6, the convolutional neural network structure is mainly composed of convolutional layers, aggregation layers and fully connected layers. The form of the convolutional layer is as shown in formula 5:

$$a_j^l = f\left(\sum_{i \in M_j} a_j^{l-1} * k_{ij}^l + b_j^l\right)$$

(5)

Among them, $f(\bullet)$ represents the activation function, and k_{ij}^l represents the convolution kernel weight.

The pooling layer samples the input feature data. If the input layer has n feature data, the output layer also has n feature data. In order to reduce the amount of calculation and make the output feature data smaller, the pooling layer adopts downsampling, and its general form is formula 6:

$$a_j^i = f\left(\beta_j^l down\left(a_j^{i-1}\right) + b_j^i\right)$$

(6)

Where $down(\bullet)$ represents the downsampling function. The reverse derivation of the fully connected layer is formula 7:

$$\frac{\partial J}{\partial w(l)} = \delta\left(a^{(l-1)}\right)^T$$

(7)

Since the convolutional layer is not fully connected, the reverse conduction of the neurons in the convolutional layer needs to be up-sampled, which is formula 8:

$$\delta_i^{(l)} = \beta_i^{(l+1)}\left(a\left(u_i^l\right) \cdot up\left(\delta_i^{(l+1)}\right)\right)$$

(8)

Where $\beta_i^{(l+1)}$ represents all the elements traversed, and $a\left(u_i^l\right)$ represents the matrix formed by the connected related elements.

3.4. Improved CNN Algorithm

In the process of training the convolution kernel weight k_{ij}^l in the traditional convolutional neural network, the convolution kernel weight is updated through the back-propagated error, and its general form is as shown in formula 9:

$$k_{ijnew}^{l} = k_{ijold}^{l} - \eta \times d_{ij}^{l} \tag{9}$$

Since traditional convolutional neural networks can easily exceed extreme values during training, traditional algorithms may lead to unstable weight updates of convolutional kernels as the number of iterations increases. Therefore, this paper proposes an improved algorithm [21], which is formula 10:

$$k_{ijnew}^{l} = k_{ijold}^{l} - \left(1 - a \times (i / e)\right) \times d_{ij}^{l} \tag{10}$$

Where e represents the total number of iterations of training. The input feature data of the convolutional neural network is shown in formula 11:

$$A_n = n \times \begin{bmatrix} a_{1,1} & a_{1,2} & a_{1,n} \\ a_{2,1} & a_{2,2} & a_{2,n} \\ a_{n,1} & a_{n,2} & a_{n,n} \end{bmatrix} \tag{11}$$

Among them, A_n is the input feature data of the enlarged convolutional neural network. This paper also studies the differences between the traditional CNN algorithm and the improved CNN algorithm, as shown in Table 1 and Table 2.

Table 1. Experimental data of traditional CNN models

Traditional CNN model	Iterations / times	Convergence iteration times/time	Training speed/sec	Misrecognition rate/%
1	30	10	453	45.87
2	30	8	480	43.93
3	30	11	502	40.70
4	30	13	500	46.05
5	30	12	490	48.72

Table 2. Experimental data of the improved CNN model

Traditional CNN model	Iterations / times	Convergence iteration times/time	Training speed/sec	Misrecognition rate/%
1	30	20	351	54.93
2	30	17	280	56.71
3	30	15	276	55.65
4	30	18	260	58.39
5	30	16	325	56.80

As shown in Table 1 and Table 2, the error recognition rate and convergence iteration number of the improved CNN model are much lower than those of the traditional CNN model, and the speech emotion recognition effect is the best. Although the error recognition rate has not been reduced much, combined with the improved algorithm in this paper, the effect of speech emotion recognition has been significantly improved.

3.5. Extraction of Emotional Features

Extracting emotional features from speech signals is the main focus of speech emotion recognition, and the quality of the extracted features directly affects the quality of the recognition system. To obtain high-quality sound signals, the sound signals must be processed before analyzing and extracting emotional features. The pre-emphasis filter can be formula 12:

$$H(z) = 1 - \mu z^{-1} \tag{12}$$

It can be seen, the filter emphasizes the high frequency part of the signal, where μ is the pre-emphasis factor. This paper uses a dual threshold method to detect the end point of a speech signal. In this method, a dual threshold of short-term energy and short-term zero-crossing rate is used to determine the start and end points of the sound. The short-term energy of the speech signal is formula 13:

$$E_n = \sum_{m=-\infty}^{\infty} [a(m)w(n-m)]^2 \tag{13}$$

In formula 13, $a(m)$ is the speech signal, $w(n)$ is the window function, and the discrete signal is expressed as formula 14:

$$ZCR = \sum_{n=1}^{N-1} |\text{sgn}[a_i(n)] - \text{sgn}[a_i(n-1)]| \tag{14}$$

Among them, $a_i(n)$ is the ith frame speech signal, N is the frame length, and $\text{sgn}(a)$ is the sign function, which is defined as formula 15:

$$\text{sgn}(a) = \begin{cases} 1, a \geq 0 \\ -1, a \pi 0 \end{cases} \tag{15}$$

Compared with the silent and unvoiced parts, the voiced part of speech has a larger volume and higher short-term energy. By setting the short-term energy threshold, the voiced part of the speech can be effectively detected, and the noise can be reduced to a certain extent. For the digitized speech signal $R(k)$, the autocorrelation function is formula 16:

$$R(k) = \sum_{m=-\infty}^{\infty} a(m)a(m+k) \tag{16}$$

Considering the interference of formants, in order to improve the accuracy and reduce the probability of misjudgment, the center clipping process should be performed on the speech signal, which is formula 17:

$$b(n) = \begin{cases} a(n) - L, a(n) \phi C_L \\ 0, |a(n)| \leq C_L \\ a(n) + L, a(n) \pi -C_L \end{cases} \tag{17}$$

Among them, C_L is clipping. This paper adopts the linear prediction method, which is a relatively common digital signal processing method. The linear prediction method can be expressed as formula 18:

$$H(z) = \frac{G}{1 + \sum_{k=1}^{p} a_{kz}^{-k}}$$

(18)

In formula 18, G is a constant, and a_k is the linear prediction coefficient (LPC), which can be obtained by the LPC method. The resulting prediction relationship in the time domain is formula 19:

$$a(n) = -\sum_{i=1}^{p} a_i(n-i)$$

(19)

Among them, $a(n)$ is the predicted value, and the selection of the pole position $(n-i)$ can be obtained by the peak selection method. This paper compares traditional music feature extraction and neural network-based feature extraction, as shown in Figure 7.
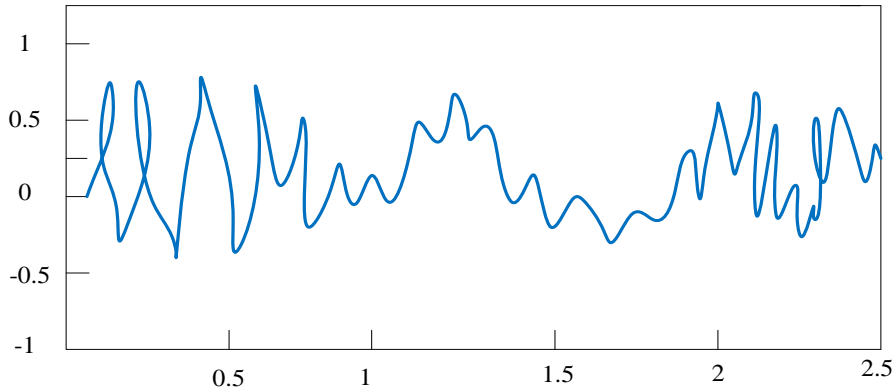
(a) Traditional music feature extraction recognition rate
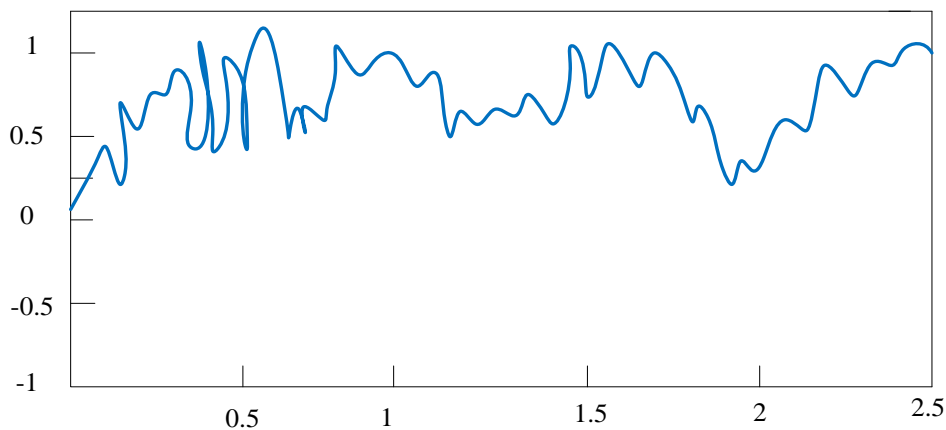
(b) Recognition rate of feature extraction based on neural network

Figure 7. Traditional music feature extraction and neural network-based feature extraction

As shown in Figure 7, the recognition rate of feature extraction based on neural network is

significantly higher than that of traditional music feature extraction, and the operating efficiency is also higher than that of traditional music feature extraction.

4. Experiment and Analysis of Dulcimer Performing Arts in the Era of Intelligent Media

4.1. Experiment and Analysis of the Development Trend of Dulcimer

When it comes to music performance, especially the art of dulcimer performance, as a kind of music art that is booming, has more and more scale and influence. From a single musical instrument to an important member of the national musical instrument, this is a progress that cannot be ignored. How to better express the mood, image and artistic conception of the work, and how to obtain the connotation and emotion of music through the performance of the work, is the focus of current research. On the one hand, these studies can improve and enhance the practical ability of music performance art, and on the other hand, they can further study the emotional relationship between music and people, and play a reference role for performance art. This paper analyzes the development trend of dulcimer from 2005 to 2020, as shown in Figure 8.

(a) Development trend of dulcimer from 2005 to 2012

(b) Development trend of dulcimer from 2013 to 2020

Figure 8. Development trend of dulcimer from 2005 to 2020

As shown in Figure 8, in ancient times, dulcimer has been popular all over the north and south. Later, it communicated and merged with Chinese folk music, and the playing form of dulcimer developed from a single solo to ensemble, unison, and important instruments that accompany other string and wind instruments. Today, the Chinese dulcimer system has become the world's dulcimer, and it is undeniable that it integrates with the national character.

This article surveys 6 dulcimer enthusiasts, whose basic information is shown in Table 3.

Table 3. Basic information of the 6 dulcimer enthusiasts

Object of investigation	Age	Gender	Years of playing
Lovers 1	36	Male	13 years
Lovers 2	32	Female	10 years
Lovers 3	28	Female	8 years
Lovers 4	26	Male	11 years
Lovers 5	30	Female	20 years
Lovers 6	21	Female	16 years

As shown in Table 3, among the 6 dulcimer fans, there are 4 women and 2 men, indicating that women are more interested in dulcimer performance than men. The age range of these 6 dulcimer lovers is between 21 and 36 years old, and the years of study have reached 8 years or more, indicating that they have been practicing dulcimer since they were young.

In this paper, 100 dulcimer listeners have been surveyed on the factors they consider emotional experience. The basic situation of these 100 dulcimer listeners is shown in Table 4.

Table 4. Basic information of 100 dulcimer listeners

		Number of people	Percentage	Will play
Gender	Male	67	67%	YES
	Female	13	13%	NO
Age	10-25	10	10%	YES
	25-40	27	27%	YES
	40-55	45	45%	NO
	55-65	18	18%	YES

As shown in Table 4, 67% of the 100 dulcimer listeners are female, and 45% of them are 40-55-year-old listeners.

4.2. The Performing Arts of Dulcimer Performance in the Era of Intelligent Multimedia

This paper analyzes the factors affecting emotional experience in dulcimer performance and the types of emotional experience in dulcimer art, as shown in Figure 9.

As shown in Figure 9, the factors that affect the emotional experience in dulcimer performance are as follows:

(1) Good hearing experience

Regarding vocal music, it is first necessary to explore sound. In the process of vocal music learning, it is very necessary to perceive the basic nature of music. In the case of experiencing the basic emotions of the work and the rich musical experience, a good auditory experience can enhance the emotional experience.

(2) Emotional experience

Emotion is a stable and long-term subjective experience. If want to accurately match the emotional changes of a certain period with the emotional changes of dulcimer performance art, it need a good emotional experience to support.

(3) Aesthetic perception

Sound aesthetics develops vocal technology, the development of vocal technology promotes the development of aesthetic consciousness, and the development of aesthetic consciousness promotes emotional experience. People's perception system is becoming more and more sensitive and perfect, which is also accompanied by the completion of emotional experience.
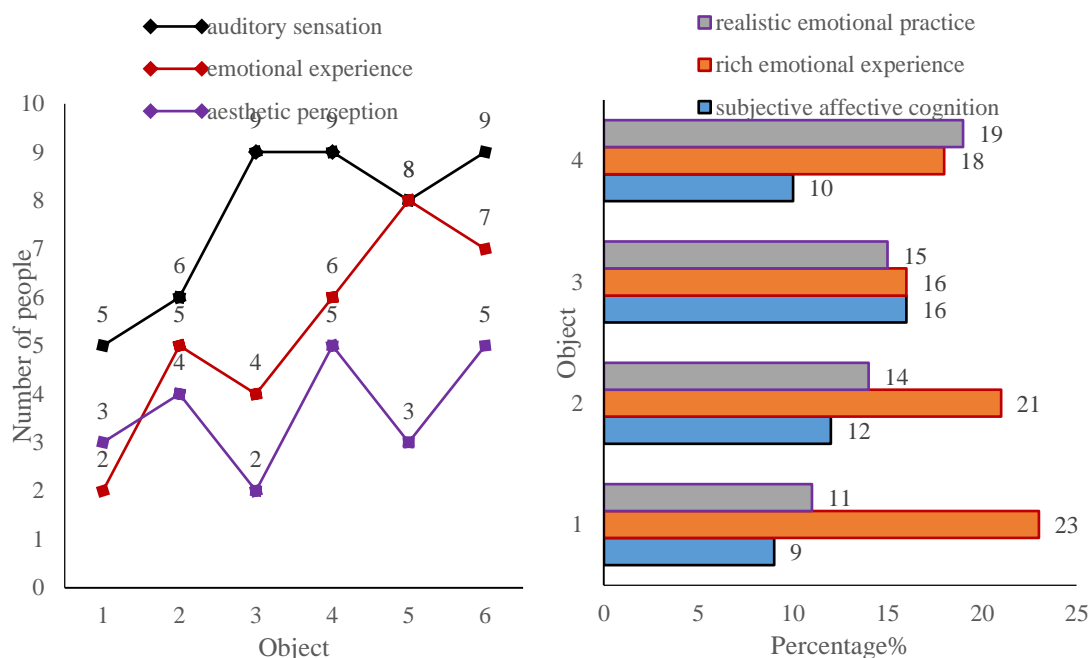
(a) Factors affecting emotional experience in dulcimer performance

(b) The types of emotional experience of dulcimer art

Figure 9. Factors affecting emotional experience in dulcimer performance and types of emotional experience in dulcimer art

The types of emotional experience in dulcimer art are as follows:

(1) Subjective emotional cognition. As an expression of emotion, music is one-sided in form, and its subjectivity is given artificially. The art of dulcimer performance uses very individual musical vocabulary, which constantly affects people's subjective world and makes people have various emotional experiences.

(2) Rich emotional experience. The art of dulcimer performance is another form of the art of living where the audience can relate to the dulcimer players. While appreciating the art of dulcimer playing, the audience can feel the emotional experiences contained in the music, and these experiences can even have an important influence on the connoisseurs, determining their worldview and values.

(3) Realistic emotional practice. The art of dulcimer performance brings rich subjective experience to the audience. The author of dulcimer performance art integrates his own emotional elements into the work, and the performer expresses his emotions in the performance, making the work and the author's experience as one.

In the world contemporary art, new media art can flourish, and cannot be separated from digital technology and network technology. This paper analyzes and compares the artistic appeal and emotional experience in the traditional dulcimer performing arts and the artistic appeal and emotional experience in the dulcimer performing arts in the intelligent age, as shown in Figure 10.
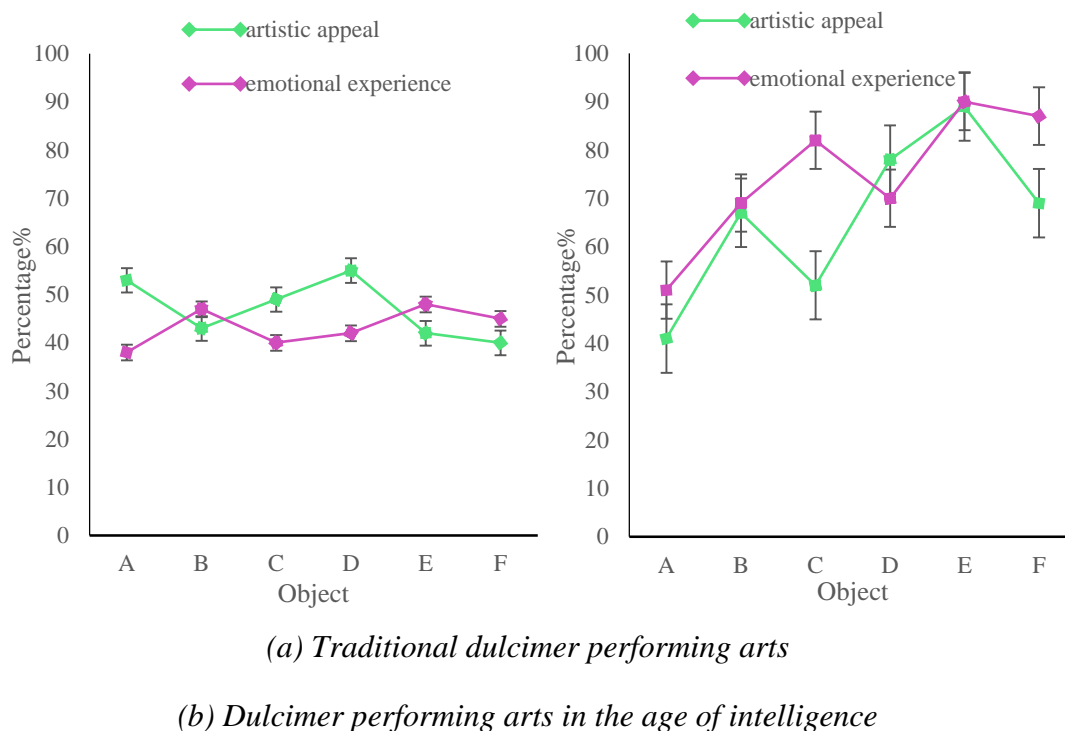
(a) Traditional dulcimer performing arts

(b) Dulcimer performing arts in the age of intelligence

Figure 10. Traditional dulcimer performance art and dulcimer performance art in the age of intelligence

As shown in Figure 10, there is indeed a big difference between traditional media art and dulcimer performance art in the intelligent age. First of all, the basic feature of the intelligent age is the art of the times, which reflects the characteristics of the times and today's productivity. Moreover, when it comes to actual creation, it is more advanced and inclusive than traditional art in terms of form aesthetics, selection of media and materials, and application of technical means. The appeal of dulcimer performance art in the age of intelligence is much stronger than that of traditional performance art, and the emotional experience has also become richer.

5. Discussion

This paper discusses the role of the intelligent media era on the artistic appeal and emotional experience of dulcimer performance art, describes the theoretical knowledge related to the intelligent media era and dulcimer performance art, and focuses on the research on artistic appeal and emotional experience. This paper explores the development of dulcimer performance art, and discusses the significance of the intelligent media era to the artistic appeal and emotional experience in dulcimer performance art through experimental analysis. Finally, it is found that the intelligent media era can promote the development of dulcimer performance art.

This paper also studies the neural network, and analyzes the neural network before and after the improvement, and finds that the improved convolutional neural network can play a more important role in sentiment analysis. This not only improves the recognition rate, but also improves the operating efficiency.

From the experimental analysis in this paper, we can know that the era of intelligent media can not only improve the artistic appeal of dulcimer performance art, but also greatly enhance the emotional experience in dulcimer performance art, so that people are satisfied both visually and

auditorily.

6. Conclusion

Whether in ancient times or in today's technologically advanced era, musical instruments have always been popular with people. Musical instruments can not only arouse people's emotional resonance, but also cultivate people's sentiments. Therefore, people have always attached great importance to musical instruments. As a classical and elegant music, dulcimer is even more intoxicating. The artistic appeal and emotional experience of dulcimer performance art are very strong. However, the traditional dulcimer performance art has not kept pace with the times. Therefore, this paper analyzes the artistic appeal and emotional experience of dulcimer performance art in the era of intelligent media. This article revolves around dulcimer performance art and the age of intelligence, and expounds the importance of combining the two. In the method part, a neural network is proposed based on the era of intelligent media, which can be applied to people's sentiment analysis. In the experimental part, this paper analyzes the development of dulcimer, and finds that the development of dulcimer has become more and more rapid in recent years. The experiment also compared the artistic appeal and emotional experience in the traditional dulcimer performing arts with the artistic appeal and emotional experience in the dulcimer performing arts in the age of intelligent media. It is found that the artistic appeal and emotional experience of dulcimer performing arts in the age of intelligent media are much stronger than those of traditional dulcimer performing arts.

Funding

Data Availability

Data sharing is not applicable to this article as no new data were created or analysed in this study.

Conflict of Interest

The author states that this article has no conflict of interest.

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