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Visual Modeling of Music Teaching Integrating Image Processing and Visualization

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Abstract. The use of computer and visualization technology in music teaching can make teaching activities more novel and interesting and attract students' attention. Based on this, this article discusses how to combine computer image processing with CAD technology and apply it to the visual modeling of music teaching. Firstly, the structural music features are extracted and calculated, the comprehensive visualization design is carried out to realize the visualization method of highlighting the main melody. Finally, the experiment accurately verified the feasibility proposed. The results show that the accuracy of the algorithm can reach 94% and the error is only 5.14. In addition, the operation efficiency of the algorithm is high, and the overall idea is achieved. Combining computer image processing technology with CAD technology, it adds concrete content expression to music visualization. This research provides methods for visual modeling of music teaching, and has important theoretical and application value.

Keywords: Computer Image Processing; CAD Technology; Music Teaching; Visualization
DOI: https://doi.org/10.14733/cadaps.2024.S10.285-299

1 INTRODUCTION

Computer image processing and CAD technology are widely used in the collection, storage, management, analysis, and visualization of spatial data. Computer image processing technology can also be used for tasks such as image classification, object recognition, and change detection, further improving the application efficiency and accuracy of information systems. Audio and text are the two main ways of expressing emotions, so emotional recognition of audio text has important research value. However, audio and text data have different features and structures, and how to effectively combine these two types of data for emotion recognition is a challenging issue. Traditional audio text emotion recognition methods are mainly based on feature extraction and machine learning algorithms, but these methods often find it difficult to fully explore the emotional information in audio signals, and their ability to express different emotions is limited. Cai et al. [1] solved the above problem by using recurrent neural networks (RNNs) for sentiment classification of audio signals. At the same time, attention mechanism is introduced to weight audio features, automatically adjusting the weights of different features to improve the accuracy of emotion classification. The experimental results show that this method has high accuracy and stability in audio text emotion recognition. And uses a short-term memory network (LSTM) to process text data. Finally, sentiment classification is performed through a fully connected layer (FC). The model is established using a combination of recurrent neural networks and attention mechanisms. The training adopts the Random Gradient Descent (SGD) algorithm with 200 iterations and a learning rate of 0.01. The test is evaluated using indicators such as accuracy, recall, and F1 value. Traditional music teaching mode often focuses on teachers' explanation and demonstration, and lacks consideration of students' cognitive characteristics and individual needs, so it is difficult to effectively combine music theoretical knowledge with practice. Music is an important artistic form for people to express emotions and convey culture. In music, beat is one of the basic elements that constitute the rhythm of music, which can affect the emotional and psychological experiences of the audience. Therefore, the study of rhythm theory is of great significance. However, traditional research methods for rhythm theory are mainly based on mathematical models and theoretical analysis, lacking intuitive visualization and vocal presentation. Therefore, Calilhanna [2] visualizes and analyzes the rhythm theory through studying ski hill and loop diagrams, providing new methods and perspectives for music analysis and creation. Visualization and soundization analysis of the theory of rhythm class were conducted by studying ski hill and loop diagrams. The results indicate that there are significant differences in the theory of rhythm between different types of music. This study not only validates the relevant concepts and models of rhythm theory, but also provides new ideas and methods for music analysis and music creation. In the future, we can further explore how to apply rhythm theory in music education and music therapy to improve people's understanding and understanding of music. How to transform abstract music knowledge into concrete, vivid and vivid forms to help students better understand and master it is an urgent problem in music teaching. "Visualization" music teaching is different from music visualization technology. Dai and Wu [3] adopted a mixed method research design to explore the effectiveness of mobile assisted pronunciation learning and/or automatic speech recognition using peer feedback in pronunciation learning. The mixed method research aims to combine quantitative and qualitative research methods to obtain more comprehensive and in-depth empirical data and theoretical explanations. It randomly assigned 60 students to learn English pronunciation, divided into three groups: mobile assisted pronunciation learning group, automatic speech recognition group, and mixed group (receiving both mobile assisted pronunciation learning and automatic speech recognition). Three groups of students need to complete a pronunciation learning task using different feedback methods: the feedback from the mobile assisted pronunciation learning group comes from the recording and annotation of peers; The feedback from the automatic speech recognition group comes; The feedback of the mixed group comes from both peer recording, annotation, and automatic speech recognition system annotation. After the experiment, the effects of different feedback methods on pronunciation learning were analyzed by comparing the accuracy and fluency of pronunciation, learning efficiency, and satisfaction of three groups of students. It refers to the design of games, body rhythms, momentum performances and other musical activities in music teaching, so that students can get a "visual" musical experience. By designing different visual effects, we can highlight the manifestations of the main theme, such as color change, shape change, position movement and so on. Because music itself has rich and subtle emotional information. Considering the change of music rhythm, CAD technology can be used to accurately control and adjust the visualization effect. For example, the animation function of CAD software can be used to realize dynamic visualization effect according to the rhythm change of music.

Music is a universal art form that conveys emotions and ideas through sound and rhythm. Music visualization has become a topic of great concern. Acoustic music graphic visualization is a special genre of electronic music, whose diverse features mask the sound source and lack traditional written encryption symbols. Therefore, how to achieve graphic visualization of acoustic works has become an important issue in the field of music visualization. With the continuous development of technology, the way music visualization has also undergone significant changes. Acoustic music graphic visualization, as a special genre of electronic music, has diverse features that mask the sound source and lack traditional written encryption symbols. Danchenko [4] aims to reveal the modern possibilities of graphic visualization in acoustic works. It first introduces the basic principles and algorithm models of acoustic music graphic visualization, and then elaborates on its application in the music field in detail. Finally, the modern possibilities of acoustic music graphic visualization and its impact on the music field were summarized. In the traditional concept, music is the responsibility of the ear, which is a kind of auditory aesthetic enjoyment, but nowadays people are more and more aware that while enjoying music, we always unconsciously understand the image thinking processes such as emotional feelings and image association on the basis of listening to music. Computer image processing technology can obtain the main melody and auxiliary melody of music by extracting and calculating the characteristics of music. CAD technology can realize the visual design of music and present music to students in a concrete form. Combining these two technologies can effectively solve the abstract and difficult problems in music teaching and improve students' ability to understand and master music. Although the existing computer image processing and CAD technology have provided strong support for the visual modeling of music teaching, there are still some limitations. For example, for different styles and types of music, the visual effect may be different. In addition, the current visual modeling methods mainly rely on manual design and adjustment, and the degree of automation needs to be improved. This article aims to discuss how to combine computer image processing with CAD technology and apply it to visual modeling of music teaching. First of all, through the extraction and calculation of structural music features, the main and auxiliary melodies of music are obtained. Then, based on the separated main melody and auxiliary melody, a comprehensive visual design is carried out to highlight the expression form of the main melody.

In traditional CNN, each word or note is only connected to its previous word or note, while bidirectional CNN considers both the contextual information of the current word or note. This structure enables bidirectional CNN to better understand music emotions. Recursive sparse network is a type of recurrent neural network (RNN) characterized by sparse connections and recursive structure. In traditional RNN, the output of each time step depends on the output of the previous time step, which can lead to gradient vanishing or explosion problems. Recursive sparse networks effectively alleviate these problems and improve the learning and generalization abilities of the model through sparse connections and recursive structures. The BCRSN model combines bidirectional convolutional networks with recursive sparse networks to form a new type of deep learning model. The characteristic of this model is that it simultaneously captures the contextual information and temporal dynamic changes of music emotions, thereby improving the understanding and classification accuracy of music emotions. The experimental results of Dong et al. [5] show that the BCRSN model has achieved excellent performance on multiple public music sentiment datasets, demonstrating its effectiveness and superiority. This model can be applied to fields such as music recommendation, music creation, and music education, providing a new solution for music sentiment analysis. The cultural landscape born from audio-visual is everywhere. The significance and value of culture are not only embodied in art and knowledge, but also in the music classroom with audio-visual combination. The cultural landscape born from audio-visual is everywhere. The significance and value of culture are not only embodied in art and knowledge, but also in the music classroom with audio-visual combination. Based on computer image processing and CAD technology, this article discusses the related contents of visual modeling in music teaching. Its main work and innovations are as follows:

(1) In this study, the structural music features are extracted and calculated. Moreover, based on the separated, the comprehensive visualization design is carried out to realize the visualization method of highlighting the main melody. The results show that this method has certain reference value for the related research of visual modeling of music teaching.

(2) This article proposes a commonly used feature extraction method in speech recognition and music classification. It can provide complex and abstract descriptions about audio. After extracting rhythm features, these features can be used to analyze the emotions of music segments. It provides new ideas and methods for accurate identification and extraction of music information and visual modeling of music teaching.

The research first analyzes the demand and technical status of music teaching visualization, and then expounds in detail the application of image processing and CAD technology in music visualization modeling, including note recognition, music dynamic composition, music performance process simulation and so on. Then, this article puts forward a new visual modeling method of music, which realizes the accurate identification and extraction of music information through a large quantity of training data and learning algorithms. Finally, the results show that the proposed method is effective and superior.

2 RELATED WORK

Schematic interactive visual method that uses visual schemata as the main tool, through the arrangement, combination, comparison, and other means of graphics, to concretize and visualize abstract artistic concepts and theoretical knowledge. The theoretical basis of this teaching method is that human understanding and memory of graphics are more direct and profound than pure words or symbols. In art education, how to fully stimulate students' creativity and imagination, and cultivate more innovative artistic talents, is an important issue that educators have been exploring. With the popularization of intelligent classroom environments, art teaching methods based on schematic interactive visual teaching have been increasingly widely applied. This teaching method, guided by visual schemata, enables students to understand and express various elements and relationships in artistic creation in a more intuitive and logical way. He [6] explored how to use an intelligent classroom environment in art courses to conduct visual teaching through schematic interaction. The piano, as a popular musical instrument, has a large number of learners. However, piano teaching requires professional knowledge and skills, and the process is relatively long. This article aims to design and research a piano performance teaching system based on artificial intelligence, which can provide personalized teaching experience and help students learn piano performance more effectively. Liu and Huang [7] designed and studied an artificial intelligence based piano performance teaching system. This system combines artificial intelligence, computer vision, and music theory, aiming to provide a personalized piano performance teaching experience. Student performance analysis, intelligent recommendation exercises, and real-time feedback. The system can accurately evaluate students' performance, provide targeted practice suggestions, and provide real-time feedback while students play. It provides a detailed introduction to the design, implementation, and experimental results of the system, the advantage of digital music feature extraction technology lies in its accuracy and scientificity. This technology can objectively evaluate students' performance and provide accurate feedback and suggestions. In addition, this technology can also reduce the workload of teachers, improve teaching efficiency and quality. In piano teaching, digital music feature extraction technology can be used to analyze students' performance, helping teachers more accurately evaluate students' performance skills and emotional expression. For example, this technology can analyze students' playing rhythm, identify students' rhythm errors, and provide corresponding correction suggestions. In addition, this technology can also analyze students' playing emotions, identify their emotional expressions, and provide corresponding emotional guidance. Maba [8] explored the issue of computer-aided music education and music creation. Firstly, the background and significance of computer-aided music education were introduced, including the development process of computer music technology, the current situation and future trends of computer music education. Next, the advantages and challenges of computer-aided music education were analyzed. Digital music feature extraction technology also has some drawbacks. Firstly, the implementation of this technology requires a large amount of computer resources and professional technical personnel. Secondly, this technology can only analyze the surface features of musical works and cannot deeply understand the connotation and emotions of musical works. Finally, this technology may replace some of the work of teachers, resulting in reduced communication and interaction between teachers and students. The digital music feature extraction technology has broad application prospects in piano teaching, but it needs to overcome its shortcomings, fully utilize its advantages, and also pay attention to communication and interaction between teachers and students. This study aims to explore how to apply musical instruments for creative music creation in online flipped classrooms, in order to improve students' learning effectiveness and creativity. Ng et al. [9] aim to explore how to apply instruments for creative music creation in online flipped classrooms. The research methods include literature review, empirical research, and instrument based instructional design. The empirical research results indicate that using musical instruments for online music creation can improve students' creativity and music skills. Meanwhile, instrument based instructional design can effectively promote the learning effect of online flipped classrooms. Therefore, it is recommended to widely use musical instruments for music creation teaching in online flipped classrooms to improve students' learning effectiveness and creativity. Including various types of music works, tracks, and artist materials. These resources can provide students with more learning materials and help them better understand music. Through the computer-aided teaching management system, students can interact with teachers and other students during the learning process. This interaction can include functions such as online questioning, discussion, and submitting assignments. This interactive learning environment can increase students' participation and improve learning outcomes. Especially in music appreciation classes, the use of computer-aided teaching management systems can better help students understand music knowledge and improve their music appreciation abilities. Pei and Wang [10] analyzed the advantages, functions, and design principles of a computer-assisted music appreciation course based on network resources combines information technology and artificial intelligence with a remote teaching system. It aims to provide an efficient and convenient learning experience for music appreciation courses. This system achieves the sharing of teaching resources through internet technology. This allows students to access course resources anytime, anywhere, and interact online with teachers. This system can not only provide students with flexible learning methods and rich learning resources, but also help teachers better understand students' learning situation, thus conducting targeted teaching. In order to further improve the effectiveness of computer remote teaching, this study applies neural network algorithms and embedded systems to teaching systems, aiming to achieve prediction and real-time monitoring of student behavior, and provide effective feedback and intervention. Qiu [11] analyzing students' behavioral data and grades, neural network algorithms are used to predict students' academic performance and difficulties, providing timely feedback and intervention for teachers and students. At the same time, real-time monitoring and remote control are achieved through embedded systems, improving the reliability and efficiency of teaching systems. The music field has also begun to apply Internet of Things technology to improve music learning, appreciation, and recommendation. The history of Western music, as an important component of human cultural heritage, contains rich information on works, musicians, and music genres, which is of great significance to music enthusiasts and learners. This article aims to explore how to use deep learning technology to analyze and personalized recommend Western music history information, in order to improve users' in-depth understanding and appreciation experience of music. Yang [12] explored how to use IoT technology and deep learning algorithms to analyze and personalized recommend Western music history information. By collecting and analyzing relevant data on Western music works, musicians, music genres, etc., a deep learning model is established to provide users with personalized music recommendations and in-depth understanding of the development of music history. The application of computer-aided design in the field of landscape design is becoming increasingly widespread. In order to adapt to this trend, many universities have opened courses in computer-aided landscape design. The music appreciation course teaching management system based on network resources can adopt various teaching methods and means to improve teaching quality. The system can provide online testing and homework, making it convenient for students to self-check and consolidate their knowledge. The system can also provide online discussion and Q&A functions, facilitating online communication and interaction between students and teachers, and improving learning effectiveness. In addition, the system can provide personalized learning recommendations based on students' learning progress and interests, improving learning effectiveness. Yao and Qi [13] proposed a reform plan for computer-aided design in response to the current problems in the teaching of garden computer-aided design, and conducted practical exploration. The results indicate that this plan can effectively improve teaching quality and students' learning outcomes. Through online platforms, students can access the necessary learning resources anytime and anywhere, without being limited by time and location. By building an online practice platform, we aim to provide students with more practical opportunities. This platform includes online practice questions, virtual experiments, practical projects, etc. Students can learn and operate independently through the online practice platform to improve their practical abilities. More and more fields are applying artificial intelligence technology to improve work efficiency and quality. Music education, as an important component of human civilization, also faces many challenges and opportunities. Traditional music education methods have many problems, such as low teaching efficiency, insufficient teacher resources, and difficulty in achieving personalized teaching. Yu et al. [14] introduced the current development status and future trends, analyzed the advantages and problems of artificial intelligence in music education, and explored how to better utilize artificial intelligence technology to serve music education. With the development of information technology, more and more educational institutions are beginning to apply computer technology to music teaching. However, there are still some problems with the existing music teaching model, such as uneven allocation of teaching resources and low student interest. This model automatically matches music teaching resources that are suitable for students by analyzing their musical abilities and interests, thereby improving the effectiveness of music teaching. Zhang and Yi [15] introduced a new music teaching model based on computer automatic matching technology. This model automatically matches music teaching resources that are suitable for students by analyzing their musical abilities and interests, thereby improving the effectiveness of music teaching. This article first introduces the background and objectives of this pattern, and then elaborates on the implementation process of this pattern, including steps such as data collection, data processing, and automatic matching. Finally, this article verifies the feasibility and effectiveness of this model through experiments.

At present, most studies only put forward the idea of applying image processing technology, lacking empirical research, and it is difficult to prove its effectiveness and reliability. In this article, a new visual modeling method of music is proposed, which realizes the accurate identification and extraction of music information through a large quantity of training data and learning algorithms. It provides new ideas and methods for accurate identification and extraction of music information and visual modeling of music teaching.

3 VISUAL MODELING OF MUSIC TEACHING

3.1 Computer Image Processing and CAD Technology

The difference between music and other disciplines is that it is an artistic discipline that pays attention to emotions. People come into contact with music and learn music mostly to express their emotions and cultivate their mood. Images are usually associated with emotions and emotions, and are supported by relevant psychological theories. With the growth of computer generation technology and CAD technology, music visualization has become an important part in the field of computer information interaction, providing more personalized and customized services and works in the experience economy. Visualization is a means to convert data into images through graphic image processing technology on the screen. It is a comprehensive technology that integrates computer graphics and image processing, computer vision, aided design and other computer fields. Music visualization is a branch of information visualization and an expression of music. Music visualization is a process of interpreting the information conveyed by music in a visual form. In the field of digital media design, the research on music visualization is helpful to build a bridge between audio-visual media and expand the expression of dynamic media in a cross-border way. With the intervention of visual teaching means, students can appreciate music not only from the perspective of "listening", but also from the perspective of "seeing". Appreciating music from multiple levels and angles can ensure the comprehensiveness and objectivity of appreciation, which is of great significance to improving students' aesthetic and appreciation ability. The music visual design of computer image processing and CAD technology is mainly visual programming, and the visual technology represents all the operations in the software development process with computer icons. In this way, designers can directly click the icon to complete the corresponding data processing, which greatly reduces the workload.

Music is composed of a series of notes, and each note contains information such as pitch, duration and strength. It is an artistic means to express emotions. Music features in music files can be analyzed and applied to visual expression. Learning music is a boring and arduous task, and students have to master a lot of knowledge points, including rhythm, tone, timbre, etc., which is difficult to learn. At present, the application field of music visual design is relatively broad, which has important theoretical and application value in visual research, sound research, performance and display, interactive design, music software interface design, game design and so on. In the visual design of music based on computer image processing and CAD technology, it is time-consuming to extract and calculate each music feature. Document management in the design of computer image processing visual software for music teaching needs the following functions: ① document opening. The image can be opened as an independent document, and the collection problem will not be caused by the different image formats. ② document storage, the document must be stored after the corresponding image structure or format conversion. ③ The document is closed. Multiple image programs can be closed simultaneously. ④ Recent documents. Can operate the image file conveniently and quickly.

Music visualization, for music art and culture, is not only the evolution of aesthetic style, but also the promotion of creative form. The "visualization" of music teaching is not to replace hearing with vision. Instead, it replaces a lot of language feelings with visual feelings, so that students' hearing can be liberated and they can fully feel the music, without having to spend effort on listening to language information, so as to feel the music itself to the maximum extent. The "visualization" in music teaching includes the visualization of music lines, music colors, music structures and music movements. In the visual design of music based on computer image processing and CAD technology, it is necessary to establish some attribute correlation between sound and visual information in order to realize the transformation and generation of information. This correlation means is called "mapping". Multi-channel audio-visual mapping in music visual design refers to establishing multiple mapping channels between sound and visual information, making different mapping attributes interact with each other to achieve comprehensive audio-visual effects, and giving play to the complementarity between different mapping means. In the visual design process of music teaching. In order to facilitate users to better understand the visualization software of computer image processing, and to realize online help, it is necessary to combine text and graphics to organize help topics and display them in the help box.

3.2 Modeling of Music Visual Intelligent Design

In the field of modern visual design, music visualization belongs to information visualization. The use of visualization technology in image processing makes the results of image calculation more directly displayed through images, so that people can intuitively observe how traditional scientific calculation works. In this article, Processing language is used to design and apply the image style transfer in the visual model of music teaching according to the music characteristics. See Figure 1 for the operation flow of image style migration guided by music features.

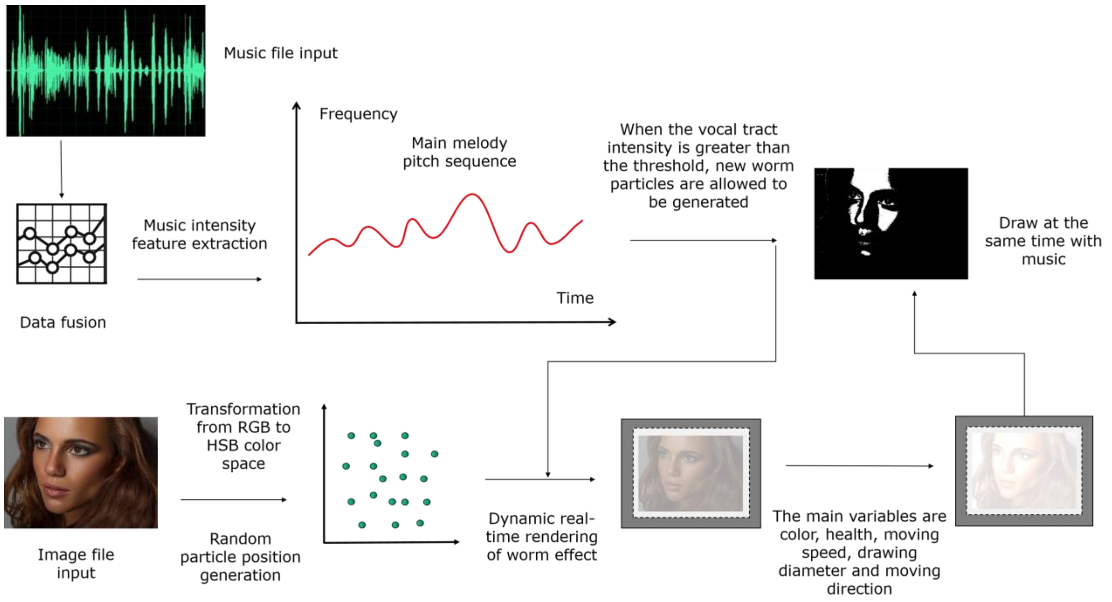

Figure 1: Operational Process of Image Style Migration Guided by Music Features.

The color space of the image is changed to hue saturation space, which corresponds to human perception of objects and attention to important edge information. In the process of computer recognition, the brightness value of unit pixel is used as a variable to extract portraits in the image. It is stipulated that the threshold of qualified pixel brightness of the input image is in the range of 0~180, and it is allowed to generate new moving pixels on the original pixels in the later stage. Matching the data variation range (0-127) of sound volume to the numerical variable (0-255) of image transparency; When the volume is 0, the transparency is 0, and when the volume is increased to 127, the transparency is increased to 255. Digital mapping in music visualization includes two steps: digital audio signal analysis and digital graphic image generation. Moreover, it is also a characteristic quantity that can reflect the amplitude. It is defined as follows:

$$E_n = \sum_{m=-\infty}^{\infty}[x(m)w(n-m)]^2 = \sum_{m=-\infty}^{\infty}\left[x^2(m)h(n-m)\right] = x^2(n)*h(n) \tag{1}$$

$$h(n) = w^2(n) \tag{2}$$

Where E_n stands for short-term energy starting from point n ; $w(n)$ is a window function of length N .

Computer image processing visualization software provides common document management functions. When programming with VC++, you need to select setting items. According to the note length and pitch information, the melody area is defined as:

$$\mathrm{Area}_i = \mathrm{Pitch}_i * \mathrm{Duration}_i \tag{3}$$

Where Area_i represents the pronunciation area of the i note; Pitch_i represents the pitch of the i note; $\mathrm{Duration}_i$ stands for the duration of the first i note. The melody area of the whole music can be defined as:

$$\mathrm{MelodyArea} = \mathrm{Area}_1 + \mathrm{Area}_2 + \mathrm{Area}_3 + \ldots \mathrm{Area}_k \tag{4}$$

Add the intensity of the note, and the energy of the note is defined as:

$$\mathrm{Power_i} = \{\mathrm{Area_i}, \mathrm{Dynamic_i}\} \tag{5}$$

Where $\mathrm{Dynamic_i}$ stands for the duration of the i note. Then the musical energy of this music can be defined as:

$$\mathrm{Power} = \{\mathrm{MelodyArea}, \overline{\mathrm{Dynamic}}\} \tag{6}$$

Among them, $\mathrm{MelodyArea}$ represents the melody area of the whole music; $\overline{\mathrm{Dynamic}}$ stands for the average intensity of all notes in the whole music.

Image preprocessing is mainly aimed at various remote sensing images, and the processed images are convenient for subsequent research. According to the contrast and brightness required by users, the visual adjustment of the image to be processed is made by using VC++ dialog box or characteristic interface. Moreover, gray scale specification, image histogram and generated histogram are used to improve the quality of image processing. The visual subject of animation is a dynamic curve that can sense the music volume, and many curves appear in the picture in clusters. In order to reflect the vividness of this cluster animation, this program manually switches the motion attributes of the whole line and the quantity of lines appearing through the computer keyboard. The frequency domain characteristics can be roughly estimated by the following formula:

$$Z_n = \frac{1}{2}\sum_{m=-\infty}^{\infty}\left|\mathrm{sgn}[x(m)] - \mathrm{sgn}[x(m-1)]\right| \times w(m-n) = \frac{1}{2}\sum_{m=n}^{n+N-1}\left|\mathrm{sgn}[x_N(m)] - \mathrm{sgn}[x_N(m-1)]\right| \tag{7}$$

Where $x(m)$ represents the value of the m signal in the n audio signal frame; $w(m)$ represents a window function with a window length of N. When $x(n) \geq 0$, then:

$$sign[x(n)] = 1 \tag{8}$$

Otherwise:

$$sign[x(n)] = 0 \tag{9}$$

Select the Minim library from the open-source library of Processing for music feature recognition. After testing different music features, taking the realization of visual effect as the primary judgment index, it is decided to choose the real-time intensity characteristics of the left and right music channels of the music file as the independent variable of the image style transfer effect, and guide the timing and shape of the new picture in the image style parameters. In this article, the influence of smoothing noise on other areas is reduced by controlling the parameters of smoothing parts. In the sharpening part, the differential or operator is used to enhance the edge jump part of the image to make the image clear. In the black area processing part, the binary processing algorithm is used to shrink and expand the image, and the regional marks and small areas are eliminated. To a certain extent, the pronunciation area value of a note can represent the energy of the note. The higher the pitch and the longer the duration of a note, the greater its energy. As shown in Figure 2.

Music emotion is not expressed by a single sound, but by the overall melody. The speed and mode of melody will have an impact on the expression of musical emotion. The pitch, intensity, timbre, melody, rhythm and other elements of music can establish a rich counterpoint relationship with the characteristics of color, brightness, shape and volume in visual experience. According to the tag matching method, music files or image files with the same tag can be matched effectively and accurately. In order to make the change of two adjacent frames smoother, this article adopts the method of partial overlap between frames, that is, the back frame repeats the length of the previous frame by nearly half.

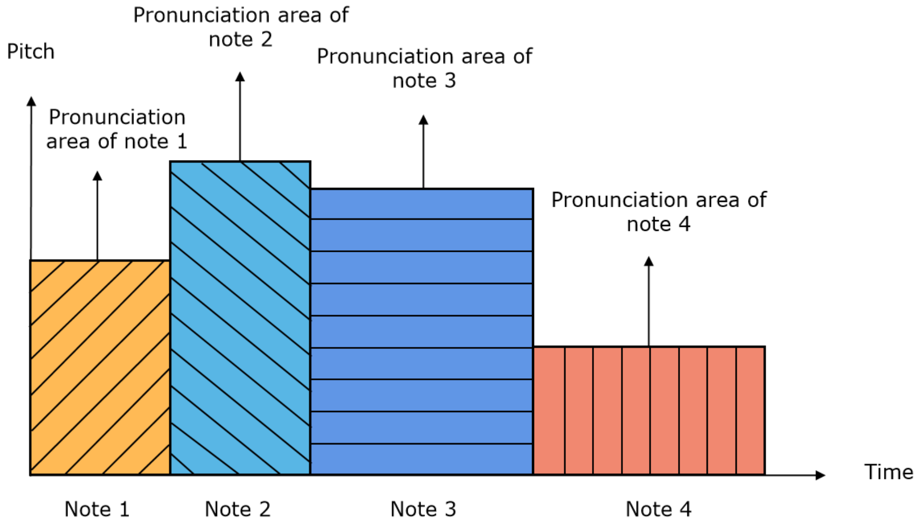

Figure 2: Pronunciation area.

For the input audio signal $s(n)$, this article finds a reasonable window function and multiplies it to realize the framing process. The expression formula is:

$$s_w(n) = s(n) * w(n) \tag{10}$$

This includes several problems, such as frame length, frame shift and window function type. The frame length is the fixed length of the intercepted signal segment, and the frame shift is the sampling point distance that the next frame moves according to the previous frame. Let the sampling period of the signal be Ts and $Ts = 1/fs$, the frequency recognition degree be Δf, and the frame length (Window length) of the intercepted frame be N, then there is an expression:

$$\Delta f = \frac{1}{NT_s} \tag{11}$$

Region extraction in line and surface target extraction is to track and process the structure and gray level of continuous external contour. Edge extraction is to select a picture according to the user's experience, then process the results extracted by visualization software, and finally correct the picture by line processing. Line processing uses operators and other methods to extract the central skeleton of the target. Generally speaking, by using computer image processing and CAD technology, educators can transform abstract data information into visual information, enhance students' cognitive process of quickly identifying abstract information, and improve students' learning ability.

4 EFFECT AND PERFORMANCE ANALYSIS OF MODEL SCREEN GENERATION

Combining computer image processing and CAD technology, this article discusses the related contents of visual modeling of music teaching and constitutes a complete visual model of music. The framework of constructing visual effect after music classification is simple, and it can be combined or displayed singly according to our needs, which makes the visual effect rich. In this section, the performance of the model is verified by experiments, and the results are analyzed. First, establish the natural audio music library to be used in this section. The image file is two portraits in jpg format. And the generation stage is saved in a single frame. 315 songs are selected as training sets to train the algorithm. Because the quantity of music files in each emotion category is different, the quantity of music files in each emotion category used as training set and test set is also uneven. This will not have a significant impact on the experiment. Input the feature vectors of MIDI files in the training set into the model for training, and the training situation of the algorithm model is shown in Figure 3.

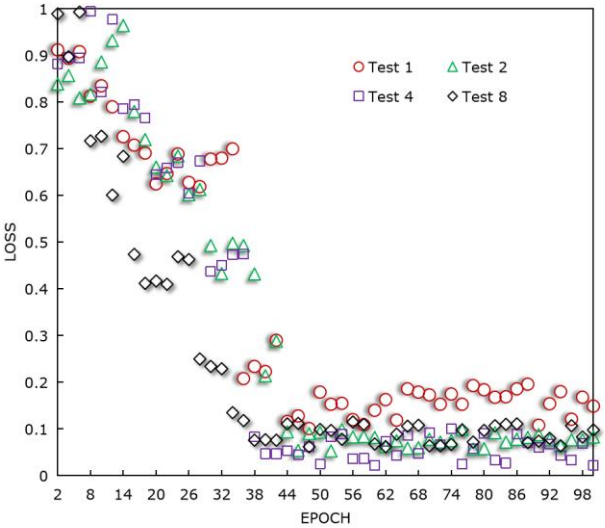

Figure 3: Algorithm training situation.

In this article, the music in the music library is selectively extracted from multiple features and a feature set is constructed. Then it is visualized according to the feature set. The multi-feature visual design of different types of music is realized. The visual effect of the visual model screen is controlled by the worm effect, and the main variables are color, health value, moving speed, drawing diameter and moving direction. The pixels randomly selected by particles are used as the starting point for dynamic real-time drawing. As shown in Figure 4 and Figure 5.

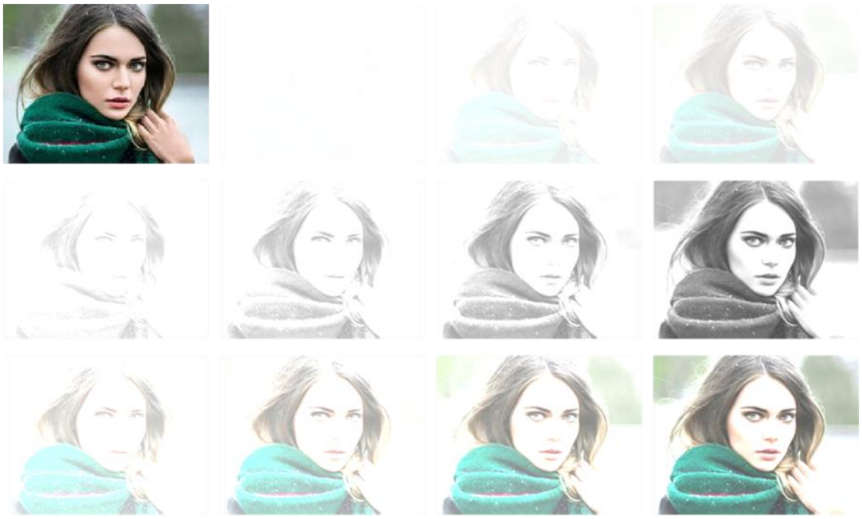

Figure 4: Music file: Smile.mp3; Image file: Portrait 1.

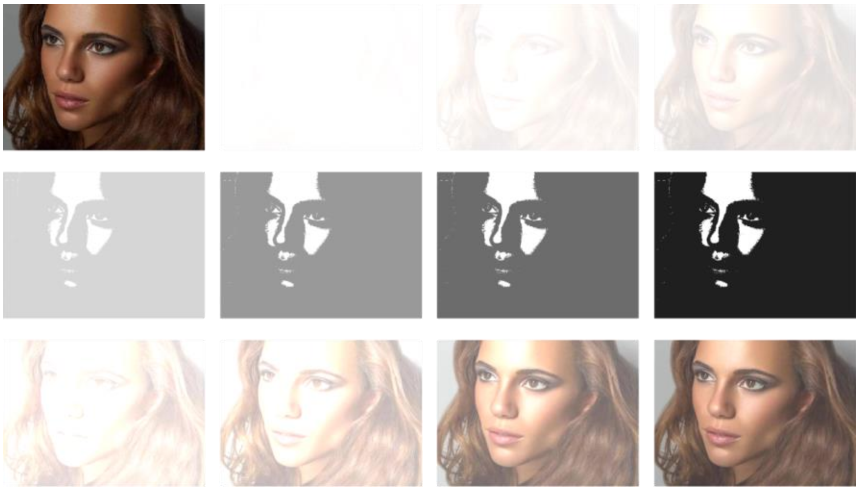

Figure 5: Music file: Smile.mp3; Image file: Portrait 2.

Firstly, the sample data set for training is established, and then the samples are calculated according to the training process to obtain the fractal dimension range parameters. Next, the range parameters obtained by training are verified with the test data set. Use the quantity of notes in a fixed duration to measure the speed of music. Moreover, the more notes there are, the faster the music will be, and vice versa. The data between music file and image file is processed bilaterally, and the music features and image features are identified at the same time to control the real-time generation effect of image style transfer. Let computer image processing and CAD technology visually simulate people's synaesthesia of music and images.

Firstly, the overall dimension of 5 pieces of music in each group is calculated to find out the maximum and minimum values, and then the difference between the two values is calculated. According to a large quantity of experimental data, if this value is greater than 0.1, this group will be abandoned and 5 pieces of music will be re-sampled as the first group. When there is a second group of experimental data, we use the difference between the latter group and the current group to make a difference again, and take its absolute value and record it as a relative difference. By default, the relative difference of the first group is 0. The model constructed in this article is used to make emotional judgment on MIDI music in the test set. Figure 6 shows the error of the algorithm. It can be seen that with the continuous increase of iteration, the error of the algorithm gradually decreases, and the final error is only 5.14, which meets the expected assumption.

Visual education enables students to observe, experience, discover, intervene and use the vivid and informative knowledge model through visual education technology, and explore the essence through phenomena. Computer image processing visualization software provides image preprocessing function, which can binarize the selected threshold and adjust the brightness and saturation of the image through the dialog box. Computer image preprocessing function and strong purpose. The audio main melody and auxiliary melody are extracted separately, and the main melody is highlighted and visually designed, while the auxiliary melody is visually designed and the background is faded and displayed. In this way, the visual effect of the prominent theme of different types of music is realized. Select the test set to test the accuracy, and get the discrimination accuracy. Figure 7 shows the accuracy results of the algorithm.

By using the method of dividing music segments using music energy proposed in this article, the influence of music length on accuracy is greatly reduced. Therefore, segmenting music can improve the accuracy of model recognition, and the method proposed in this article is simple and effective. The accuracy of the experimental results reached 94%, and the error was only 5.14. In addition, the operation efficiency of the algorithm is high, which basically achieves the expected effect.

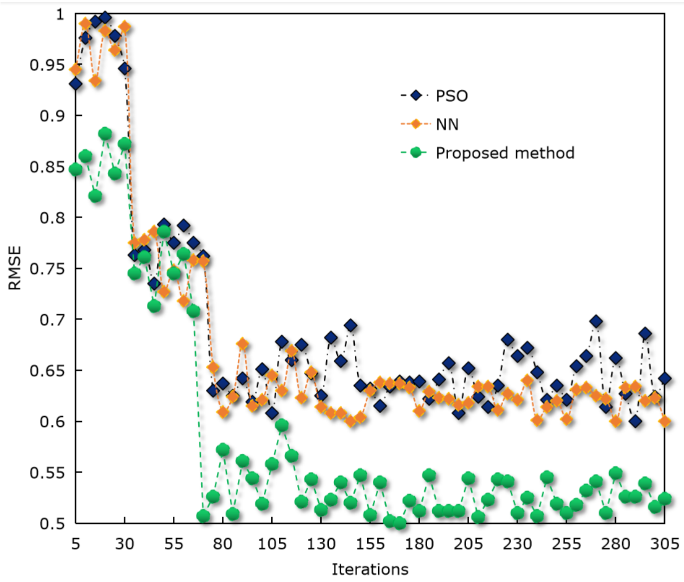

Figure 6: Error situation of the algorithm.

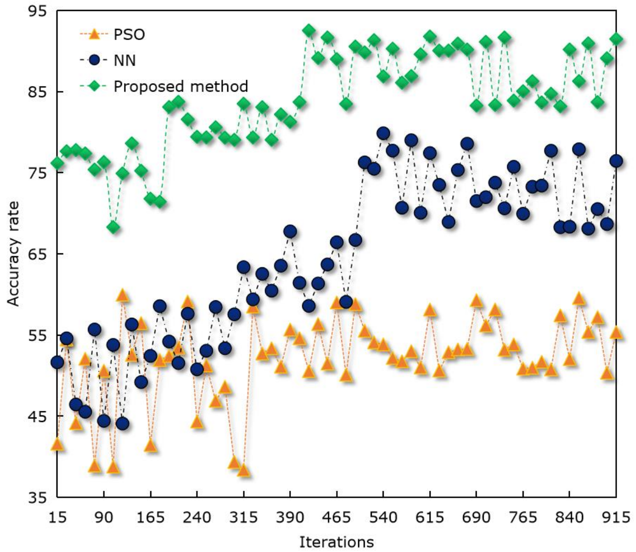

Figure 7: Algorithm accuracy.

Because the volume change controls the acceleration of the path motion in real time, it can produce ideal visual changes in the sound effect with strong graininess from musical instruments. When the player plays a single note, the geometric curve will suddenly accelerate and slowly slow down. The combination of sudden change and gradual change in movement speed can create a more natural and vivid dynamic effect. When the music is fast-paced, there are more new pixels. When the sound intensity is high, the strokes added to the picture will be more exaggerated. The model program can completely present the process of image style transfer effect changing with music characteristics, and the final effect is more abstract than the original image file. Finally, the outline of portrait is extracted, forming the information aesthetic characteristics and artistic style of information visualization.

5 CONCLUSIONS

As an auditory art form, music plays an important role in social life. Music visualization is not only a topic about aesthetics, but also a topic about music teaching. The intervention of visual teaching method in music teaching makes students' experience more profound, association more abundant and learning easier. The combination of visual art and auditory art is of great significance for improving students' learning quality and optimizing classroom teaching effect. This article puts forward a new visual modeling method of music based on computer image processing and CAD technology, and expounds the design and implementation of visual modeling method on the basis of computer image theory and algorithm. This method realizes the accurate identification and extraction of music information through a large quantity of training data and learning algorithms. Using the existing music files and image files, we try to rebuild the synaesthesia relationship between them in hearing and vision, and generate dynamic, visual and real-time visual works. The simulation results show that the accuracy of the algorithm can reach 94% and the error is only 5.14. In addition, the operation efficiency of the algorithm is high, and the overall idea is achieved. Combining computer image processing technology with CAD technology, it adds concrete content expression to music visualization. In the future, visualization tools will be applied to more educational fields to realize concrete visualization education.

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